Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50 Printed on 23 November 2021 at 13:25:03

Proiect Information:

Assessed By: Neil Ingham (STRO010943) Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 100.05m²

Site Reference: 11-12 Grenville Street - LEAN

Plot Reference: Unit 1

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

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

17.98 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 22.79 kg/m² Fail

Excess emissions = 4.81 kg/m² (26.8 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 56.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 71.5 kWh/m²

Excess energy = $15.49 \text{ kg/m}^2 (27.7 \%)$

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	4.37 (max. 2.00)	5.30 (max. 3.30)	Fail

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 5.00 (design value)

Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Combi boiler

Efficiency 89.5 % SEDBUK2009

Minimum 88.0 % OK

Secondary heating system: None

Fail

5 Cylinder insulation			
Hot water Storage:	No cylinder		
6 Controls			
Space heating controls	TTZC by plumbing and e	electrical services	OK
Hot water controls:	No cylinder thermostat		
	No cylinder		
Boiler interlock:	Yes		OK
7 Low energy lights			
Percentage of fixed lights with	n low-energy fittings	100.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames val	ley):	Slight	OK
Based on:			
Overshading:		Average or unknown	
Windows facing: South East		9.44m²	
Windows facing: South West		3.39m²	
Windows facing: North West		2.08m ²	
Roof windows facing: North V	Vest	1.85m²	
Ventilation rate:		4.00	
10 Key features			
Party Walls U-value		0 W/m²K	

		User Details:		
Assessor Name: Software Name:	Neil Ingham Stroma FSAP 2012	Stroma Nun Software Ve		0010943 on: 1.0.5.50
Adduses	Р	roperty Address: Unit 1		
Address: 1. Overall dwelling dime	ancione:			
1. Overall dwelling diffle	11510115.	Area(m²)	Av. Height(m)	Volume(m³)
Basement		32.47 (1a) x	2.4 (2a) =	77.93 (3
Ground floor		33.79 (1b) x	2.8 (2b) =	94.61 (3)
First floor		33.79 (1c) x	3.45 (2c) =	116.58 (30
	a)+(1b)+(1c)+(1d)+(1e)+(1r		3.43	110.36
•	a)+(1b)+(1c)+(1u)+(1e)+(11	,		
Dwelling volume		(3a)+(3l	b)+ $(3c)+(3d)+(3e)+(3n) =$	289.12 (5)
2. Ventilation rate:				
	main secondar heating heating	y other	total	m³ per hour
Number of chimneys	0 + 0	+ 0 =	0 x 40 =	0 (68
Number of open flues	0 + 0	+ 0 =	0 x 20 =	0 (68
Number of intermittent fa	ns		3 x 10 =	30 (78
Number of passive vents		Ī	0 x 10 =	0 (7)
Number of flueless gas fi	res	Ī	0 x 40 =	0 (70
		-		hangaa nar haur
1.60	(0-1)-(01)-(7	(a) . (7b) . (7 a) [hanges per hour
	ys, flues and fans = $(6a)+(6b)+(7a)$ ween carried out or is intended, proceed		\div (5) =	0.1
Number of storeys in the		a to (17), caller mee contained	, om (o) to (10)	0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10
Structural infiltration: 0	.25 for steel or timber frame or	0.35 for masonry const	truction	0 (1
• • • • • • • • • • • • • • • • • • • •	resent, use the value corresponding to	the greater wall area (after		
deducting areas of openir If suspended wooden f	ilgs), if equal user 0.35 floor, enter 0.2 (unsealed) or 0.	1 (sealed), else enter 0		0 (12
If no draught lobby, en	,	((()))		0 (1:
•	s and doors draught stripped			0 (14
Window infiltration	0 11	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 metre	s per hour per square n	netre of envelope area	5 (17
If based on air permeabil	ity value, then (18) = [(17) ÷ 20]+(8	3), otherwise (18) = (16)	·	0.35 (18
Air permeability value applie	s if a pressurisation test has been don	e or a degree air permeability	is being used	
Number of sides sheltere	ed			0 (19
Shelter factor		$(20) = 1 - [0.075 \times ($		1 (20
Infiltration rate incorporat	ing shelter factor	$(21) = (18) \times (20) =$		0.35
Infiltration rate modified f	or monthly wind speed			7
Jan Feb	Mar Apr May Jun	Jul Aug Sep	Oct Nov Dec	_
Monthly average wind sp	eed from Table 7			_

4.4

4.3

3.8

3.8

3.7

4.3

4

4.5

4.7

4.9

(22)m=

5.1

5

Wind Factor (2 (22a)m= 1.27	22a)m = 1.25	(22)m ÷	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	1
(ZZa)III= 1.21	1.25	1.23	1.1	1.00	1 0.93	0.93	0.92	'	1.00	1.12	1.10	l
Adjusted infiltr		<u> </u>			1	i ´	`	`	·	ī	1	1
0.45 Calculate effe	0.44 ctive air	0.43 change i	0.39 rate for t	0.38 he appli	0.34 cable ca	0.34 ise	0.33	0.35	0.38	0.4	0.42	
If mechanic		-										0 (23a)
If exhaust air h	eat pump	using Appe	endix N, (2	(3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0 (23b)
If balanced with	h heat reco	overy: effici	iency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				0 (23c)
a) If balance	1			·		- 	- 	í `	, 		' ' '	,
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	(24a)
b) If balance	1	1		i	1		, 	``	r ´ `		1 .	1 (245)
(24b)m= 0	0	0	0	0		0	0	0	0	0	0	(24b)
c) If whole h if (22b)r		tract ven ≺ (23b), t		•	•				.5 x (23h))		
(24c)m = 0	0	0	0	0	0	0	0	0	0	0	0	(24c)
d) If natural	ventilation	on or wh	ole hous	e positiv	ve input	ventilatio	on from I	oft	!	<u>I</u>	ļ.	ı
if (22b)r	n = 1, th	en (24d)	m = (22l	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]	•	_	1
(24d)m= 0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)
Effective air			<u> </u>	``	í `	ŕ `	. 	`	•	î	1	1
(25)m= 0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)
3. Heat losse	se and he	act loca r	oromot	or.								
3. Heat 10556	s and ne	zai 1055 f	Jaramett	er.								
ELEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/l	<)	k-value kJ/m²·	
	Gros	SS	Openin	gs		m²				<) 		
ELEMENT	Gros area	SS	Openin	gs	A ,r	m² x	W/m2	K =	(W/I	<) 		K kJ/K
ELEMENT Doors	Gros area e 1	SS	Openin	gs	A ,r	m² x x1	W/m2	= 0.04] =	(W/l	<) 		K kJ/K (26)
ELEMENT Doors Windows Type	Gros area e 1 e 2	SS	Openin	gs	A ,r 2.71 9.44	m ² x x ¹ x ¹	W/m2 1.4 /[1/(4.8)+	0.04] = 0.04] =	3.794 38.01	<) 		K kJ/K (26) (27)
Doors Windows Type Windows Type	Gros area e 1 e 2	SS	Openin	gs	A ,r 2.71 9.44 3.39	m ² x x ¹ x ¹ x ¹	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+	0.04] = 0.04] = 0.04] =	3.794 38.01 13.65	<)		K kJ/K (26) (27) (27)
Doors Windows Type Windows Type Windows Type	Gros area e 1 e 2	SS	Openin	gs	A ,r 2.71 9.44 3.39 2.08	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	0.04] = 0.04] = 0.04] =	(W/l 3.794 38.01 13.65 8.38			K kJ/K (26) (27) (27)
Doors Windows Type Windows Type Windows Type Rooflights	Gros area e 1 e 2	ss (m²)	Openin	gs	A ,r 2.71 9.44 3.39 2.08	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	0.04] = 0.04] = 0.04] = 0.04] =	(W/l 3.794 38.01 13.65 8.38 9.805		kJ/m²-	K kJ/K (26) (27) (27) (27b)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor	Gros area e 1 e 2 e 3	ss (m²)	Openin m	gs ₁ ²	A ,r 2.71 9.44 3.39 2.08 1.85	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458		kJ/m²-	K kJ/K (26) (27) (27) (27) (27b) (28)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1	Gros area e 1 e 2 e 3	6 08	Openin m	gs 1 ²	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15	0.04] = 0.04]	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458 6.09		110 9	K kJ/K (26) (27) (27) (27) (27b) 3571.7 (28) 365.4 (29)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1 Walls Type2	Gros area e 1 e 2 e 3 40. 99.0	6 08	0 17.62	gs 1 ²	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6 81.46	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15	0.04] = 0.04]	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458 6.09		110 9 60	K kJ/K (26) (27) (27) (27) (27b) (27b) (28) (365.4 (29) 4887.6 (29)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1 Walls Type2 Roof	Gros area e 1 e 2 e 3 40. 99.0	6 08	0 17.62	gs 1 ²	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6 81.46	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15	0.04] = 0.04]	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458 6.09		110 9 60	K kJ/K (26) (27) (27) (27) (27b) (27b) (28) (365.4 (29) (30) (30)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1 Walls Type2 Roof Total area of e	Gros area e 1 e 2 e 3 40. 99.0 36.4	6 08	0 17.62	gs 1 ²	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6 81.46 208.6	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15 0.14	0.04] = 0.04]	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458 6.09 12.22 4.85		110 9 60	K kJ/K (26) (27) (27) (27) (27b) (27b) (27b) (28) (365.4 (29) (30) (31)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1 Walls Type2 Roof Total area of e Party wall	Gros area e 1 e 2 e 3 40. 99.0 36.4	6 08	0 17.62	gs 1 ²	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6 81.46 208.6 52.37	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15 0.14	0.04] = 0.04]	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458 6.09 12.22 4.85		110 9 60 9	K kJ/K (26) (27) (27) (27) (27b) (27b) (27b) (3571.7 (28) (365.4 (29) (31) (31) (31) (2356.65 (32)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1 Walls Type2 Roof Total area of e Party wall Internal wall **	Gros area e 1 e 2 e 3 40. 99.0 36.4 elements	6 08	0 17.62	gs 1 ²	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6 81.46 208.6 52.37 180.9	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15 0.14	0.04] = 0.04]	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458 6.09 12.22 4.85		110 9 60 9 45 75	K kJ/K (26) (27) (27) (27) (27b) (27b) (3571.7 (28) (365.4 (29) (311.49 (30) (31) (2356.65 (32) (32c) (32c)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1 Walls Type2 Roof Total area of e Party wall Internal wall ** Internal floor Internal ceiling * for windows and	Gros area e 1 e 2 e 3 40. 99.0 36.4 elements	6 08 46 3, m ²	Openin 0 17.6: 1.85	gs p ² gs gs gs gs gs	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6 81.46 208.6 52.37 180.9 67.58 alue calcul	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15 0.14	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = = =	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458 6.09 12.22 4.85		110 9 60 9 45 75 18 9	K kJ/K (26) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (28) (365.4 (29) (311.49 (30) (31) (2356.65 (32) (32c) (1216.44 (32d) (608.22 (32e)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1 Walls Type2 Roof Total area of e Party wall Internal wall ** Internal floor Internal ceiling * for windows and ** include the area	Gros area e 1 e 2 e 3 40. 99.0 36.4 elements d roof wind as on both	6 08 46 5, m ²	Openin 0 17.62 1.85	gs p ² gs gs gs gs gs	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6 81.46 208.6 52.37 180.9 67.58 alue calcul	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15 0.14	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = = =	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458 6.09 12.22 4.85		110 9 60 9 45 75 18 9	K kJ/K (26) (27) (27) (27) (27b) (27b) (27b) (3571.7 (28) (365.4 (29) (311.49 (30) (31) (31) (2356.65 (32) (32c) (1216.44 (32d) (608.22 (32e) (32e) (32e) (32e)
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1 Walls Type2 Roof Total area of e Party wall Internal wall ** Internal floor Internal ceiling * for windows and	Gros area e 1 e 2 e 3 40. 99.0 36.4 elements at roof wind as on both ss, W/K =	6 08 46 3, m ² dows, use e	Openin 0 17.62 1.85	gs p ² gs gs gs gs gs	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6 81.46 208.6 52.37 180.9 67.58 alue calcul	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15 0.14 0 g formula 1	K	(W/l 3.794 38.01 13.65 8.38 9.805 4.5458 6.09 12.22 4.85	as given in	110 9 60 9 45 75 18 9	K kJ/K (26) (27) (27) (27) (27b) (27b) (27b) (3571.7 (28) (365.4 (29) (311.49 (30) (31) (31) (3256.65 (32) (32e) (32e) (33.2 (32e) (33.2 (33))
ELEMENT Doors Windows Type Windows Type Windows Type Rooflights Floor Walls Type1 Walls Type2 Roof Total area of e Party wall Internal wall ** Internal floor Internal ceiling * for windows and ** include the area Fabric heat los	Gros area e 1 e 2 e 3 40. 99.0 36.4 elements area con both ss, W/K: Cm = Si	6 08 46 3, m ² dows, use end sides of interest and i	Openin 0 17.62 1.85	gs p ² 2 5 5 6 6 7 7 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	A ,r 2.71 9.44 3.39 2.08 1.85 32.47 40.6 81.46 208.6 52.37 180.9 67.58 alue calculatitions	m ²	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(5.3) + 0.14 0.15 0.14 0 g formula 1	K	(W// 3.794 38.01 13.65 8.38 9.805 4.5458 6.09 12.22 4.85	as given in	110 9 60 9 45 75 18 9	K kJ/K (26) (27) (27) (27) (27b) (27b) (27b) (3571.7 (28) (365.4 (29) (311.49 (30) (31) (31) (2356.65 (32) (32c) (1216.44 (32d) (608.22 (32e) (32e) (32e) (32e)

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For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

oon ha waad inatas	ad of a do	tailed calar	ulation										
can be used instead Thermal bridge				usina An	nendix l	K						15.01	(36)
if details of therma	,	,			•							15.01	(30)
Total fabric hea	0 0		()	(0	.,			(33) +	(36) =			114.63	(37)
Ventilation hea	t loss ca	alculated	l monthly	y				(38)m	= 0.33 × (25)m x (5)			_
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 57.41	57.03	56.66	54.93	54.6	53.09	53.09	52.81	53.67	54.6	55.26	55.95		(38)
Heat transfer c	oefficier	nt, W/K		-	-	-	-	(39)m	= (37) + (37)	38)m	-	•	
(39)m= 172.04	171.67	171.3	169.56	169.24	167.73	167.73	167.45	168.31	169.24	169.89	170.58		
Heat loss para	meter (H	HLP), W/	m²K			-	-		Average = = (39)m ÷		12 /12=	169.56	(39)
(40)m= 1.72	1.72	1.71	1.69	1.69	1.68	1.68	1.67	1.68	1.69	1.7	1.7		
Number of day	s in mor	nth (Tab	le 1a)						Average =	Sum(40) ₁	12 /12=	1.69	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
		_		_	-	-	-	-		-	-		
4. Water heat	ing ener	rgy requi	rement:								kWh/ye	ear:	
Assumed occu	nancy I	NI									7.4	1	(42)
if TFA > 13.9 if TFA £ 13.9	0, N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13.	.9)	74		(42)
Annual averag	e hot wa).27		(43)
Reduce the annua not more that 125	_				_	_	to achieve	a water us	se target o	f			
						•	۸	Can	0.4	Nav	Daa		
Jan Hot water usage ir	Feb i litres per	Mar day for ea	Apr ach month	Vd,m = fa	Jun ctor from	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m= 109.2	105.23	101.26	97.29	93.32	89.35	89.35	93.32	97.29	101.26	105.23	109.2		
(1.7	.00.20	.020	01.120	00.02	00.00	00.00	00.02	<u> </u>	Total = Su	<u> </u>		1191.3	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 161.94	141.64	146.16	127.42	122.27	105.51	97.77	112.19	113.53	132.31	144.42	156.83		
W. ' (((((((((- 1 1 C		-6 (()				Total = Su	m(45) ₁₁₂ =	=	1561.98	(45)
If instantaneous w			,		· · · ·		· ·	, , ,	T			1	(40)
(46)m= 24.29 Water storage	21.25 loss:	21.92	19.11	18.34	15.83	14.66	16.83	17.03	19.85	21.66	23.53		(46)
Storage volume		includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	` ,					_					-		, ,
Otherwise if no	stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage												•	
a) If manufacti				or is kno	wn (kWł	n/day):					0		(48)
Temperature fa											0		(49)
Energy lost from b) If manufaction		_	-		or is not		(48) x (49)) =			0		(50)
Hot water stora			-								0		(51)
If community h	eating s	ee secti		,		-							. ,
Volume factor			Ol-							-	0		(52)
Temperature fa	acior tro	ın rabie	ZD								0		(53)

Energy lost fro		•	, kWh/ye	ear			(47) x (51) x (52) x (53) =		0		(54)
Enter (50) or (Water storage			or each	month			((56)m = ((55) × (41)r	m		0		(55)
	0		0	0	0	0	0	0	0	0	0		(56)
(56)m= 0 If cylinder contains		d solar stor	-	_		-	_	-			_	ix H	(30)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
	<u> </u>	ļļ											(58)
Primary circuit Primary circuit	`	,			50\m - /	(50) · 36	S5 ~ (41)	ım			0		(30)
(modified by				•		` '	, ,		r thermo	stat)			
(59)m = 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m	•				!	
(61)m= 50.96	46.03	50.96	47.98	47.55	44.06	45.53	47.55	47.98	50.96	49.32	50.96		(61)
Total heat requ	uired for	water he	eating ca	alculated	for eacl	h month	(62)m =	: 0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 212.9	187.66	197.12	175.4	169.82	149.57	143.3	159.74	161.51	183.27	193.74	207.79		(62)
Solar DHW input	calculated	using Appe	endix G oı	· Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contributi	on to wate	er heating)	l	
(add additiona	I lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from w	ater hea	ter				•	•	•			•	'	
(64)m= 212.9	187.66	197.12	175.4	169.82	149.57	143.3	159.74	161.51	183.27	193.74	207.79		
							Out	out from wa	ater heate	r (annual)₁	12	2141.81	(64)
Heat gains from	m water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m= 66.59	58.6	04.04		1		r							
	30.0	61.34	54.36	52.54	46.1	43.89	49.19	49.74	56.73	60.35	64.89		(65)
include (57)	ļ											eating	(65)
include (57)	m in calc	culation o	of (65)m	only if c								eating	(65)
5. Internal ga	m in calc ains (see	culation of Table 5	of (65)m and 5a	only if c								eating	(65)
, ,	m in calc ains (see	culation of Table 5	of (65)m and 5a	only if c								eating	(65)
5. Internal ga	m in calc ains (see as (Table	culation of Table 5	of (65)m and 5a	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	eating	(65)
5. Internal games Metabolic gain Jan	m in calc ains (see as (Table Feb	culation control Table 5 5), Watt	of (65)m and 5a ts Apr 137	only if c : May	ylinder is Jun 137	Jul	Aug 137	or hot w	ater is fr	om com	munity h	eating	
5. Internal games Metabolic gain Jan (66)m= 137	m in calc ains (see as (Table Feb	culation control Table 5 5), Watt	of (65)m and 5a ts Apr 137	only if c : May	ylinder is Jun 137	Jul	Aug 137	or hot w	ater is fr	om com	munity h	eating	
5. Internal games Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12	m in calconnum in	Table 5 Table 5 Solution of the state of t	of (65)m and 5a ts Apr 137 opendix 12.64	May 137 L, equati 9.45	Jun 137 on L9 o	Jul 137 r L9a), a	Aug 137 Iso see	Sep 137 Table 5 15.04	Oct 137	Nov	Dec	eating	(66)
5. Internal games Metabolic gain Jan (66)m= 137 Lighting gains	m in calconnum in	Table 5 Table 5 Solution of the state of t	of (65)m and 5a ts Apr 137 opendix 12.64	May 137 L, equati 9.45	Jun 137 on L9 o	Jul 137 r L9a), a	Aug 137 Iso see	Sep 137 Table 5 15.04	Oct 137	Nov	Dec	eating	(66)
5. Internal games Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41	m in calcular (calcular 20.53 ins (calcular 259.07	Table 5 Table 5 S), Watt Mar 137 ted in Ap 16.7 ulated in	and 5a ts Apr 137 opendix 12.64 Appendix 238.09	May 137 L, equati 9.45 dix L, eq 220.07	Jun 137 on L9 o 7.98 uation L 203.14	Jul 137 r L9a), a 8.62 13 or L1 191.82	Aug 137 Iso see 11.21 3a), also	Sep 137 Table 5 15.04 see Tal 195.87	Oct 137 19.1 ole 5 210.14	Nov 137 22.29	Dec 137	eating	(66) (67)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga	m in calcular (calcular 20.53 ins (calcular 259.07	Table 5 Table 5 S), Watt Mar 137 ted in Ap 16.7 ulated in	and 5a ts Apr 137 opendix 12.64 Appendix 238.09	May 137 L, equati 9.45 dix L, eq 220.07	Jun 137 on L9 o 7.98 uation L 203.14	Jul 137 r L9a), a 8.62 13 or L1 191.82	Aug 137 Iso see 11.21 3a), also	Sep 137 Table 5 15.04 see Tal 195.87	Oct 137 19.1 ole 5 210.14	Nov 137 22.29	Dec 137	eating	(66) (67)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41 Cooking gains (69)m= 36.7	m in calc ains (see s (Table Feb 137 (calculat 20.53 ins (calc 259.07 (calculat 36.7	ted in Apulated in	and 5a ts Apr 137 opendix 12.64 Append 238.09 opendix 36.7	May 137 L, equati 9.45 dix L, equ 220.07 L, equat	Jun 137 on L9 or 7.98 uation L 203.14 ion L15	Jul 137 r L9a), a 8.62 13 or L1 191.82 or L15a	Aug 137 Iso see 11.21 3a), also 189.16), also se	Sep 137 Table 5 15.04 See Tal 195.87	Oct 137 19.1 ole 5 210.14	Nov 137 22.29 228.16	Dec 137 23.76 245.1	eating	(66) (67) (68)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41 Cooking gains	m in calc ains (see s (Table Feb 137 (calculat 20.53 ins (calc 259.07 (calculat 36.7	ted in Apulated in	and 5a ts Apr 137 opendix 12.64 Append 238.09 opendix 36.7	May 137 L, equati 9.45 dix L, equ 220.07 L, equat	Jun 137 on L9 or 7.98 uation L 203.14 ion L15	Jul 137 r L9a), a 8.62 13 or L1 191.82 or L15a	Aug 137 Iso see 11.21 3a), also 189.16), also se	Sep 137 Table 5 15.04 See Tal 195.87	Oct 137 19.1 ole 5 210.14	Nov 137 22.29 228.16	Dec 137 23.76 245.1	eating	(66) (67) (68)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41 Cooking gains (69)m= 36.7 Pumps and fair (70)m= 3	m in calc ains (see s (Table Feb 137 (calculat 20.53 ins (calc 259.07 (calculat 36.7 ns gains 3	ted in Ap 252.36 ted in Ap 36.7 (Table 5	and 5a ts Apr 137 opendix 12.64 Appendix 238.09 opendix 36.7 5a)	only if constructions only its construction of constructions on the construction of constructions on the const	Jun 137 5 on L9 of 7.98 uation L 203.14 ion L15 36.7	Jul 137 r L9a), a 8.62 13 or L1 191.82 or L15a; 36.7	Aug 137 Iso see 11.21 3a), also 189.16), also se 36.7	Sep 137 Table 5 15.04 See Tal 195.87 ee Table 36.7	Oct 137 19.1 ole 5 210.14 5 36.7	Nov 137 22.29 228.16	Dec 137 23.76 245.1 36.7	eating	(66) (67) (68) (69)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41 Cooking gains (69)m= 36.7 Pumps and fai	m in calc ains (see s (Table Feb 137 (calculat 20.53 ins (calc 259.07 (calculat 36.7 ns gains 3	ted in Ap 252.36 ted in Ap 36.7 (Table 5	and 5a ts Apr 137 opendix 12.64 Appendix 238.09 opendix 36.7 5a)	only if constructions only its constructions only in constructions	Jun 137 5 on L9 of 7.98 uation L 203.14 ion L15 36.7	Jul 137 r L9a), a 8.62 13 or L1 191.82 or L15a; 36.7	Aug 137 Iso see 11.21 3a), also 189.16), also se 36.7	Sep 137 Table 5 15.04 See Tal 195.87 ee Table 36.7	Oct 137 19.1 ole 5 210.14 5 36.7	Nov 137 22.29 228.16	Dec 137 23.76 245.1 36.7	eating	(66) (67) (68) (69)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41 Cooking gains (69)m= 36.7 Pumps and fail (70)m= 3 Losses e.g. ev (71)m= -109.6	m in calc ains (see as (Table Feb 137 (calculat 20.53 ins (calc 259.07 (calcula 36.7 ns gains 3 raporatio -109.6	ted in Apulated in	and 5a ts Apr 137 opendix 12.64 Appendix 238.09 opendix 36.7 5a) 3	only if c): May 137 L, equati 9.45 dix L, equ 220.07 L, equati 36.7	Jun 137 fon L9 of 7.98 uation L 203.14 ion L15 36.7	Jul 137 r L9a), a 8.62 13 or L1 191.82 or L15a 36.7	Aug 137 Iso see 11.21 3a), also 189.16), also se 36.7	Sep 137 Table 5 15.04 See Tal 195.87 ee Table 36.7	Oct 137 19.1 ole 5 210.14 5 36.7	Nov 137 22.29 228.16 36.7	Dec 137 23.76 245.1 36.7	eating	(66) (67) (68) (69) (70)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41 Cooking gains (69)m= 36.7 Pumps and far (70)m= 3 Losses e.g. ev (71)m= -109.6 Water heating	m in calc ains (see as (Table Feb 137 (calculat 20.53 ins (calc 259.07 (calcula 36.7 ns gains 3 raporatio -109.6	ted in Apulated in	and 5a ts Apr 137 opendix 12.64 Appendix 238.09 opendix 36.7 5a) 3	only if c): May 137 L, equati 9.45 dix L, equ 220.07 L, equati 36.7	Jun 137 fon L9 of 7.98 uation L 203.14 ion L15 36.7	Jul 137 r L9a), a 8.62 13 or L1 191.82 or L15a 36.7	Aug 137 Iso see 11.21 3a), also 189.16), also se 36.7	Sep 137 Table 5 15.04 See Tal 195.87 ee Table 36.7	Oct 137 19.1 ole 5 210.14 5 36.7	Nov 137 22.29 228.16 36.7	Dec 137 23.76 245.1 36.7	eating	(66) (67) (68) (69) (70)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41 Cooking gains (69)m= 36.7 Pumps and fair (70)m= 3 Losses e.g. ev (71)m= -109.6 Water heating (72)m= 89.5	m in calc ains (see as (Table Feb 137 (calculat 20.53 ins (calc 259.07 (calculat 36.7 as gains 3 raporatio -109.6 gains (T	ted in Apulated in 252.36 ted in Apulated	of (65)m and 5a ts Apr 137 opendix 12.64 Append 238.09 opendix 36.7 5a) 3 cive valu	only if c May 137 L, equati 9.45 dix L, equ 220.07 L, equati 36.7 3 es) (Tab	Jun 137 fon L9 of 7.98 uation L 203.14 ion L15 36.7 3 le 5) -109.6	Jul 137 r L9a), a 8.62 13 or L1 191.82 or L15a 36.7	Aug 137 Iso see 11.21 3a), also 189.16), also se 36.7	Sep 137 Table 5 15.04 See Tal 195.87 ee Table 36.7 3 -109.6	Oct 137 19.1 ole 5 210.14 5 36.7 3 -109.6	Nov 137 22.29 228.16 36.7 3	Dec 137 23.76 245.1 36.7 3	eating	(66) (67) (68) (69) (70) (71)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41 Cooking gains (69)m= 36.7 Pumps and fai (70)m= 3 Losses e.g. ev (71)m= -109.6 Water heating (72)m= 89.5 Total internal	m in calc ains (see s (Table Feb 137 (calculat 20.53 ins (calc 259.07 (calculat 36.7 ns gains 3 raporatio -109.6 gains (T 87.2 gains =	ted in Ap 16.7 ulated in Ap 252.36 ted in Ap 36.7 (Table 5 3 on (negat -109.6 Table 5) 82.44	of (65)m and 5a ts Apr 137 opendix 12.64 Appendix 238.09 opendix 36.7 5a) 3 cive valu -109.6	only if c May 137 L, equati 9.45 dix L, equ 220.07 L, equati 36.7 3 es) (Tab	Jun 137 on L9 of 7.98 uation L 203.14 ion L15 36.7 3 le 5) -109.6	Jul 137 r L9a), a 8.62 13 or L1 191.82 or L15a; 36.7 3 -109.6	Aug 137 Iso see 11.21 3a), also 189.16), also so 36.7 3	Sep 137 Table 5 15.04 See Tal 195.87 See Table 36.7 3	Oct 137 19.1 ole 5 210.14 5 36.7 3 -109.6 76.25 70)m + (7	Nov 137 22.29 228.16 36.7 3	Dec 137 23.76 245.1 36.7 3 87.21	eating	(66) (67) (68) (69) (70) (71)
Metabolic gain Jan (66)m= 137 Lighting gains (67)m= 23.12 Appliances ga (68)m= 256.41 Cooking gains (69)m= 36.7 Pumps and fair (70)m= 3 Losses e.g. ev (71)m= -109.6 Water heating (72)m= 89.5	m in calc ains (see as (Table Feb 137 (calculat 20.53 ins (calc 259.07 (calculat 36.7 as gains 3 raporatio -109.6 gains (T 87.2 gains =	ted in Apulated in 252.36 ted in Apulated	of (65)m and 5a ts Apr 137 opendix 12.64 Append 238.09 opendix 36.7 5a) 3 cive valu	only if c May 137 L, equati 9.45 dix L, equ 220.07 L, equati 36.7 3 es) (Tab -109.6	Jun 137 fon L9 of 7.98 uation L 203.14 ion L15 36.7 3 le 5) -109.6	Jul 137 r L9a), a 8.62 13 or L1 191.82 or L15a 36.7	Aug 137 Iso see 11.21 3a), also 189.16), also se 36.7	Sep 137 Table 5 15.04 See Tal 195.87 ee Table 36.7 3 -109.6	Oct 137 19.1 ole 5 210.14 5 36.7 3 -109.6	Nov 137 22.29 228.16 36.7 3 -109.6 83.82 1)m + (72)	Dec 137 23.76 245.1 36.7 3	eating	(66) (67) (68) (69) (70) (71)

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Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation: Access Fa	octor	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x 0.77	X	9.44	x	36.79	x	0.85	x	0.7	=	143.22	(77)
Southeast 0.9x 0.77	X	9.44	X	62.67	x	0.85	x	0.7	=	243.95	(77)
Southeast 0.9x 0.77	x	9.44	X	85.75	x	0.85	x	0.7	=	333.79	(77)
Southeast 0.9x 0.77	X	9.44	x	106.25	x	0.85	x	0.7	=	413.58	(77)
Southeast 0.9x 0.77	x	9.44	X	119.01	x	0.85	x	0.7	=	463.24	(77)
Southeast 0.9x 0.77	x	9.44	X	118.15	x	0.85	x	0.7	=	459.89	(77)
Southeast 0.9x 0.77	x	9.44	X	113.91	X	0.85	X	0.7	=	443.39	(77)
Southeast 0.9x 0.77	Х	9.44	X	104.39	x	0.85	x	0.7	=	406.33	(77)
Southeast 0.9x 0.77	X	9.44	X	92.85	x	0.85	x	0.7	=	361.42	(77)
Southeast 0.9x 0.77	x	9.44	X	69.27	x	0.85	x	0.7	=	269.62	(77)
Southeast 0.9x 0.77	X	9.44	X	44.07	x	0.85	x	0.7	=	171.54	(77)
Southeast 0.9x 0.77	X	9.44	X	31.49	x	0.85	x	0.7	=	122.56	(77)
Southwest _{0.9x} 0.77	X	3.39	X	36.79		0.85	x	0.7	=	51.43	(79)
Southwest _{0.9x} 0.77	X	3.39	X	62.67]	0.85	x	0.7	=	87.61	(79)
Southwest _{0.9x} 0.77	x	3.39	X	85.75]	0.85	x	0.7	=	119.87	(79)
Southwest _{0.9x} 0.77	X	3.39	X	106.25		0.85	x	0.7	=	148.52	(79)
Southwest _{0.9x} 0.77	х	3.39	X	119.01]	0.85	x	0.7	=	166.35	(79)
Southwest _{0.9x} 0.77	X	3.39	X	118.15		0.85	x	0.7	=	165.15	(79)
Southwest _{0.9x} 0.77	X	3.39	X	113.91		0.85	x	0.7	=	159.22	(79)
Southwest _{0.9x} 0.77	х	3.39	X	104.39]	0.85	x	0.7	=	145.92	(79)
Southwest _{0.9x} 0.77	X	3.39	X	92.85		0.85	x	0.7	=	129.79	(79)
Southwest _{0.9x} 0.77	X	3.39	X	69.27		0.85	x	0.7	=	96.82	(79)
Southwest _{0.9x} 0.77	X	3.39	X	44.07]	0.85	X	0.7	=	61.6	(79)
Southwest _{0.9x} 0.77	x	3.39	X	31.49]	0.85	X	0.7	=	44.01	(79)
Northwest 0.9x 0.77	X	2.08	X	11.28	X	0.85	X	0.7	=	9.68	(81)
Northwest 0.9x 0.77	X	2.08	X	22.97	X	0.85	X	0.7	=	19.7	(81)
Northwest 0.9x 0.77	X	2.08	X	41.38	X	0.85	X	0.7	=	35.49	(81)
Northwest 0.9x 0.77	X	2.08	X	67.96	X	0.85	X	0.7	=	58.28	(81)
Northwest 0.9x 0.77	X	2.08	X	91.35	X	0.85	X	0.7	=	78.34	(81)
Northwest 0.9x 0.77	X	2.08	X	97.38	X	0.85	X	0.7	=	83.52	(81)
Northwest 0.9x 0.77	X	2.08	X	91.1	X	0.85	X	0.7	=	78.13	(81)
Northwest 0.9x 0.77	X	2.08	X	72.63	X	0.85	X	0.7	=	62.29	(81)
Northwest 0.9x 0.77	X	2.08	X	50.42	X	0.85	X	0.7	=	43.24	(81)
Northwest 0.9x 0.77	X	2.08	X	28.07	X	0.85	X	0.7	=	24.07	(81)
Northwest 0.9x 0.77	X	2.08	X	14.2	x	0.85	x	0.7	=	12.18	(81)
Northwest 0.9x 0.77	X	2.08	X	9.21	x	0.85	x	0.7	=	7.9	(81)
Rooflights _{0.9x} 1	X	1.85	X	18.86	x	0.63	x	0.7	=	13.85	(82)
Rooflights _{0.9x} 1	X	1.85	X	39.78	x	0.63	x	0.7	=	29.21	(82)
Rooflights _{0.9x} 1	X	1.85	x	74.42	x	0.63	x	0.7	=	54.64	(82)

Rooflights 0.9s		
Rooflights 0.9	Rooflights 0.9x 1 x 1.85 x 125.11 x 0.63 x 0.7 =	91.87 (82)
Rooflights 0.0x	Rooflights 0.9x 1 x 1.85 x 169.75 x 0.63 x 0.7 =	124.64 (82)
Rooflights 0.9x	Rooflights 0.9x 1 x 1.85 x 181.43 x 0.63 x 0.7 =	133.22 (82)
Rooflights 0.9x	Rooflights 0.9x 1 x 1.85 x 169.55 x 0.63 x 0.7 =	124.5 (82)
Rooflights 0.9x	Rooflights 0.9x 1 x 1.85 x 134.35 x 0.63 x 0.7 =	98.65 (82)
Rooflights 0.ax	Rooflights 0.9x 1 x 1.85 x 91.71 x 0.63 x 0.7 =	67.34 (82)
Rooflights 0.9x	Rooflights 0.9x 1 x 1.85 x 49.39 x 0.63 x 0.7 =	36.27 (82)
Solar gains in watts, calculated for each month (83)m = Sum(74)m (82)m (83)m = Z18.17 390.47 543.78 171.225 832.58 841.78 805.24 713.19 601.8 426.78 262.94 185.66 (83) Total gains — internal and solar (84)m = (73)m + (83)m , watts (84)m = (864.3 843.8 962.39 1105.58 1198.92 1184.02 1131.78 1046.78 948.89 799.37 664.31 608.83 (84) 7. Mean internal temperature (ineating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a) When internal temperature in living area, h1,m (see Table 9a) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (86)m = 1 0.99 0.98 0.96 0.89 0.76 0.6 0.66 0.87 0.98 1 1 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 19.21 19.42 19.76 20.2 20.59 20.86 20.96 20.94 20.73 20.21 19.62 19.17 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m = 19.53 19.53 19.53 19.53 19.54 19.55 19.56 19.56 19.56 19.55 19.55 19.55 19.54 19.54 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) Mean internal temperature in the rest of dwelling, h2,m (see Table 9a) (89)m = 1 0.99 0.98 0.98 0.94 0.84 0.64 0.43 0.49 0.78 0.96 0.99 1 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m = 17.2 17.51 18 18.83 19.16 19.47 19.55 19.54 19.55 19.54 19.35 18.66 17.82 17.16 (90) Rea internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m = 17.55 17.79 18.25 18.83 19.33 19.53 19.71 19.75 19.55 19.54 19.55 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.56 19.55 19.54 19.55 19.56	Rooflights 0.9x 1 x 1.85 x 23.99 x 0.63 x 0.7 =	17.62 (82)
Casim	Rooflights 0.9x 1 x 1.85 x 15.23 x 0.63 x 0.7 =	11.18 (82)
Casim		
Casim	Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m	
(84) me 664.3 814.38 962.39 1105.58 1199.82 1184.02 1131.78 1046.78 948.89 799.37 664.31 608.83 (84) 7. Mean internal temperature (freating season)		(83)
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C)	Total gains – internal and solar (84)m = (73)m + (83)m , watts	
Temperature during heating periods in the living area from Table 9, Th1 (°C)	(84)m= 654.3 814.38 962.39 1105.58 1199.82 1184.02 1131.78 1046.78 948.89 799.37 664.31 608.83	(84)
Temperature during heating periods in the living area from Table 9, Th1 (°C)	7 Mean internal temperature (heating season)	
Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		21 (85)
Mean internal temperature in the rest of dwelling, h2,m (see Table 9a) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature in the rest of dwelling from Table 9, Th2 (°C) Mean internal temperature in the rest of dwelling from Table 9, Th2 (°C) Mean internal temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) Mean internal temperature in the rest of dwelling from Table 9 in 1 0.99 0.98 0.94 0.84 0.64 0.43 0.49 0.78 0.96 0.99 1 0.99 0.98 0.94 0.84 0.64 0.43 0.49 0.78 0.96 0.99 1 0.99 0.98 0.94 0.84 0.64 0.43 0.49 0.78 0.96 0.99 1 0.90 0.99		21 (00)
Residual Nation 1		
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.21 19.42 19.76 20.2 20.59 20.86 20.96 20.94 20.73 20.21 19.62 19.17 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.53 19.53 19.53 19.53 19.54 19.55 19.56 19.56 19.56 19.56 19.55 19.55 19.55 19.54 19.54 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 1 0.99 0.98 0.94 0.84 0.84 0.64 0.43 0.49 0.78 0.96 0.99 1 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 17.2 17.51 18 18.63 19.16 19.47 19.55 19.55 19.54 19.35 18.66 17.82 17.16 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 17.65 17.94 18.4 18.98 19.48 19.78 19.86 19.85 19.66 19.01 18.22 17.61 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.5 17.79 18.25 18.83 19.33 19.63 19.71 19.7 19.51 18.86 18.07 17.46 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.99 0.99 0.97 0.93 0.83 0.83 0.65 0.45 0.51 0.78 0.95 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 (95) Monthly average external temperature from Table 8		(86)
(87)me		(00)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.53 19.53 19.53 19.54 19.55 19.56 19.56 19.56 19.56 19.55 19.55 19.55 19.54 19.54 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 1 0.99 0.98 0.94 0.84 0.84 0.64 0.43 0.49 0.78 0.96 0.99 1 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 17.2 17.51 18 18.63 19.16 19.47 19.55 19.54 19.35 18.66 17.82 17.16 (90) ILA = Living area + (4) = 0.22 (91) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 17.65 17.94 18.4 18.98 19.48 19.78 19.86 19.85 19.66 19.01 18.22 17.61 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.5 17.79 18.25 18.83 19.33 19.63 19.71 19.7 19.51 18.86 18.07 17.46 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.99 0.99 0.99 0.97 0.93 0.83 0.85 0.45 0.51 0.78 0.95 0.99 1 (94) Useful gains, hmGm, W = (94)m x (84)m (95)m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 (95) Monthly average external temperature from Table 8		
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 17.2 17.51 18 18.63 19.16 19.47 19.55 19.54 19.35 18.66 17.82 17.16 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 17.65 17.94 18.4 18.98 19.48 19.78 19.86 19.85 19.66 19.01 18.22 17.61 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.5 17.79 18.25 18.83 19.33 19.63 19.71 19.7 19.51 18.86 18.07 17.46 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.99 0.99 0.97 0.93 0.83 0.65 0.45 0.51 0.78 0.95 0.99 1 (94) Useful gains, hmGm W = (94)m x (84)m (95)m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 (95) Monthly average external temperature from Table 8	Utilisation factor for gains for rest of dwelling, h2.m (see Table 9a)	
(90)m= 17.2 17.51 18 18.63 19.16 19.47 19.55 19.54 19.35 18.66 17.82 17.16 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 17.65 17.94 18.4 18.98 19.48 19.78 19.86 19.85 19.66 19.01 18.22 17.61 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.5 17.79 18.25 18.83 19.33 19.63 19.71 19.7 19.51 18.86 18.07 17.46 (93) S. Space heating requirement		(89)
(90)m= 17.2 17.51 18 18.63 19.16 19.47 19.55 19.54 19.35 18.66 17.82 17.16 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 17.65 17.94 18.4 18.98 19.48 19.78 19.86 19.85 19.66 19.01 18.22 17.61 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.5 17.79 18.25 18.83 19.33 19.63 19.71 19.7 19.51 18.86 18.07 17.46 (93) S. Space heating requirement	Macro internal term eventure in the year of ducelling TO (follow stone 2 to 7 in Table 2a)	
Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 17.65 17.94 18.4 18.98 19.48 19.78 19.86 19.85 19.66 19.01 18.22 17.61 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.5 17.79 18.25 18.83 19.33 19.63 19.71 19.7 19.51 18.86 18.07 17.46 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.99 0.99 0.97 0.93 0.83 0.65 0.45 0.51 0.78 0.95 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 (95) Monthly average external temperature from Table 8		(90)
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(93)m= 17.5 17.79 18.25 18.83 19.33 19.63 19.71 19.7 19.51 18.86 18.07 17.46 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.99 0.99 0.97 0.93 0.83 0.65 0.45 0.51 0.78 0.95 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 (95) Monthly average external temperature from Table 8	(92)m= 17.65 17.94 18.4 18.98 19.48 19.78 19.86 19.85 19.66 19.01 18.22 17.61	(92)
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Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.99 0.99 0.97 0.93 0.83 0.65 0.45 0.51 0.78 0.95 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 Monthly average external temperature from Table 8	(93)m= 17.5 17.79 18.25 18.83 19.33 19.63 19.71 19.7 19.51 18.86 18.07 17.46	(93)
the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm:	8. Space heating requirement	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.99 0.99 0.97 0.93 0.83 0.65 0.45 0.51 0.78 0.95 0.99 1 (94) Useful gains, hmGm , W = (94)m x (84)m (95)m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 Monthly average external temperature from Table 8		
Utilisation factor for gains, hm:		
(94)m= 0.99 0.99 0.97 0.93 0.83 0.65 0.45 0.51 0.78 0.95 0.99 1 Useful gains, hmGm, W = (94)m x (84)m (95)m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 Monthly average external temperature from Table 8		
Useful gains, hmGm , W = (94) m x (84) m (95) m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 Monthly average external temperature from Table 8		(0.4)
(95)m= 650.63 803.87 933.47 1022.78 990.89 766.05 508.36 531.17 741.29 758.97 656.85 606.23 (95) Monthly average external temperature from Table 8		(94)
Monthly average external temperature from Table 8		(05)
		(95)
(96) m = 4.3		(00)
		(96)
Heat loss rate for mean internal temperature, Lm , W = $[(39)m \times [(93)m - (96)m]]$		(07)
(07)	(97)m= 2270.8 2212.79 2012.09 1684.14 1291.27 843.61 521.64 552.68 909.82 1397.11 1863.79 2261.43	(97)
(97)m= 2270.8 2212.79 2012.09 1684.14 1291.27 843.61 521.64 552.68 909.82 1397.11 1863.79 2261.43 (97)	- 19710 = 1.2270.8 1.2212.79 1.2012.09 1.1684.14 1.1291.27 1.843.61 1.521.64 1.552.68 1.909.82 1.1397.11 1.1863.79 1.2261.43 1	(97)

Space heating requi	rement fo	r each n	nonth, k\	Wh/mon	th = 0.02	4 x [(97)	m – (95)m] x (4	1)m			
(98)m= 1205.41 946.8	802.49	476.18	223.48	0	0	0	0	474.78	869	1231.47		_
						Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	6229.6	(98)
Space heating requi	rement in	kWh/m²	²/year								62.26	(99)
9a. Energy requireme	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	HP)					
Space heating:										г		7
Fraction of space he				mentary	•	(200)	(004)			Ļ	0	(201)
Fraction of space he		•	` ,			(202) = 1 -	, ,	(222)]		Ļ	1	(202)
Fraction of total heat	_	•				(204) = (20	02) x [1 –	(203)] =		Ļ	1	(204)
Efficiency of main sp		•								Ļ	90.4	(206)
Efficiency of second	ary/suppl	ementar •	y heating	g systen	า, % 					<u> </u>	0	(208)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space heating requi	rement (c	476.18	223.48) 0	0	0	0	474.78	869	1231.47		
$(211)m = \{[(98)m \times (211)m + $						U U		474.70	000	1231.47		(211)
1333.42 1047.34	T	526.75	247.21	0	0	0	0	525.2	961.28	1362.24		(211)
	1	ļ	<u> </u>				l (kWh/yea	ar) =Sum(2	L 211) _{15,1012}	<u> </u>	6891.15	(211)
Space heating fuel (secondar	y), kWh/	month							L		_
$= \{[(98)m \times (201)]\} \times$	100 ÷ (20	(8)										
(215)m = 0 0	0	0	0	0	0	0	0	0	0	0		7
						Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	Ē	0	(215)
Water heating Output from water heating	ater (calc	ulated a	hove)									
212.9 187.66	197.12	175.4	169.82	149.57	143.3	159.74	161.51	183.27	193.74	207.79		
Efficiency of water he	ater	•	•		•			•		·	80.3	(216)
(217)m= 88.72 88.56	88.21	87.44	85.74	80.3	80.3	80.3	80.3	87.34	88.37	88.79		(217)
Fuel for water heating												
(219)m = (64) m x 10 (219)m= 239.96 211.91	$0 \div (217)$ 223.46	200.6	198.06	186.26	178.45	198.93	201.13	209.83	219.23	234.03		
, ,		ļ		ļ		Tota	I = Sum(2	19a) ₁₁₂ =		! <u> </u>	2501.84	(219)
Annual totals								k\	Wh/year	· _	kWh/year	
Space heating fuel us	ed, main	system	1								6891.15	
Water heating fuel us	ed										2501.84	
Electricity for pumps,	fans and	electric	keep-ho	t								_
central heating pump) :									30		(230c)
boiler with a fan-ass	sted flue									45		(230e)
Total electricity for the	above, I	kWh/yea	ır			sum	of (230a).	(230g) =			75	(231)
Electricity for lighting										ļ	408.29	(232)
Total delivered energ	v for all us	sas (211) (221)	± (231)	± (232)	(237h)	_			F	9876.28	(338)
Total delivered energ	y ioi ali a	363 (211)(~~ 1)	1 (201)	T (232).	(2370)	_				9070.20	(000)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	1488.49 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	540.4 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2028.89 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	211.9 (268)
Total CO2, kg/year	sum	of (265)(271) =	2279.71 (272)
Dwelling CO2 Emission Rate	(272	(a) ÷ (4) =	22.79 (273)
El rating (section 14)			79 (274)

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Proiect Information:

Assessed By: Neil Ingham (STRO010943) Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 94.4m²

Site Reference: 11-12 Grenville Street - LEAN

Plot Reference: Unit 2

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

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

18.63 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

31.26 kg/m²

Fail

Excess emissions = 12.63 kg/m² (67.8 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 107.1 kWh/m²

Excess energy = $49.07 \text{ kg/m}^2 (84.6 \%)$

2 Fabric U-values

Element	Average	Highest	
External wall	0.30 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	(no roof)		
Openings	4.71 (max. 2.00)	4.80 (max. 3.30)	Fail

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals 10.00 (design value)

Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Combi boiler

Efficiency 89.5 % SEDBUK2009

Minimum 88.0 % OK

Secondary heating system: None

Fail

5 Cylinder insulation			
Hot water Storage:	No cylinder		
6 Controls			
Space heating controls	TTZC by plumbing and	electrical services	ok
Hot water controls:	No cylinder thermostat		
	No cylinder		
Boiler interlock:	Yes		OK
7 Low energy lights			
Percentage of fixed lights with	n low-energy fittings	100.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames val	ley):	Slight	OK
Based on:			
Overshading:		Average or unknown	
Windows facing: North East		10.89m²	
Windows facing: North West		5.44m²	
Windows facing: South West		6.21m²	
Ventilation rate:		4.00	
40 V			
10 Key features		0.101/2021	
Party Walls U-value		0 W/m²K	

		User Details:			
Assessor Name: Software Name:	Neil Ingham Stroma FSAP 2012	Stroma Nui Software V	ersion: Ve	ΓRO010943 ersion: 1.0.5.50	
Address :	Pi	roperty Address: Unit 2	2		
1. Overall dwelling dime	nsions:				
1. Overall awelling anne	11310113.	Area(m²)	Av. Height(m)	Volume(m³)	
Ground floor		15.96 (1a) x	3.3 (2a)		3a)
First floor		39.22 (1b) x	3.25 (2b)		3b)
Second floor		39.22 (1c) x	3.05 (2c)		3c)
	a)+(1b)+(1c)+(1d)+(1e)+(1n		0.00	110.02	,
Dwelling volume	2) (((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) (((2) (((2) (((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) (((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) ((2) (((2) (((2) ((2) ((2) (((2) (((2) (((2) (((2)		Bb)+(3c)+(3d)+(3e)+(3n)	= 200.75 //5	E)
		(04) (0	(00) (00) (00) (00)	= 299.75 (5)
2. Ventilation rate:	main secondar	y other	total	m³ per hour	
	heating heating	y other			
Number of chimneys	0 + 0	+ 0 =	0 x 40 =	0 (6	6a)
Number of open flues	0 + 0	+ 0 =	0 x 20 =	0 (6	6b)
Number of intermittent fa	ns		4 x 10 =	40 (7	7a)
Number of passive vents			0 x 10 =	0 (7	7 b)
Number of flueless gas fi	res		0 x 40 =	0 (7	7c)
			Δ	ir changes per hour	
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7	a)+(7h)+(7c) -			0)
·	een carried out or is intended, proceed		40 ÷ (5)	= 0.13 (8	5)
Number of storeys in th		(),	(-) (-)	0 (9	9)
Additional infiltration			[(9)-1]x0	.1 = 0 (1	10)
Structural infiltration: 0.	25 for steel or timber frame or	0.35 for masonry cons	struction	0 (1	11)
**	resent, use the value corresponding to	the greater wall area (after			
deducting areas of opening	loor, enter 0.2 (unsealed) or 0.	1 (sealed), else enter ()	0 (1	12)
If no draught lobby, ent	,	(000000), 000000000000000000000000000000			13)
• •	and doors draught stripped				14)
Window infiltration	3 11	0.25 - [0.2 x (14) -	- 100] =		15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =		16)
Air permeability value,	q50, expressed in cubic metre	s per hour per square	metre of envelope are		, 17)
•	ity value, then $(18) = [(17) \div 20] + (8)$		-1 - 2		18)
•	s if a pressurisation test has been don		ty is being used		•
Number of sides sheltere	d			0 (1	19)
Shelter factor		(20) = 1 - [0.075 x]	(19)] =	1 (2	20)
Infiltration rate incorporat	ing shelter factor	(21) = (18) x (20) :	=	0.63	21)
Infiltration rate modified for	or monthly wind speed				
Jan Feb	Mar Apr May Jun	Jul Aug Sep	Oct Nov [Dec	
Monthly average wind sp	eed from Table 7				

4.4

4.3

3.8

3.8

3.7

4.3

4

4.5

4.7

4.9

(22)m=

5.1

5

Wind Factor (2	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 infilti	ration rat	e (allowi	ng for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.81	0.79	0.78	0.7	0.68	0.6	0.6	0.59	0.63	0.68	0.71	0.74]	
Calculate effe		•	rate for t	he appli	cable ca	ise	•	•	•	•	•		(22-)
If exhaust air h			endix N. (2	(23a) = (23a	a) × Fmv (e	eguation (N	N5)) . othe	rwise (23b) = (23a)			0	(23a)
If balanced wit									,, = (20a)			0	(23b)
a) If balance		•	•	•		,		,	2h)m + (23h) x [1 – (23c)		(230)
(24a)m = 0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If balance	ed mech	anical ve	entilation	without	heat red	covery (N	л ЛV) (24t	p)m = (22)	2b)m + (23b)		1	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If whole h	nouse ex	tract ven	tilation o	or positiv	e input	ventilatio	n from o	outside			•	•	
if (22b)	m < 0.5 ×	(23b), t	hen (24	c) = (23b	o); other	wise (24	c) = (22h	o) m + 0.	.5 × (23b	o)	_	-	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If natural					•				0.51				
(24d)m = 0.83	$m = 1, th_0$	0.8	0.74	0.73	0.68	0.68	0.5 + [(2	0.7	0.5]	0.75	0.78	1	(24d
Effective air	ļ	<u> </u>	<u> </u>			ļ			1 0.70	1 0.70	0.70	J	(= : -,
(25)m= 0.83	0.81	0.8	0.74	0.73	0.68	0.68	0.67	0.7	0.73	0.75	0.78	1	(25)
				l	l							J	
3. Heat losse	es and he Gros		<u>oaramet</u> Openir		NIa4 Au								
ELEMENT		_	Operiii	ius		.00	LL val		A V I I		L volu	^	$\Lambda V \nu$
	area	(m^2)	· n	_	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²-		A X k kJ/K
Doors	area	(m²)	· m	_		m²				K)			
Doors Windows Type		(m²)	m	_	A ,r	m² x	W/m2	2K =	(W/	K)			kJ/K
	e 1	(m²)	· m	_	A ,r	m ² x	W/m2	2K = - 0.04] =	(W/ 10.101	K)			kJ/K (26)
Windows Type	e 1 e 2	(m²)	'n	_	A ,r 2.59	m ² x y x ¹ x x x x x x x x x x x x x x x x x x x	W/m2 3.9 /[1/(4.8)+	2K = 0.04] = 0.04] =	(W/ 10.101 43.85	K)			kJ/K (26) (27)
Windows Type	e 1 e 2	(m²)	'n	_	A ,r 2.59 10.89	m ² x x x x x x x x x x x x x x x x x x x	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+	2K = 0.04] = 0.04] =	(W/ 10.101 43.85 21.91	K)			kJ/K (26) (27) (27)
Windows Type Windows Type Windows Type	e 1 e 2		18.9	n ²	A ,r 2.59 10.89 5.44 6.21	m ²	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+	eK = 0.04] = 0.04] = 0.04] =	(W// 10.101 43.85 21.91 25.01	K)			kJ/K (26) (27) (27) (27)
Windows Type Windows Type Windows Type Floor	e 1 e 2 e 3	24		2	A ,r 2.59 10.89 5.44 6.21	m ²	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	eK = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = = = =	(W// 10.101 43.85 21.91 25.01 2.394	K)			kJ/K (26) (27) (27) (27) (28)
Windows Type Windows Type Windows Type Floor Walls Type1	e 1 e 2 e 3 98.2	24	18.9	2	A ,r 2.59 10.89 5.44 6.21 15.96 79.32	m ²	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.15 0.3	eK = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = = = =	(W// 10.101 43.85 21.91 25.01 2.394 23.8	K)			kJ/K (26) (27) (27) (27) (28) (29)
Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2	e 1 e 2 e 3 98.2	24	18.9	2	A ,r 2.59 10.89 5.44 6.21 15.96 79.32	m ²	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.15 0.3	eK = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = = = =	(W// 10.101 43.85 21.91 25.01 2.394 23.8	K)			kJ/K (26) (27) (27) (27) (28) (29)
Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e	e 1 e 2 e 3 98.2	24	18.9	2	A ,r 2.59 10.89 5.44 6.21 15.96 79.32 16.66 137.0	m ²	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.15 0.3 0.28	2K = 0.04] = 0.04] = 0.04] = = = =	(W// 10.101 43.85 21.91 25.01 2.394 23.8 4.66	K)			kJ/K (26) (27) (27) (27) (28) (29) (29) (31) (32)
Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall Party ceiling * for windows and	e 1 e 2 e 3 98.2 22.8 elements	24 37 , m ² ows, use e	18.9 6.21	2 2 indow U-va	A ,r 2.59 10.89 5.44 6.21 15.96 137.0 118.1 39.22 alue calcul	m ²	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.15 0.3 0.28	2K = 0.04 = 0.04 = 0.04 = = = =	(W// 10.101 43.85 21.91 25.01 2.394 23.8 4.66	K)	kJ/m²-	K	kJ/K (26) (27) (27) (27) (28) (29) (29) (31) (32)
Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall Party ceiling	e 1 e 2 e 3 98.2 22.8 elements	24 37 , m ² ows, use e sides of in	18.9 6.21 effective whaternal wal	2 2 indow U-va	A ,r 2.59 10.89 5.44 6.21 15.96 137.0 118.1 39.22 alue calcul	x1.	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.15 0.3 0.28	2K = 0.04 = 0.04 = 0.04 = = = = =	(W// 10.101 43.85 21.91 25.01 2.394 23.8 4.66	K)	kJ/m²-	K	kJ/K (26) (27) (27) (28) (29) (31) (32)
Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall Party ceiling * for windows and ** include the are	e 1 e 2 e 3 98.2 22.8 elements d roof windows on both	ows, use e sides of in= S (A x	18.9 6.21 effective whaternal wal	2 2 indow U-va	A ,r 2.59 10.89 5.44 6.21 15.96 137.0 118.1 39.22 alue calcul	x1.	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.15 0.3 0.28	2K = 0.04 =	(W// 10.101 43.85 21.91 25.01 2.394 23.8 4.66	K)	kJ/m²-	K	kJ/K (26) (27) (27) (28) (29) (31) (32) (32b
Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall Party ceiling * for windows and ** include the are Fabric heat lo	e 1 e 2 e 3 98.2 22.8 elements d roof winders on both ss, W/K = Cm = S(24 37 , m ² ows, use e sides of in = S (A x (A x k)	18.9 6.21 effective winternal wall U)	2 2 indow U-va	A ,r 2.59 10.89 5.44 6.21 15.96 79.32 16.66 137.0 118.1 39.22 alue calculatitions	x1.	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.15 0.3 0.28	2K = 0.04 = 0.04 = 0.04 = = = = = = = ((28).	(W// 10.101 43.85 21.91 25.01 2.394 23.8 4.66	K)	kJ/m²-	K	kJ/K (26) (27) (27) (28) (29) (31) (32) (32b) (72 (33)
Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall Party ceiling * for windows and ** include the are Fabric heat lo Heat capacity Thermal mass For design assess	e 1 e 2 e 3 98.2 22.8 elements d roof winders on both ss, W/K = Cm = S(ows, use esides of interest (TMF)	18.9 6.21 effective weaternal waiternal waiter	indow U-valls and pan	A ,r 2.59 10.89 5.44 6.21 15.96 79.32 16.66 137.0 118.1 39.22 alue calculatitions	x1.	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.15 0.3 0.28 0 formula 1 (26)(30)	2K = 0.04 =	(W// 10.101 43.85 21.91 25.01 2.394 23.8 4.66 0	K)	kJ/m²-	h 3.2	kJ/K (26) (27) (27) (28) (29) (31) (32) (32b) 72 (33) 58 (34)
Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall Party ceiling * for windows and ** include the are Fabric heat lo Heat capacity Thermal mass	e 1 e 2 e 3 98.2 22.8 elements d roof winders on both ss, W/K = Cm = S(s parame essments wheeled of a decease of a dec	ows, use e sides of in = S (A x (A x k) eter (TMF ere the de tailed calcu	18.9 6.21 effective weaternal was U) $P = Cm - tails of the ulation.$	indow U-valls and part	A ,r 2.59 10.89 5.44 6.21 15.96 79.32 16.66 137.0 118.1 39.22 alue calculatitions	x1.	W/m2 3.9 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.15 0.3 0.28 0 formula 1 (26)(30)	2K = 0.04 =	(W// 10.101 43.85 21.91 25.01 2.394 23.8 4.66 0	K)	kJ/m²-	h 3.2	kJ/K (26) (27) (27) (28) (29) (31) (32) (32b) (72 (33) 58 (34)

if details	s of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)						_		
	abric he								(33) +	(36) =			152.28	(37)
Ventila	ation hea	at loss ca	alculated	l monthly	/	ı	ı	ı	· · ·	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	81.72	80.47	79.24	73.47	72.39	67.37	67.37	66.44	69.3	72.39	74.58	76.86		(38)
Heat t	ransfer c	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	234	232.75	231.52	225.75	224.67	219.65	219.65	218.72	221.59	224.67	226.86	229.14		
Heat l	oss para	meter (F	ILP), W/	′m²K						Average = = (39)m ÷	Sum(39) _{1.} · (4)	12 /12=	225.75	(39)
(40)m=	2.48	2.47	2.45	2.39	2.38	2.33	2.33	2.32	2.35	2.38	2.4	2.43		
										Average =	Sum(40) ₁ .	12 /12=	2.39	(40)
Numb	er of day	s in mor	nth (Tab	le 1a)		г	г		г	r	ī			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ener	gy requi	rement:								kWh/ye	ear:	
	ned occu			[4 0)(0)	(0 0003) 40 v /TF	-A 12.0°	\2\1 · 0 (0012 v /	TEA 12		68		(42)
	FA > 13.9 FA £ 13.9		+ 1.76 X	[1 - exp	(-0.0003	349 X (11	-A -13.9)2)] + 0.0	JU13 X (IFA -13.	.9)			
	al averag	•	iter usac	ae in litre	s per da	av Vd.av	erage =	(25 x N)	+ 36		97	.88		(43)
	the annua									se target o		.00		(10)
not mor	e that 125	litres per p	person per	day (all w	ater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage in	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	107.67	103.75	99.84	95.92	92.01	88.09	88.09	92.01	95.92	99.84	103.75	107.67		
Energy	content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x D	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	1174.57	(44)
(45)m=	159.67	139.65	144.1	125.63	120.55	104.02	96.39	110.61	111.93	130.45	142.39	154.63		
						<u>[</u>	<u>[</u>	<u> </u>	-	<u>I </u>	I m(45) ₁₁₂ =		1540.04	(45)
If instar	ntaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)			, ,	L		
(46)m=	23.95	20.95	21.62	18.85	18.08	15.6	14.46	16.59	16.79	19.57	21.36	23.19		(46)
Water	storage	loss:												
Storag	ge 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)						
	wise if no		hot wate	er (this in	ıcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	storage													
,	nanufact				or is kno	wn (kvvr	n/day):					0		(48)
Temp	erature fa	actor fro	m Table	2b								0		(49)
-	y lost fro		_	-				(48) x (49)) =			0		(50)
h) If n	nanufact			-										(= 4)
•		aye ioss	iacior if	omiabl	⊌∠ (KVVI	n/nue/ua	ıy <i>)</i>					0		(51)
Hot wa		_												
Hot wa	munity h	eating s	ee sectio											(52)
Hot was If com Volum	munity h e factor	eating s from Tal	ee section	on 4.3							-	0		(52) (53)
Hot wa If com Volum Tempo	munity h le factor erature fa	eating s from Tal actor fro	ee section ole 2a m Table	on 4.3 2b	a a r			(A7) v (51)) v (52) v (53) –		0		(53)
Hot was If com Volum Tempo Energ	munity h e factor	eating s from Tal actor fro m water	ee section ole 2a m Table storage	on 4.3 2b	ear			(47) x (51)) x (52) x (53) =				

Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)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 circui	t loss (ar	nnual) fro	m Table	3							0		(58)
Primary circui	•	•			59)m = ((58) ÷ 36	55 × (41)	m				•	
(modified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 50.96	46.03	50.88	47.3	46.89	43.44	44.89	46.89	47.3	50.88	49.32	50.96		(61)
Total heat req	uired for	water he	eating ca	alculated	I for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 210.63	185.68	194.98	172.94	167.43	147.47	141.28	157.5	159.24	181.32	191.71	205.59		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	v) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add additiona	I lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from w	ater hea	ter											
(64)m= 210.63	185.68	194.98	172.94	167.43	147.47	141.28	157.5	159.24	181.32	191.71	205.59		
	•	•					Outp	out from wa	ater heate	r (annual) ₁	12	2115.77	(64)
Heat gains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m= 65.83	57.94	60.63	53.6	51.8	45.45	43.27	48.5	49.04	56.09	59.67	64.15		(65)
						¬0.21	₹0.0	75.07	30.03	59.67	04.13		(00)
include (57)	m in cal	culation of	of (65)m		<u> </u>	<u> </u>		<u> </u>		<u> </u>		l eating	(00)
include (57) 5. Internal g			. ,	only if c	<u> </u>	<u> </u>		<u> </u>		<u> </u>		eating	(00)
5. Internal g	ains (see	e Table 5	and 5a	only if c	<u> </u>	<u> </u>		<u> </u>		<u> </u>		eating	(66)
` '	ains (see	e Table 5	and 5a	only if c	<u> </u>	<u> </u>		<u> </u>		<u> </u>		eating	(55)
5. Internal g	ains (see	E Table 5	and 5a	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	(66)
5. Internal g Metabolic gair Jan	ns (Table Feb 134.06	2 5), Wat Mar 134.06	and 5a) ts Apr 134.06	only if constant of the consta	ylinder i: Jun 134.06	Jul 134.06	Aug 134.06	or hot w	ater is fr	om com	munity h	eating	
5. Internal g Metabolic gain Jan (66)m= 134.06	ns (Table Feb 134.06	2 5), Wat Mar 134.06	and 5a) ts Apr 134.06	only if constant of the consta	ylinder i: Jun 134.06	Jul 134.06	Aug 134.06	or hot w	ater is fr	om com	munity h	eating	
5. Internal g Metabolic gain Jan (66)m= 134.06 Lighting gains	res (Table Feb 134.06 (calcula 19.55	2 Table 5 2 5), Wat Mar 134.06 ted in Ap	ts Apr 134.06 ppendix 12.04	May 134.06 L, equat	Jun 134.06 ion L9 o	Jul 134.06 r L9a), a	Aug 134.06 Iso see	Sep 134.06 Table 5	Oct 134.06	Nov	Dec	eating	(66)
5. Internal g Metabolic gain Jan (66)m= 134.06 Lighting gains (67)m= 22.02	res (Table Feb 134.06 (calcula 19.55	2 Table 5 2 5), Wat Mar 134.06 ted in Ap	ts Apr 134.06 ppendix 12.04	May 134.06 L, equat	Jun 134.06 ion L9 o	Jul 134.06 r L9a), a	Aug 134.06 Iso see	Sep 134.06 Table 5	Oct 134.06	Nov	Dec	eating	(66)
5. Internal g Metabolic gain Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga	res (Table Feb 134.06 (calcula 19.55 ins (calcula 249.51	Mar 134.06 ted in Ap 15.9 culated in 243.05	ts Apr 134.06 ppendix 12.04 Appendix 229.3	May 134.06 L, equat 9 dix L, eq 211.95	Jun 134.06 ion L9 o 7.6 uation L	Jul 134.06 r L9a), a 8.21 13 or L1 184.74	Aug 134.06 Iso see 10.67 3a), also	Sep 134.06 Table 5 14.32 see Ta	Oct 134.06 18.19 ble 5 202.39	Nov 134.06	Dec 134.06	eating	(66) (67)
5. Internal g Metabolic gair Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga (68)m= 246.94	res (Table Feb 134.06 (calcula 19.55 ins (calcula 249.51	Mar 134.06 ted in Ap 15.9 culated in 243.05	ts Apr 134.06 ppendix 12.04 Appendix 229.3	May 134.06 L, equat 9 dix L, eq 211.95	Jun 134.06 ion L9 o 7.6 uation L	Jul 134.06 r L9a), a 8.21 13 or L1 184.74	Aug 134.06 Iso see 10.67 3a), also	Sep 134.06 Table 5 14.32 see Ta	Oct 134.06 18.19 ble 5 202.39	Nov 134.06	Dec 134.06	eating	(66) (67)
5. Internal g Metabolic gain Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga (68)m= 246.94 Cooking gains	res (Table Feb 134.06 (calcula 19.55 ins (calcula 249.51 calcula 36.41	Mar 134.06 ted in Ap 15.9 culated in 243.05 ated in A 36.41	ts Apr 134.06 ppendix 12.04 Append 229.3 ppendix 36.41	May 134.06 L, equat 9 dix L, eq 211.95 L, equat	Jun 134.06 ion L9 of 7.6 uation L 195.64 ion L15	Jul 134.06 r L9a), a 8.21 13 or L1 184.74 or L15a)	Aug 134.06 Iso see 10.67 3a), also 182.18	Sep 134.06 Table 5 14.32 See Ta 188.64 ee Table	Oct 134.06 18.19 ble 5 202.39 5	Nov 134.06 21.23	Dec 134.06 22.63 236.05	eating	(66) (67) (68)
5. Internal g Metabolic gain Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga (68)m= 246.94 Cooking gains (69)m= 36.41	res (Table Feb 134.06 (calcula 19.55 ins (calcula 249.51 calcula 36.41	Mar 134.06 ted in Ap 15.9 culated in 243.05 ated in A 36.41	ts Apr 134.06 ppendix 12.04 Append 229.3 ppendix 36.41	May 134.06 L, equat 9 dix L, eq 211.95 L, equat	Jun 134.06 ion L9 of 7.6 uation L 195.64 ion L15	Jul 134.06 r L9a), a 8.21 13 or L1 184.74 or L15a)	Aug 134.06 Iso see 10.67 3a), also 182.18	Sep 134.06 Table 5 14.32 See Ta 188.64 ee Table	Oct 134.06 18.19 ble 5 202.39 5	Nov 134.06 21.23	Dec 134.06 22.63 236.05	eating	(66) (67) (68)
5. Internal g Metabolic gain Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga (68)m= 246.94 Cooking gains (69)m= 36.41 Pumps and fa (70)m= 3	reb 134.06 (calcula 19.55) (calcula 249.51) (calcula 36.41) rs gains	Mar 134.06 ted in Ap 15.9 culated in 243.05 ated in Ap 36.41 (Table 5	and 5a ts Apr 134.06 ppendix 12.04 Appendix 229.3 ppendix 36.41 5a)	May 134.06 L, equat 9 dix L, eq 211.95 L, equat 36.41	Jun 134.06 ion L9 of 7.6 uation L 195.64 ion L15 36.41	Jul 134.06 r L9a), a 8.21 13 or L1 184.74 or L15a) 36.41	Aug 134.06 Iso see 10.67 3a), also 182.18 1, also se 36.41	Sep 134.06 Table 5 14.32 see Ta 188.64 ee Table 36.41	Oct 134.06 18.19 ble 5 202.39 5 36.41	Nov 134.06 21.23 219.74	Dec 134.06 22.63 236.05	eating	(66) (67) (68) (69)
5. Internal g Metabolic gair Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga (68)m= 246.94 Cooking gains (69)m= 36.41 Pumps and fa	res (Table Feb 134.06 (calcula 19.55 ins (calcula 249.51 calcula 36.41 res gains 3 vaporatio	Mar 134.06 ted in Ap 15.9 culated in 243.05 ated in Ap 36.41 (Table 5	and 5a ts Apr 134.06 ppendix 12.04 Appendix 229.3 ppendix 36.41 5a)	May 134.06 L, equat 9 dix L, eq 211.95 L, equat 36.41	Jun 134.06 ion L9 of 7.6 uation L 195.64 ion L15 36.41	Jul 134.06 r L9a), a 8.21 13 or L1 184.74 or L15a) 36.41	Aug 134.06 Iso see 10.67 3a), also 182.18 1, also se 36.41	Sep 134.06 Table 5 14.32 see Ta 188.64 ee Table 36.41	Oct 134.06 18.19 ble 5 202.39 5 36.41	Nov 134.06 21.23 219.74	Dec 134.06 22.63 236.05	eating	(66) (67) (68) (69)
Metabolic gair Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga (68)m= 246.94 Cooking gains (69)m= 36.41 Pumps and fa (70)m= 3 Losses e.g. ev	reportion (see land) (Mar 134.06 ted in Ap 15.9 sulated in 243.05 ated in A 36.41 (Table 5	ts Apr 134.06 ppendix 12.04 Appendix 229.3 ppendix 36.41 5a) 3	only if construction only if c	Jun 134.06 ion L9 of 7.6 uation L 195.64 ion L15 36.41	Jul 134.06 r L9a), a 8.21 13 or L1 184.74 or L15a) 36.41	Aug 134.06 Iso see 10.67 3a), also 182.18 , also se 36.41	Sep 134.06 Table 5 14.32 See Ta 188.64 ee Table 36.41	Oct 134.06 18.19 ble 5 202.39 5 36.41	Nov 134.06 21.23 219.74 36.41	Dec 134.06 22.63 236.05 36.41	eating	(66) (67) (68) (69)
5. Internal g Metabolic gair Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga (68)m= 246.94 Cooking gains (69)m= 36.41 Pumps and fa (70)m= 3 Losses e.g. et (71)m= -107.25	reportion (see land) (Mar 134.06 ted in Ap 15.9 sulated in 243.05 ated in A 36.41 (Table 5	ts Apr 134.06 ppendix 12.04 Appendix 229.3 ppendix 36.41 5a) 3	only if construction only if c	Jun 134.06 ion L9 of 7.6 uation L 195.64 ion L15 36.41	Jul 134.06 r L9a), a 8.21 13 or L1 184.74 or L15a) 36.41	Aug 134.06 Iso see 10.67 3a), also 182.18 , also se 36.41	Sep 134.06 Table 5 14.32 See Ta 188.64 ee Table 36.41	Oct 134.06 18.19 ble 5 202.39 5 36.41	Nov 134.06 21.23 219.74 36.41	Dec 134.06 22.63 236.05 36.41	eating	(66) (67) (68) (69)
5. Internal g Metabolic gain Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga (68)m= 246.94 Cooking gains (69)m= 36.41 Pumps and fa (70)m= 3 Losses e.g. ev (71)m= -107.25 Water heating	res (Table Feb 134.06 (calcula 19.55 ins (calcula 36.41 res gains 3 vaporatio gains (Table 86.22	e Table 5 e 5), Wat Mar 134.06 ted in Ap 15.9 culated in 243.05 ated in Ap 36.41 (Table 5 3 on (negation of the color) -107.25 Table 5) 81.5	ts Apr 134.06 ppendix 12.04 Appendix 229.3 ppendix 36.41 5a) 3 tive valu -107.25	only if constructions only if constructions only if constructions on the construction of the construction	Jun 134.06 ion L9 of 7.6 uation L 195.64 ion L15 36.41 3	Jul 134.06 r L9a), a 8.21 13 or L1 184.74 or L15a) 36.41	Aug 134.06 Iso see 10.67 3a), also 182.18 , also se 36.41 3	Sep 134.06 Table 5 14.32 see Ta 188.64 ee Table 36.41 3	Oct 134.06 18.19 ble 5 202.39 5 36.41 3 -107.25	Nov 134.06 21.23 219.74 36.41 3	Dec 134.06 22.63 236.05 36.41 3	eating	(66) (67) (68) (69) (70)
Metabolic gair Jan (66)m= 134.06 Lighting gains (67)m= 22.02 Appliances ga (68)m= 246.94 Cooking gains (69)m= 36.41 Pumps and fa (70)m= 3 Losses e.g. ev (71)m= -107.25 Water heating (72)m= 88.48	res (Table Feb 134.06 (calcula 19.55 ins (calcula 36.41 res gains 3 raporatio gains (Table 86.22	e Table 5 e 5), Wat Mar 134.06 ted in Ap 15.9 culated in 243.05 ated in Ap 36.41 (Table 5 3 on (negation of the color) -107.25 Table 5) 81.5	ts Apr 134.06 ppendix 12.04 Appendix 229.3 ppendix 36.41 5a) 3 tive valu -107.25	only if constructions only if constructions only if constructions on the construction of the construction	Jun 134.06 ion L9 of 7.6 uation L 195.64 ion L15 36.41 3	Jul 134.06 r L9a), a 8.21 13 or L1 184.74 or L15a) 36.41	Aug 134.06 Iso see 10.67 3a), also 182.18 , also se 36.41 3	Sep 134.06 Table 5 14.32 see Ta 188.64 ee Table 36.41 3	Oct 134.06 18.19 ble 5 202.39 5 36.41 3 -107.25	Nov 134.06 21.23 219.74 36.41 3	Dec 134.06 22.63 236.05 36.41 3	eating	(66) (67) (68) (69) (70)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation: Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b	-	FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	X	10.89	x	11.28	x	0.85	x	0.7		50.66	(75)
Northeast 0.9x 0.77	X	10.89	x	22.97	x	0.85	×	0.7	= [103.13	(75)
Northeast 0.9x 0.77	X	10.89	x	41.38	x	0.85	x	0.7	<u> </u>	185.8	(75)
Northeast 0.9x 0.77	X	10.89	x	67.96	x	0.85	x [0.7	_ = [305.14	(75)
Northeast 0.9x 0.77	X	10.89	x	91.35	X	0.85	x	0.7	<u> </u>	410.17	(75)
Northeast 0.9x 0.77	X	10.89	x	97.38	X	0.85	x	0.7	=	437.29	(75)
Northeast 0.9x 0.77	X	10.89	x	91.1	X	0.85	х	0.7	=	409.07	(75)
Northeast _{0.9x} 0.77	X	10.89	x	72.63	X	0.85	x	0.7	=	326.12	(75)
Northeast 0.9x 0.77	X	10.89	x	50.42	X	0.85	x [0.7	= [226.41	(75)
Northeast 0.9x 0.77	X	10.89	x	28.07	X	0.85	x [0.7	= [126.03	(75)
Northeast 0.9x 0.77	X	10.89	x	14.2	X	0.85	x [0.7	= [63.75	(75)
Northeast 0.9x 0.77	X	10.89	x	9.21	X	0.85	x [0.7	= [41.37	(75)
Southwest _{0.9x} 0.77	X	6.21	x	36.79]	0.85	x [0.7	= [94.21	(79)
Southwest _{0.9x} 0.77	X	6.21	x	62.67]	0.85	x	0.7	= [160.48	(79)
Southwest _{0.9x} 0.77	X	6.21	x	85.75]	0.85	х	0.7	=	219.58	(79)
Southwest _{0.9x} 0.77	X	6.21	х	106.25]	0.85	x	0.7	= [272.07	(79)
Southwest _{0.9x} 0.77	X	6.21	x	119.01]	0.85	x	0.7		304.74	(79)
Southwest _{0.9x} 0.77	X	6.21	x	118.15]	0.85	×	0.7	=	302.54	(79)
Southwest _{0.9x} 0.77	X	6.21	x	113.91]	0.85	×	0.7	= [291.68	(79)
Southwest _{0.9x} 0.77	X	6.21	x	104.39]	0.85	x	0.7	=	267.3	(79)
Southwest _{0.9x} 0.77	X	6.21	x	92.85]	0.85	×	0.7	=	237.76	(79)
Southwest _{0.9x} 0.77	X	6.21	х	69.27]	0.85	x	0.7	= [177.37	(79)
Southwest _{0.9x} 0.77	X	6.21	x	44.07]	0.85	x	0.7	=	112.85	(79)
Southwest _{0.9x} 0.77	X	6.21	х	31.49]	0.85	x	0.7		80.63	(79)
Northwest 0.9x 0.77	X	5.44	x	11.28	X	0.85	x	0.7	= [25.31	(81)
Northwest 0.9x 0.77	X	5.44	x	22.97	X	0.85	x [0.7	= [51.52	(81)
Northwest 0.9x 0.77	X	5.44	x	41.38	X	0.85	x [0.7	= [92.82	(81)
Northwest 0.9x 0.77	X	5.44	x	67.96	X	0.85	x	0.7	= [152.43	(81)
Northwest 0.9x 0.77	X	5.44	x	91.35	X	0.85	x [0.7	= [204.9	(81)
Northwest 0.9x 0.77	X	5.44	x	97.38	X	0.85	x [0.7	= [218.44	(81)
Northwest 0.9x 0.77	X	5.44	x	91.1	X	0.85	x [0.7	= [204.35	(81)
Northwest 0.9x 0.77	X	5.44	x	72.63	X	0.85	x [0.7	= [162.91	(81)
Northwest 0.9x 0.77	X	5.44	x	50.42	X	0.85	x [0.7	= [113.1	(81)
Northwest 0.9x 0.77	X	5.44	x	28.07	X	0.85	x [0.7	= [62.96	(81)
Northwest 0.9x 0.77	X	5.44	x	14.2	X	0.85	х	0.7	=	31.85	(81)
Northwest 0.9x 0.77	X	5.44	х	9.21	x	0.85	x	0.7	= [20.67	(81)
					_						
Solar gains in watts, calcula	$\overline{}$		$\overline{}$			n = Sum(74)m .		_			
(83)m= 170.19 315.13 498.		729.64 919.8		58.27 905.1	756	.33 577.26	366.35	208.44	142.67		(83)
Total gains – internal and so		` 	<u> </u>		1			T			(0.0)
(84)m= 593.85 736.63 904.	87	1111.65 1276.6	1 12	290.85 1222.43	108	0.59 914.56	728.54	598.51	553.8		(84)

7 Me	an inter	nal temr	erature	(heating	season)								
			eating p			•	from Tal	ole 9 Th	1 (°C)				21	(85)
		Ū	ains for I			Ū		J.O O, 111	. (0)					(00)
Otinot	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.96	0.89	0.78	0.66	0.72	0.9	0.98	0.99	1		(86)
Mean	internal	temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)		•		l	
(87)m=	18.34	18.58	19.02	19.65	20.23	20.67	20.86	20.82	20.42	19.68	18.93	18.34		(87)
Temr	erature	durina h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9 T	h2 (°C)				l	
(88)m=	19.03	19.04	19.05	19.09	19.09	19.12	19.12	19.13	19.11	19.09	19.08	19.06		(88)
Utilisa	ation fac	tor for a	ains for i	rest of d	wellina. I	h2.m (se	ee Table	9a)					l	
(89)m=	0.99	0.99	0.98	0.94	0.83	0.64	0.43	0.51	0.82	0.96	0.99	1		(89)
Mean	internal	temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	ens 3 to ⁻	Tin Tahl	 e 9c)	!	<u>I</u>	l	
(90)m=	15.68	16.03	16.67	17.59	18.38	18.93	19.09	19.07	18.68	17.66	16.56	15.69		(90)
, ,									f	LA = Livin	l ig area ÷ (4	4) =	0.35	(91)
Mean	internal	l temner	ature (fo	r the wh	ole dwe	lling) – f	Ι Δ ν Τ1	+ (1 – fl	Δ) v T2					
(92)m=		16.92	17.49	18.31	19.03	19.54	19.71	19.68	19.29	18.36	17.39	16.62		(92)
			he mean											
(93)m=	16.46	16.77	17.34	18.16	18.88	19.39	19.56	19.53	19.14	18.21	17.24	16.47		(93)
	ace hea	tina real	uirement											
					re obtain	ed at st	ep 11 of	Table 9l	o. so tha	t Ti.m=(76)m an	d re-calc	ulate	
			or gains			-		_		, (,	_		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:				_					•	
(94)m=	0.99	0.98	0.97	0.92	0.83	0.67	0.49	0.56	0.82	0.95	0.99	0.99		(94)
Usefu	ıl gains,	hmGm	W = (94)	4)m x (8	4)m								•	
(95)m=	588.58	724.52	873.86	1022.69	1054.72	862.81	599.97	608.53	747.41	693.47	589.84	549.83		(95)
Mont	nly avera	age exte	rnal tem	perature	from Ta	able 8							1	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			an intern			1	-``		<u> </u>		,	ı	İ	
	2845.97			2089.91	1612.9	1052.1	650.08	684.69		1710.52		2810.52		(97)
-			ement fo					T			r	l	I	
(98)m=	1679.49	1369.76	1216.77	768.4	415.29	0	0	0	0	756.69		1681.95		
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	9119.3	(98)
Spac	e heating	g require	ement in	kWh/m²	² /year								96.6	(99)
9a. En	ergy req	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
-	e heating	_	nt from se	econdar	v/supple	mentary	, system						0	(201)
	-		at from m			momany	0,000111	(202) = 1	- (201) =				1	(202)
	-		ng from	-	, ,				02) × [1 –	(203)] =			1	(204)
			ace heat	-				, ,	· -				90.4	(206)
	•	-	ry/supple			a svsten	າ. %						0	(208)
	,) »FP"		,	, 5.511	,						<u> </u>	` ==/

								•	
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space heating requirement (calculated above)					750.00	4000.04	4004.05]	
1679.49 1369.76 1216.77 768.4 415.29	0	0	0	0	756.69	1230.94	1681.95		(5.4.1)
$ (211)m = \{[(98)m \times (204)] \} \times 100 \div (206) $ $ 1857.85 \ 1515.23 \ 1345.99 \ 850 \ 459.39 $	0	0	0	0	837.04	1361.66	1860.57]	(211)
1007.00 1010.20 1040.00 000 400.00	<u> </u>	<u> </u>				211) _{15,1012}		10087.73	(211)
Space heating fuel (secondary), kWh/month						10,1012			」 ` ′
= {[(98)m x (201)] } x 100 ÷ (208)								_	
(215)m= 0 0 0 0 0	0	0	0	0	0	0	0		_
			Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating									
Output from water heater (calculated above) 210.63 185.68 194.98 172.94 167.43	147.47 1	141.28	157.5	159.24	181.32	191.71	205.59		
Efficiency of water heater	<u>l</u>	l			ļ.		ļ.	80.3	(216)
(217)m= 89.15 89.06 88.86 88.36 87.25	80.3	80.3	80.3	80.3	88.25	88.89	89.18		(217)
Fuel for water heating, kWh/month	-							•	
(219) m = (64) m x $100 \div (217)$ m (219)m = 236.26 208.48 219.43 195.72 191.91	183.65 1	175.95	196.14	198.3	205.46	215.66	230.54		
		1		I = Sum(2	19a) ₁₁₂ =			2457.5	(219)
Annual totals					k'	Wh/year	•	kWh/year	_
Space heating fuel used, main system 1								10087.73	
Water heating fuel used								2457.5]
Electricity for pumps, fans and electric keep-hot									
central heating pump:								1	
Januar Hoaming Pullip.							30		(230c)
boiler with a fan-assisted flue							30 45		(230c) (230e)
			sum	of (230a).	(230g) =			75	
boiler with a fan-assisted flue			sum	of (230a).	(230g) =			75 388.8	(230e)
boiler with a fan-assisted flue Total electricity for the above, kWh/year	+ (231) +	(232)		,	(230g) =				(230e)](231)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting		` ′	(237b)	=	(230g) =			388.8	(230e) (231) (232)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) +	ns includ	ling mic	(237b)	=			45	388.8	(230e) (231) (232)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) +	ns includ Ener	ling mic	(237b)	=		ion fac	45	388.8	(230e)](231)](232)](338)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) +	ns includ Ener	ing mid r gy /year	(237b)	=	Emiss	ion fac 2/kWh	45	388.8 13009.02 Emissions	(230e)](231)](232)](338)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system	ns includ Ener kWh	ing mid rgy /year x	(237b)	=	Emiss kg CO	ion fac 2/kWh	45	388.8 13009.02 Emissions kg CO2/yea	(230e) (231) (232) (338)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1)	Ener kWh.	rgy /year ×	(237b)	=	Emiss kg CO	ion fac 2/kWh 16	45 tor	388.8 13009.02 Emissions kg CO2/yea 2178.95	(230e) (231) (232) (338) (17)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary)	Ener kWh. (211) (215) (219)	rgy /year x	(237b)	=	Emiss kg CO:	ion fac 2/kWh 16	45 tor = =	388.8 13009.02 Emissions kg CO2/yea 2178.95	(230e)](231)](232)](338) ar [(261)](263)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating	Ener kWh. (211) (215) (219)	rgy /year x x x	(237b) cro-CHP	=	Emiss kg CO:	ion fac 2/kWh 16 19	45 tor = =	388.8 13009.02 Emissions kg CO2/yea 2178.95 0 530.82	(230e)](231)](232)](338) ar](261)](263)](264)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Ener kWh. (211) (215) (219) (261) -	rgy /year x x x + (262) +	(237b) cro-CHP	=	Emiss kg CO: 0.2 0.5	ion fac 2/kWh 16 19	45 tor = = =	388.8 13009.02 Emissions kg CO2/yea 2178.95 0 530.82 2709.77	(230e)](231)](232)](338) [(261)](263)](264)](265)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Ener kWh. (211) (215) (219) (261) - (231)	rgy /year x x x + (262) +	(237b) cro-CHP	= 264) =	Emiss kg CO: 0.2 0.5 0.5	ion fac 2/kWh 16 19 16	45 tor = = =	388.8 13009.02 Emissions kg CO2/yea 2178.95 0 530.82 2709.77 38.93	(230e)](231)](232)](338) If [(261)]](263)](264)](265)](267)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	Ener kWh. (211) (215) (219) (261) - (231)	rgy /year x x x + (262) +	(237b) cro-CHP	= 264) = sum o	Emiss kg CO. 0.2 0.5 0.5 0.5	ion fac 2/kWh 16 19 16	45 tor = = =	388.8 13009.02 Emissions kg CO2/yea 2178.95 0 530.82 2709.77 38.93 201.79	(230e)](231)](232)](338) If [(261)](263)](264)](265)](267)
boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	Ener kWh. (211) (215) (219) (261) - (231)	rgy /year x x x + (262) +	(237b) cro-CHP	= 264) = sum o	Emiss kg CO 0.2 0.5 0.5 0.5 0.6 0.7 0.7 0.7 0.7 0.8	ion fac 2/kWh 16 19 16	45 tor = = =	388.8 13009.02 Emissions kg CO2/yea 2178.95 0 530.82 2709.77 38.93 201.79 2950.48	(230e)](231)](232)](338) ur](261)](263)](264)](265)](267)](268)](272)

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50 Printed on 23 November 2021 at 13:25:00

Proiect Information:

Assessed By: Neil Ingham (STRO010943) Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 48.28m²

Site Reference: 11-12 Grenville Street - LEAN

Plot Reference: Unit 3

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

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

23.48 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 35.96 kg/m² Fail

Excess emissions = 12.48 kg/m² (53.2 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 65.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 109.8 kWh/m²

Excess energy = $44.01 \text{ kg/m}^2 (66.9 \%)$

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	(no roof)		
Openings	4.10 (max. 2.00)	4.80 (max. 3.30)	Fail

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals 10.00 (design value)

Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Combi boiler

Efficiency 89.5 % SEDBUK2009

Minimum 88.0 % OK

Secondary heating system: None

Fail

5 Cylinder insulation			
Hot water Storage:	No cylinder		
6 Controls			
Space heating controls	TTZC by plumbing and e	electrical services	OK
Hot water controls:	No cylinder thermostat		
	No cylinder		
Boiler interlock:	Yes		OK
7 Low energy lights			
Percentage of fixed lights wit	h low-energy fittings	100.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames va	alley):	Not significant	OK
Based on:			
Overshading:		Average or unknown	
Windows facing: North East		7.36m²	
Windows facing: South East		1.84m²	
Ventilation rate:		8.00	
1016			
10 Key features		2.111/2.015	
Party Walls U-value		0 W/m²K	
Floors U-value		0.11 W/m²K	

User Details:	
Assessor Name: Neil Ingham Stroma Number: STRO01 Software Name: Stroma FSAP 2012 Software Version: Version:	
Property Address: Unit 3 Address:	
1. Overall dwelling dimensions:	
<u> </u>	Volume(m³)
Ground floor 48.28 (1a) x 2.95 (2a) =	142.43 (3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 48.28 (4)	_
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) =	142.43 (5)
2. Ventilation rate:	
main secondary other total r heating heating	m³ per hour
Number of chimneys $0 + 0 + 0 = 0 \times 40 =$	0 (6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 =$	0 (6b)
Number of intermittent fans 3 × 10 =	30 (7a)
Number of passive vents 0 x 10 =	0 (7b)
Number of flueless gas fires 0 x 40 =	0 (7c)
Air chan	ges per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ 30 $\div (5) =$	0.21 (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)	0 (9)
Additional infiltration [(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35	
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$	0 (15)
Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	10 (17)
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	0.71 (18)
Number of sides sheltered	0 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor (21) = (18) x (20) =	0.71 (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	

djusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	_				
0.91	0.89	0.87	0.78	0.76	0.68	0.68	0.66	0.71	0.76	0.8	0.83		
<i>alculate effed</i> If mechanica		_	rate for t	he appli	cable ca	se					ı		
If exhaust air h			endix N (2	3h) = (23a	a) × Fmv (e	equation (N5)) othe	wise (23h	n) = (23a)		l	0	
If balanced with		0		, ,	,	. `	,, .	,) = (20a)		ļ	0	=
		-	-	_					Ol.) /	001.)	4 (00)	0	
a) If balance	i	anicai ve				- ` ` 	, 	$\frac{1}{0} = (2.5)$, 	23b) × [``	÷ 100]	
a)m= 0	0		0	0	0	0	0		0		0		
b) If balance	ı —	ı —				, 	r ´`	<u> </u>	 	- ´-			
b)m= 0	0	0	0	0	0	0	0	0	0	0	0		
c) If whole h if (22b)n				•	•		on from (·c) = (22b		.5 × (23k	o)			
c)m= 0	0	0	0	0	0	0	0	0	0	0	0		
d) If natural if (22b)n				•			on from I 0.5 + [(2		0.5]	•			
d)m= 0.91	0.89	0.88	0.81	0.79	0.73	0.73	0.72	0.75	0.79	0.82	0.85		
Effective air	change	rate - er	iter (24a	or (24k	o) or (24	c) or (24	ld) in box	(25)	!	!			
)m= 0.91	0.89	0.88	0.81	0.79	0.73	0.73	0.72	0.75	0.79	0.82	0.85		
					1	l			1	1			
. Heat losse LEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/		k-value kJ/m²-ł		A X I kJ/K
ors					2.59	X	1.6	=	4.144				
ndows Type	e 1				7.36	x1	/[1/(4.8)+	0.04] =	29.64				
ndows Type	2				1.84	x1	/[1/(4.8)+	0.04] =	7.41				
oor					48.28	3 x	0.11	□ = i	5.3108				
alls Type1	31.6	3	9.2		22.43	3 x	0.3	=	6.73	=		7 -	
alls Type2	33.4	_	2.59		30.84	_	0.22	╡ .	6.9	북 ¦		-	
tal area of e			2.00			=	0.22		0.9				
	ileirierits	, 111			113.3	=							
rty wall					55.39	_	0	=	0			_	
rty ceiling					48.28								
or windows and nclude the area						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	3.2	
bric heat los				o ana pan			(26)(30)	+ (32) =			i	60.13	
at capacity	•	•	O)						(30) + (3	2) + (32a).	(32e) =	6476.02	==
ermal mass		,	P = Cm =	- TFΔ) ir	n k.l/m²K			,	itive Value	, , ,	()	250	
design assess	•	`		,			recisely the				able 1f	230	
be used inste							, ,						
ermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix l	<						17	
etails of therma		are not kn	own (36) =	= 0.05 x (3	11)								
tal fabric he								(33) +	(36) =			77.13	
ntilation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × ((25)m x (5)) 		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 42.79	42.04	41.31	37.86	37.21	34.21	34.21	33.65	35.37	37.21	38.52	39.89		
at transfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
)m= 119.92	119.17	118.44	114.99	114.34	111.34	111.34	110.78	112.5	114.34	115.65	117.01		
,									1	1			

Heat loss para	ameter (I	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 2.48	2.47	2.45	2.38	2.37	2.31	2.31	2.29	2.33	2.37	2.4	2.42		
		!		!					Average =	Sum(40) ₁	12 /12=	2.38	(40)
Number of day	<u> </u>	<u> </u>						-					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occurring TFA > 13.1 if TFA £ 13.1	9, N = 1		[1 - exp	o(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13.		64		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the α	lwelling is	designed t			se target o		.14		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								· '	!				
(44)m= 80.45	77.53	74.6	71.68	68.75	65.83	65.83	68.75	71.68	74.6	77.53	80.45		
										m(44) ₁₁₂ =	L	877.69	(44)
Energy content of	f hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x C	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 119.31	104.35	107.68	93.88	90.08	77.73	72.03	82.65	83.64	97.48	106.4	115.55		_
If instantaneous v	vətor hoati	na at noint	of use (no	n hot water	r storaga)	enter () in	hoves (46		Total = Su	m(45) ₁₁₂ =	= [1150.79	(45)
	i		,		, , , , , , , , , , , , , , , , , , ,		, ,	, , , -	44.00	15.00	47.00		(46)
(46)m= 17.9 Water storage	15.65 loss:	16.15	14.08	13.51	11.66	10.8	12.4	12.55	14.62	15.96	17.33		(46)
Storage volum) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	neating a	and no ta	nk in dw	velling, e	nter 110	litres in	(47)						
Otherwise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage					4.144	<i>,</i> , , ,							
a) If manufact				or is kno	wn (kVVI	n/day):					0		(48)
Temperature f											0		(49)
Energy lost from b) If manufact		_	-		or io not		(48) x (49)) =			0		(50)
Hot water stor			-								0		(51)
If community h	•			•		,					<u> </u>		, ,
Volume factor	from Ta	ble 2a									0		(52)
Temperature f	actor fro	m Table	2b								0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	(54) in (55)									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = ((55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	x H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	 e 3							0		(58)
Primary circuit	,	•			59)m = ((58) ÷ 36	65 × (41)	m					
(modified by	/ factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

					(22)									
Combi loss c				<u> </u>	<u> </u>	- ` ` 		.					1	(04)
(61)m= 41	35.68	38.02	35.35	35.04	32.46	33.54	35.0			38.02	38.23	41	J	(61)
	. 						`		``		` ´ 	`	(59)m + (61)m	
(62)m= 160.31	140.04	145.7	129.23	125.11	110.19	105.57	117.	69 118.9	99 13	35.49	144.64	156.55		(62)
Solar DHW inpu									olar co	ontributi	ion to wate	er heating)		
(add addition	al lines if	FGHRS	and/or \		applies	s, see Ap	pend	x G)					1	
(63)m= 0	0	0	0	0	0	0	0	0		0	0	0		(63)
Output from v	water hea	ter				_								
(64)m= 160.31	140.04	145.7	129.23	125.11	110.19	105.57	117.	69 118.9	99 13	35.49	144.64	156.55		,
							(Output fron	water	r heatei	r (annual)₁	12	1589.51	(64)
Heat gains from	om water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (6	1)m] + 0.	8 x [(4	46)m	+ (57)m	+ (59)m]	
(65)m= 49.92	43.62	45.31	40.05	38.71	33.96	32.34	36.2	4 36.6	5 4	11.92	44.94	48.67		(65)
include (57)m in cald	culation of	of (65)m	only if c	ylinder i	s in the	dwelli	ng or ho	t wate	er is fr	om com	munity h	neating	
5. Internal of	gains (see	Table 5	and 5a):										
Metabolic gai	ns (Table	5), Wat	ts											
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ig Se	р	Oct	Nov	Dec]	
(66)m= 81.98	81.98	81.98	81.98	81.98	81.98	81.98	81.9	8 81.9	8 8	31.98	81.98	81.98	1	(66)
Lighting gains	s (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso se	e Table	5		•		•	
(67)m= 12.75	11.32	9.21	6.97	5.21	4.4	4.75	6.18	8.29) 1	0.53	12.29	13.1]	(67)
Appliances g	ains (calc	ulated in	Append	dix L. ea	uation L	.13 or L1	3a). a	lso see	—— Table	5	Į.	!		
(68)m= 142.77	- ` 	140.52	132.57	122.54	113.11	106.81	105.			17.01	127.04	136.47	1	(68)
Cooking gain	s (calcula	ıted in Aı	opendix	L. eguat	ion L15	or L15a), also	see Ta	ole 5				J	
(69)m= 31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2			31.2	31.2	31.2	1	(69)
Pumps and fa	I ane daine	(Table F	[[a]	<u> </u>		<u> </u>	L					l	ı	
(70)m= 3	3	3	3	3	3	3	3	3	Т	3	3	3	1	(70)
Losses e.g. e				<u> </u>	<u> </u>		L						J	(- /
(71)m= -65.58		-65.58	-65.58	-65.58	-65.58	-65.58	-65.5	58 -65.5		65.58	-65.58	-65.58	1	(71)
` /	<u> </u>		-05.50	-03.30	-00.00	-03.30	-00.	00 -00.0	,0 -0	05.56	-03.30	-00.00	J	(, ,)
Water heating	g gains (1 64.91	60.9	55.63	52.03	47.17	43.46	48.7	1 50.9	\	56.34	60.44	65.42	1	(72)
` '			55.65	52.05		ļ					62.41		J	(12)
Total interna	-		0.45.70	000.07)m + (67)m		- i					1	(72)
(73)m= 273.21		261.22	245.76	230.37	215.27	205.62	210.	218.8	35 23	34.47	252.34	265.58		(73)
6. Solar gains are		using solo	r flux from	Table 6a	and accor	riated equa	tions t	o convert t	o the o	pplicab	lo orientat	ion		
Orientation:		•	Area		Flu	•	ilions i		J lile a	ррпсар	FF	.1011.	Gains	
Onemation.	Table 6d	actor	m ²			ble 6a		g_ Table (6b	Ta	able 6c		(W)	
Northeast 0.9x	0.77	x	7.3	06	х -	11.28] _x [0.85		хГ	0.7		34.24	(75)
Northeast 0.9x		_			-		ј L 1 г		\dashv	-		=		╡
Northeast 0.9x		X	7.3			22.97]	0.85	\dashv	х <u>Г</u>	0.7	=	69.7	(75)
Northeast 0.9x		X	7.3			41.38] X [] [0.85	\dashv	х Г	0.7	_ =	125.58	(75)
		X	7.3		=	67.96] X [0.85	_	X	0.7	=	206.23	(75)
Northeast 0.9x	0.77	X	7.3	36	X (91.35	X	0.85		X	0.7	=	277.22	(75)

					_			,						_
Northeast _{0.9x}	0.77	X	7.3	36	x	9	7.38	X	0.85	X	0.7	=	295.54	(75)
Northeast _{0.9x}	0.77	X	7.3	36	X	9	1.1	X	0.85	X	0.7	=	276.47	(75)
Northeast _{0.9x}	0.77	X	7.3	36	x	72	2.63	X	0.85	X	0.7	=	220.41	(75)
Northeast _{0.9x}	0.77	X	7.3	36	x	50	0.42	X	0.85	X	0.7	=	153.02	(75)
Northeast _{0.9x}	0.77	X	7.3	36	x	28	8.07	x	0.85	X	0.7	=	85.18	(75)
Northeast _{0.9x}	0.77	x	7.3	36	x	1	4.2	x	0.85	X	0.7	=	43.08	(75)
Northeast _{0.9x}	0.77	x	7.3	36	x	9	.21	x	0.85	X	0.7	=	27.96	(75)
Southeast _{0.9x}	0.77	x	1.8	34	x	36	6.79	X	0.85	X	0.7	=	27.92	(77)
Southeast _{0.9x}	0.77	x	1.8	34	x	62	2.67	x	0.85	X	0.7	=	47.55	(77)
Southeast 0.9x	0.77	x	1.8	34	x	8	5.75	x	0.85	X	0.7	=	65.06	(77)
Southeast _{0.9x}	0.77	X	1.8	34	x	10	6.25	x	0.85	X	0.7	=	80.61	(77)
Southeast _{0.9x}	0.77	×	1.8	34	x	11	9.01	x	0.85	X	0.7	=	90.29	(77)
Southeast _{0.9x}	0.77	x	1.8	34	x [11	8.15	x	0.85	x	0.7	=	89.64	(77)
Southeast _{0.9x}	0.77	×	1.8	34	x	11	3.91	x	0.85	x	0.7	_ =	86.42	(77)
Southeast _{0.9x}	0.77	x	1.8	34	x	10	4.39	x	0.85	x	0.7		79.2	(77)
Southeast _{0.9x}	0.77	×	1.8	34	x T	92	2.85	x	0.85	x	0.7	 =	70.45	(77)
Southeast _{0.9x}	0.77	×	1.8	34	x	69	9.27	x	0.85	x	0.7	_ =	52.55	(77)
Southeast _{0.9x}	0.77	×	1.8	34	x	4	4.07	x	0.85	x	0.7		33.44	(77)
Southeast _{0.9x}	0.77	×	1.8	34	x T	3	1.49	x	0.85	x	0.7	 =	23.89	(77)
Solar gains in	· · ·				_			<u> </u>	n = Sum(74)m	- 			7	
(83)m= 62.16		90.64	286.84	367.51		5.18	362.9	299	.61 223.46	137.7	3 76.52	51.85		(83)
Total gains – i				<u> </u>	·			·		1		l	1	(0.4)
(84)m= 335.36	388.32 45	51.85	532.6	597.88	600	0.45	568.51	510	.42 442.31	372.2	328.86	317.43		(84)
7. Mean inter	nal tempera	ature ((heating	seasor	1)									
Temperature	Ū	٠.			·			ole 9	, Th1 (°C)				21	(85)
Utilisation fac					ì								1	
Jan	 	Mar	Apr	May	+	Jun	Jul	_	ug Sep	Oc	+	Dec	1	(0.0)
(86)m= 1	0.99	0.98	0.96	0.91	0.	.81	0.69	0.7	75 0.91	0.98	0.99	1]	(86)
Mean interna	l temperatu	re in I	iving ar	ea T1 (f	ollov	v step	os 3 to 7	in T	able 9c)				-	
(87)m= 18.39	18.59	19	19.6	20.17	20).64	20.85	20	.8 20.4	19.69	18.97	18.4		(87)
Temperature	during hear	ting p	eriods ir	n rest of	dwe	elling	from Ta	able 9	9, Th2 (°C)					
(88)m= 19.03	19.04	9.05	19.09	19.1	19).14	19.14	19.	14 19.12	19.1	19.08	19.07		(88)
Utilisation fac	ctor for gain	s for r	est of d	welling,	h2,r	n (se	e Table	9a)					_	
(89)m= 0.99		0.98	0.94	0.86	1	.68	0.46	0.5	0.83	0.96	0.99	0.99]	(89)
Mean interna	l temperatu	re in t	he rest	of dwell	ina ⁻	T2 (fc	ollow ste	ens 3	to 7 in Tah	le 9c)	•	!	•	
(90)m= 15.74	 	6.64	17.53	18.32	Ť	3.91	19.09	19.		17.6	7 16.62	15.77	1	(90)
				<u> </u>	1	!		<u> </u>			ving area ÷ (Į	0.55	(91)
Moon inter-	l tomporat:	ro /f-	r tha ···!-	.ala d	۔ منال	Λ. σ	Λ	. /4	fl A\)				
Mean interna (92)m= 17.19	 	7.93	18.67	19.34	~	$\frac{1}{0.86}$	20.05	+ (1	<u> </u>	18.7	7 17.9	17.21	1	(92)
Apply adjustr				l	<u> </u>							17.21	J	(02)
י יברי, ממומטנו						201		,	αρρι	٠,٠٠٠	-			

F			·			1	1	,					ı	
(93)m=	17.04	17.29	17.78	18.52	19.19	19.71	19.9	19.87	19.46	18.62	17.75	17.06		(93)
			uirement											
				mperatui using Ta		ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
Г	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
L Utilisat			ains, hm	<u> </u>	iviay	Juli	Jui	L	Seb	Oct	INOV	Dec		
(94)m=	0.99	0.98	0.97	0.94	0.86	0.73	0.57	0.64	0.85	0.96	0.98	0.99		(94)
	I ∣ ɑains.	hmGm .	. W = (94	ـــــــــــــــــــــــــــــــــــــ	L 4)m	<u> </u>	<u> </u>		l		<u> </u>			
	331.95	382.14	438.59	498.55	515.51	438.06	325.19	324.85	376.52	356.36	323.82	314.72		(95)
∟ Monthl	ly avera	age exte	rnal tem	perature	from Ta	able 8	ļ				<u> </u>	ļ	l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat Id	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]			l.	
(97)m=	1527.8	1476.73	1336.17	1105.72	855.95	568.45	367.57	383.99	603.29	917.25	1232.14	1504.42		(97)
Space	heating	g require	ement fo	r each n	nonth, k\	Nh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	889.71	735.56	667.8	437.16	253.29	0	0	0	0	417.31	653.99	885.14		
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	4939.96	(98)
Space	heating	g require	ement in	kWh/m²	/year								102.32	(99)
9a Ene	rav rea	uiremer	nts – Indi	ividual h	eating s	vstems i	ncluding	micro-C	HP)					_
	heatin		ito iria	ividual II	caming 5	yotomo i	riolaaliig	TITIOTO C)					
-		•	t from s	econdar	y/supple	mentary	system						0	(201)
Fractio	on of sp	ace hea	nt from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
	•			main sys	` ,			(204) = (2	02) × [1 –	(203)] =			1	(204)
			_	ing syste					, -	`			90.4	(206)
	•	•				a ovetom	. 0/							╣`
Elliciei			* • • • • • • • • • • • • • • • • • • •	ementar				1				ı	0	(208)
L	Jan	Feb .	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
· -	i	•	· `	alculate	· ·	I		<u> </u>		447.04	050.00	005.44	ſ	
L	889.71	735.56	667.8	437.16	253.29	0	0	0	0	417.31	653.99	885.14		
(211)m				00 ÷ (20		<u> </u>	<u> </u>				Г		l	(211)
L	984.2	813.67	738.72	483.59	280.18	0	0	0	0	461.62	723.44	979.14		٦
								lota	ıl (kWh/yea	ar) =Sum(2	211) _{15,1012}	F	5464.56	(211)
•		•		y), kWh/	month									
			00 ÷ (20					Ι ο	0		0			
(215)m=	0	0	0	0	0	0	0	0 Tota	l (kWh/yea	0 er) =Sum(3	_	0	0	(215)
								Tota	ii (KVVII/yee	ar) =50111(2	210) _{15,1012}	<u>-</u>	0	(215)
Water h	_		tor (colo	ulated al	hovo)									
	160.31	140.04	145.7	129.23	125.11	110.19	105.57	117.69	118.99	135.49	144.64	156.55		
Efficien		ater hea	ter			<u> </u>					<u> </u>	l	80.3	(216)
(217)m=	88.7	88.62	88.41	87.88	86.79	80.3	80.3	80.3	80.3	87.7	88.39	88.72		(217)
			kWh/mo	l		<u> </u>	<u> </u>	L		L		<u> </u>		•
		0.	÷ (217)										ı	
(219)m=	180.74	158.02	164.8	147.05	144.16	137.23	131.47	146.56	148.18	154.5	163.64	176.44		_
								Tota	I = Sum(2	19a) ₁₁₂ =			1852.81	(219)
Annual			_							k\	Wh/year	•	kWh/year	,
Space h	heating	fuel use	ed, main	system	1								5464.56	_

Water heating fuel used			1852.81
Electricity for pumps, fans and electric keep-hot			
central heating pump:			30 (2300
boiler with a fan-assisted flue		•	45 (230e
Total electricity for the above, kWh/year	sum of ((230a)(230g) =	75 (231)
Electricity for lighting			225.11 (232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =		7617.47 (338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP		
	F		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	0,		
Space heating (main system 1) Space heating (secondary)	kWh/year	kg CO2/kWh	kg CO2/year
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating (secondary)	kWh/year (211) x (215) x	kg CO2/kWh 0.216 = 0.519 = 0.216 =	kg CO2/year 1180.34 (261) 0 (263)
Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	kg CO2/kWh 0.216 = 0.519 = 0.216 =	kg CO2/year 1180.34 (261) 0 (263) 400.21 (264)
Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264)	kg CO2/kWh 0.216 = 0.519 = 0.216 =	kg CO2/year 1180.34 (261) 0 (263) 400.21 (264) 1580.55 (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x	kg CO2/kWh 0.216 = 0.519 = 0.216 = 0.519 =	kg CO2/year 1180.34 (261) 0 (263) 400.21 (264) 1580.55 (265) 38.93 (267)

El rating (section 14)

(274)

75

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50 Printed on 23 November 2021 at 13:24:59

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 48.28m²

Site Reference: 11-12 Grenville Street - LEAN **Plot Reference:** Unit 4

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

Fuel factor: 1.00 (mains gas)

21.06 kg/m² Target Carbon Dioxide Emission Rate (TER)

Dwelling Carbon Dioxide Emission Rate (DER) 33.80 kg/m² Fail

Excess emissions = $12.74 \text{ kg/m}^2 (60.5 \%)$

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.6 kWh/m²

100.2 kWh/m² Dwelling Fabric Energy Efficiency (DFEE)

Excess energy = $46.56 \text{ kg/m}^2 (86.8 \%)$

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		

Openings 2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals 10.00 (design value)

4.14 (max. 2.00)

Maximum OK 10.0

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Combi boiler

Efficiency 89.5 % SEDBUK2009

Minimum 88.0 % OK

4.80 (max. 3.30)

Secondary heating system: None Fail

Fail

5 Cylinder insulation			
Hot water Storage:	No cylinder		
6 Controls			
Space heating controls	TTZC by plumbing and e	electrical services	OK
Hot water controls:	No cylinder thermostat		
	No cylinder		
Boiler interlock:	Yes		OK
7 Low energy lights			
Percentage of fixed lights w	rith low-energy fittings	100.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames v	valley):	Not significant	OK
Based on:			
Overshading:		Average or unknown	
Windows facing: North Eas	t	6.3m ²	
Windows facing: South Eas		1.84m²	
Windows facing: South We	st	1.89m²	
Ventilation rate:		8.00	
10 Key features			
Party Walls U-value		0 W/m²K	

		l Isar I	Details:							
Assessor Name: Software Name:	Neil Ingham Stroma FSAP 2012	- 036 11	Strom Softwa					0010943 on: 1.0.5.50		
	F	Property	Address	Unit 4						
Address: 1. Overall dwelling dime	ansions:									
1. Overall dwelling diffie	: IISIOIIS.	Are	a(m²)		Av. He	ight(m)		Volume(m	3)	
Ground floor				(1a) x		2.75	(2a) =	132.77	(3a)	
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	48.28	(4)			1			
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	132.77	(5)	
2. Ventilation rate:									(3)	
2. Ventuation rate.	main seconda	ry	other		total			m³ per hou	ır	
Number of chimneys	heating heating + 0	- + -	0] = [0	X 4	40 =	0	(6a)	
Number of open flues	0 + 0	╡╻┝	0	j = F	0	x	20 =	0	(6b)	
Number of intermittent fa	ns			_ _ _	3	x .	10 =	30	(7a)	
Number of passive vents	;			L	0	x	10 =	0	(7b)	
Number of flueless gas fi				F	0	X 4	40 =	0	(7c)	
3				L						
							Air ch	nanges per ho	our	
	ys, flues and fans = $(6a)+(6b)+($				30		÷ (5) =	0.23	(8)	
If a pressurisation test has be Number of storeys in the	peen carried out or is intended, proceed the dwelling (ns)	ed to (17),	otherwise (continue fr	rom (9) to	(16)			¬(0)	
Additional infiltration	ne dwelling (115)					[(9)	-1]x0.1 =	0	(9) (10)	
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	y constr	ruction	,		0	(11)	
• • • • • • • • • • • • • • • • • • • •	resent, use the value corresponding t	o the grea	ter wall are	a (after						
deducting areas of openial If suspended wooden to	ngs);	.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	x (14) ÷ 1	00] =			0	(15)	
Infiltration rate			(8) + (10)					0	(16)	
•	q50, expressed in cubic metro	•	•	•	etre of e	envelope	area	10	(17)	
•	lity value, then $(18) = [(17) \div 20] + (18)$ if a pressurisation test has been do				is boing u	sod		0.73	(18)	
Number of sides sheltere		ne or a de	gree air pe	пеаышу	is being u	seu		0	(19)	
Shelter factor			(20) = 1 -	[0.0 75 x (1	19)] =			1	(20)	
Infiltration rate incorporate	ting shelter factor		(21) = (18) x (20) =				0.73	(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]		
								J		

djusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.93	0.91	0.89	0.8	0.78	0.69	0.69	0.67	0.73	0.78	0.82	0.85		
a <i>lcul<mark>ate effe</mark>d</i> If mechanica		_	rate for t	ne appli	cable ca	se					ſ		(
If exhaust air h			endix N (2	3h) = (23a	a) × Fmv (e	equation (N5)) other	wise (23h	n) = (23a)		l I	0	
If balanced with		0		, ,	,	. `	,, .	`) = (25a)		l r	0	
		-	-	_					OL) (0	
a) If balance		i				- ` ` 	- ´ `	<u> </u>	, 		``	÷ 100]	
a)m= 0	0	0	0	0	0	0	0	0	0	0	0		
b) If balance	d mech	anical ve	ntilation	without	heat rec	overy (ľ	ИV) (24b	m = (22)	2b)m + (23b)			
b)m= 0	0	0	0	0	0	0	0	0	0	0	0		
c) If whole h if (22b)n				•	•		on from c c) = (22b		.5 × (23k	o)			
c)m= 0	0	0	0	0	0	0	0	0	0	0	0		
d) If natural				•			on from I 0.5 + [(2		0.51	Į.			
d)m= 0.93	0.91	0.9	0.82	0.8	0.74	0.74	0.73	0.76	0.8	0.83	0.86		
Effective air	change	rate - er	ter (24a) or (24h	n) or (24)	c) or (24	.d) in box	(25)					
)m= 0.93	0.91	0.9	0.82	0.8	0.74	0.74	0.73	0.76	0.8	0.83	0.86		
,					1		1		1	1			
. Heat losse _EMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/		k-value kJ/m²-k		A X k kJ/K
ors					2.59	x	1.6	_	4.144				
ndows Type	. 1				6.3		/[1/(4.8)+	0.04] =	25.37	=			
ndows Type					1.84	=	/[1/(4.8)+		7.41	=			
ndows Type							/[1/(4.8)+			\dashv			
				_	1.89	=			7.61	륵 ,			
alls Type1	45.2	25	10.0	=	35.22	_	0.3	= !	10.57	_			
alls Type2	31.1	6	2.59		28.57	X	0.22	=	6.39				
tal area of e	lements	, m²			76.41								
rty wall					35.87	x	0	=	0				
rty ceiling					48.28	3				Γ			
r windows and nclude the area						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	3.2	
bric heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				61.49	
at capacity	Cm = S((Axk)						((28).	(30) + (3	2) + (32a).	(32e) =	4610.93	<u> </u>
ermal mass	parame	ter (TMF	o = Cm -	TFA) ir	n kJ/m²K			Indica	itive Value	: Medium	[250	
design assess be used inste	sments wh	ere the de	tails of the	•			ecisely the	indicative	e values of	TMP in T	able 1f		
ermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix ł	<						11.46	
etails of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)						•		
tal fabric he	at loss							(33) +	(36) =			72.95	
ntilation hea	at loss ca	alculated	l monthly	<u>/</u>				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 40.68	39.95	39.23	35.88	35.25	32.33	32.33	31.79	33.45	35.25	36.52	37.85		
eat transfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
		,						. ,	. , \				
)m= 113.63	112.9	112.18	108.83	108.2	105.28	105.28	104.74	106.4	108.2	109.47	110.8		

Heat loss para	ameter (I	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 2.35	2.34	2.32	2.25	2.24	2.18	2.18	2.17	2.2	2.24	2.27	2.29		
						l .	l .		Average =	Sum(40) ₁ .	12 /12=	2.25	(40)
Number of day	·	nth (Tab	le 1a)	1	ı			ı		i			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occu if TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13		64		(42)
Annual average Reduce the annual not more that 125	ge hot wa al average	hot water	usage by	5% if the α	lwelling is	designed t			se target o		.14		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage								· '	!				
(44)m= 80.45	77.53	74.6	71.68	68.75	65.83	65.83	68.75	71.68	74.6	77.53	80.45		
	ļ								Total = Su	m(44) ₁₁₂ =	=	877.69	(44)
Energy content of	f hot water	used - cal	culated me	onthly = 4.	190 x Vd,r	n x nm x D	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 119.31	104.35	107.68	93.88	90.08	77.73	72.03	82.65	83.64	97.48	106.4	115.55		_
If instantaneous	water beat	na ot noint	of upo /pr	a hat water	r otorogol	antar O in	haves (46		Total = Su	m(45) ₁₁₂ =	- [1150.79	(45)
If instantaneous v			,		, , , , , , , , , , , , , , , , , , ,		, ,	, , , -		1			(40)
(46)m= 17.9 Water storage	15.65 1088	16.15	14.08	13.51	11.66	10.8	12.4	12.55	14.62	15.96	17.33		(46)
Storage volum) includin	ia anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	•					_							` '
Otherwise if n	_			-			, ,	ers) ente	er '0' in (47)			
Water storage													
a) If manufac	turer's d	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature f	factor fro	m Table	2b								0		(49)
Energy lost fro		_	-				(48) x (49)) =			0		(50)
b) If manufact Hot water stor			-										(51)
If community h	•			IC 2 (KVV)	11/11110/00	' y)					0		(31)
Volume factor	_										0		(52)
Temperature f	factor fro	m Table	2b								0		(53)
Energy lost fro	om watei	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	(54) in (55)									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = ((55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хН	
(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	,	•			59)m = ((58) ÷ 36	65 × (41)	m					
(modified by				,	•	. ,	, ,		r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss ca		1		,	<u> </u>	- ` `			Г		I	1	(5.1)
(61)m= 41	35.68	38.02	35.35	35.04	32.46	33.54	35.04	35.35	38.02	38.23	41	J	(61)
							`		` 	ì ´ 	` ´ 	(59)m + (61)m	
(62)m= 160.31	<u> </u>	145.7	129.23	125.11	110.19	105.57	117.69	1	135.49	144.64	156.55]	(62)
Solar DHW input									r contribut	ion to wate	er heating)		
(add additiona	1					 		- 		<u> </u>		1	(00)
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(63)
Output from v	1								-			1	
(64)m= 160.31	140.04	145.7	129.23	125.11	110.19	105.57	117.69	118.99	135.49	144.64	156.55		1
								tput from w				1589.51	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	î .	r	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	ı] •	
(65)m= 49.92	43.62	45.31	40.05	38.71	33.96	32.34	36.24	36.65	41.92	44.94	48.67]	(65)
include (57)	m in cald	culation of	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	ains (see	Table 5	and 5a):									
Metabolic gai	ns (Table	5), Wat	ts									_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 81.98	81.98	81.98	81.98	81.98	81.98	81.98	81.98	81.98	81.98	81.98	81.98		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 12.73	11.3	9.19	6.96	5.2	4.39	4.75	6.17	8.28	10.51	12.27	13.08		(67)
Appliances ga	ains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5	•	•	•	
(68)m= 142.77	144.25	140.52	132.57	122.54	113.11	106.81	105.33	109.06	117.01	127.04	136.47]	(68)
Cooking gains	s (calcula	ted in Ap	pendix	L, equat	ion L15	or L15a), also s	ee Table	5	•	!	•	
(69)m= 31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	1	(69)
Pumps and fa	ıns gains	(Table 5	ia)									1	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3	1	(70)
Losses e.g. e	vaporatio	n (negat	ive valu	es) (Tab	le 5)		!	1	!	1	!	1	
(71)m= -65.58	-65.58	-65.58	-65.58	-65.58	-65.58	-65.58	-65.58	-65.58	-65.58	-65.58	-65.58	1	(71)
Water heating	gains (T	 able 5)				•	<u>!</u>		<u>!</u>		<u>!</u>	1	
(72)m= 67.1	64.91	60.9	55.63	52.03	47.17	43.46	48.71	50.9	56.34	62.41	65.42]	(72)
Total interna	l gains =	<u> </u>			(66	<u>I</u>)m + (67)m	ı + (68)m	+ (69)m +	I (70)m + (7	1 (1)m + (72)	l)m	1	
(73)m= 273.19		261.2	245.75	230.36	215.26	205.61	210.8	218.83	234.45	252.32	265.56	1	(73)
6. Solar gain	1												
Solar gains are		using sola	flux from	Table 6a	and assoc	iated equa	itions to d	onvert to th	ne applical	ole orientat	tion.		
Orientation:	Access F	actor	Area		Flu	ıx		g_		FF		Gains	
	Table 6d		m²		Ta	ble 6a		Table 6b	Т	able 6c		(W)	
Northeast 0.9x	0.77	х	6.3	3	x ·	11.28	x	0.85	х	0.7	=	29.31	(75)
Northeast 0.9x	0.77	×	6.3	3	x 2	22.97	x	0.85	x	0.7	_ =	59.66	(75)
Northeast 0.9x		X	6.3		x 2	41.38	x	0.85	x	0.7	-	107.49	(75)
Northeast 0.9x		х	6.3			67.96	x -	0.85	x	0.7	=	176.53	(75)
Northeast _{0.9x}		X	6.3	==	-	91.35) <u> </u>	0.85	x	0.7	_ =	237.29	(75)
					`		. L						J. ,

Northeast 0.94	Northeast _{0.9x}		ا ا		1 .,	07.00	1	0.05			_	050.00	(75)
Northeast 0.9%	<u> </u>		╡╏		1] 1		╡		=		╡` ′
Northeast 0.9x	<u> </u>		╡╏		1		1		╡		=		╡` ′
Northeast 0.0x	<u> </u>		╡ ¦		1]]		╡		=		╡` ′
Northeast 0.sb	<u> </u>		╡╏		1		1		╡		=		╡` ′
Northeast 0.5%	<u> </u>	0.77	X	6.3	X	28.07	X	0.85	x [0.7	=	72.91	╡` ′
Southeast 0.9x	<u> </u>	0.77	X	6.3	X	14.2	X	0.85	x [0.7	=	36.88	(75)
Southeast 0,9%	<u> </u>	0.77	X	6.3	X	9.21	X	0.85	x [0.7	=	23.94	(75)
Southeast 0.9x	<u> </u>	0.77	X	1.84	X	36.79	X	0.85	x [0.7	=	27.92	(77)
Southeast 0, 9x	Southeast 0.9x	0.77	X	1.84	X	62.67	X	0.85	x	0.7	=	47.55	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.84	X	85.75	X	0.85	X	0.7	=	65.06	(77)
Southeast 0.9x	Southeast _{0.9x}	0.77	X	1.84	X	106.25	X	0.85	x	0.7	=	80.61	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.84	X	119.01	X	0.85	x [0.7	=	90.29	(77)
Southwesto, 9x	Southeast 0.9x	0.77	x	1.84	X	118.15	x	0.85	x [0.7	=	89.64	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.84	X	113.91	x	0.85	x	0.7	=	86.42	(77)
Southwesto,9x	Southeast _{0.9x}	0.77	x	1.84	x	104.39	x	0.85	= x	0.7	=	79.2	(77)
Southeast 0.9x	Southeast 0.9x	0.77	x	1.84	x	92.85	x	0.85	= x [0.7	=	70.45	(77)
Southeast 0.9x	Southeast 0.9x	0.77	x	1.84	x	69.27	x	0.85	_ x [0.7	_	52.55	(77)
Southwesto, 9x	Southeast 0.9x	0.77	×	1.84	X	44.07	x	0.85		0.7	_ =	33.44	(77)
Southwesto, 9x 0.77 x 1.89 x 62.67 0.85 x 0.7 = 48.84 (79) Southwesto, 9x 0.77 x 1.89 x 106.25 0.85 x 0.7 = 66.83 (79) Southwesto, 9x 0.77 x 1.89 x 119.01 0.85 x 0.7 = 82.8 (79) Southwesto, 9x 0.77 x 1.89 x 119.01 0.85 x 0.7 = 92.75 (79) Southwesto, 9x 0.77 x 1.89 x 119.01 0.85 x 0.7 = 92.08 (79) Southwesto, 9x 0.77 x 1.89 x 113.91 0.85 x 0.7 = 92.08 (79) Southwesto, 9x 0.77 x 1.89 x 113.91 0.85 x 0.7 = 88.77 (79) Southwesto, 9x 0.77 x 1.89 x 104.39 0.85 x 0.7 = 81.35 (79) Southwesto, 9x 0.77 x 1.89 x 92.85 0.85 x 0.7 = 81.35 (79) Southwesto, 9x 0.77 x 1.89 x 92.85 0.85 x 0.7 = 72.36 (79) Southwesto, 9x 0.77 x 1.89 x 69.27 0.85 x 0.7 = 53.98 (79) Southwesto, 9x 0.77 x 1.89 x 44.07 0.85 x 0.7 = 53.98 (79) Southwesto, 9x 0.77 x 1.89 x 44.07 0.85 x 0.7 = 34.34 (79) Southwesto, 9x 0.77 x 1.89 x 31.49 0.85 x 0.7 = 24.54 (79) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 85.9 156.05 239.38 339.95 420.33 434.69 411.85 349.22 273.79 179.44 104.66 72.36 (83) Total gains — internal and solar (84)m = (73)m + (83)m , watts (84)m = 359.09 427.11 500.58 585.7 650.69 649.95 617.46 560.02 492.62 413.9 356.98 337.92 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m 0.99 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 (66)	Southeast 0.9x	0.77	- x	1.84	X	31.49	x	0.85	x	0.7	=	23.89	(77)
Southwest0,9x	Southwest _{0.9x}	0.77	×	1.89	X	36.79	i	0.85	_ x [0.7	=	28.67	(79)
Southwestg, 9x 0.77 x 1.89 x 85.75 0.85 x 0.7 = 66.83 (79) Southwestg, 9x 0.77 x 1.89 x 106.25 0.85 x 0.7 = 82.8 (79) Southwestg, 9x 0.77 x 1.89 x 119.01 0.85 x 0.7 = 92.75 (79) Southwestg, 9x 0.77 x 1.89 x 118.15 0.85 x 0.7 = 92.08 (79) Southwestg, 9x 0.77 x 1.89 x 113.91 0.85 x 0.7 = 92.08 (79) Southwestg, 9x 0.77 x 1.89 x 113.91 0.85 x 0.7 = 88.77 (79) Southwestg, 9x 0.77 x 1.89 x 104.39 0.85 x 0.7 = 81.35 (79) Southwestg, 9x 0.77 x 1.89 x 92.85 0.85 x 0.7 = 81.35 (79) Southwestg, 9x 0.77 x 1.89 x 69.27 0.85 x 0.7 = 72.36 (79) Southwestg, 9x 0.77 x 1.89 x 69.27 0.85 x 0.7 = 53.98 (79) Southwestg, 9x 0.77 x 1.89 x 44.07 0.85 x 0.7 = 53.98 (79) Southwestg, 9x 0.77 x 1.89 x 1.40 0.85 x 0.7 = 34.34 (79) Southwestg, 9x 0.77 x 1.89 x 1.49 0.85 x 0.7 = 24.54 (79) Southwestg, 9x 0.77 x 1.89 x 1.49 x 0.7 = 24.54 (79) Southwestg, 9x 0.77 x 1.49 x 0.7 = 24.54	Southwest _{0.9x}		×	1.89	X		j	0.85	x	0.7		48.84	(79)
Southwest0.9x	Southwest _{0.9x}		۲ x)]		i	0.85	 x		= =	66.83	(79)
Southwest0.9x	<u> </u>		╡ ¦		1		<u>.</u>]		╡		= -		╡` ′
Southwesto.9x	Southwest _{0.9x}		- x]]]		_		= -		╡` ′
Southwesto,9x	Southwest _{0.9x}		≓ ¦		1]		╡		=		╡` ′
Southwesto.9x	<u> </u>		╡╏		1]]		╡┆		=		=
Southwesto,9x	<u> </u>		╡╏		1]		╡		=		= ' '
Southwesto.9x	<u> </u>		≓ ¦		1]]		╡		=		=
Southwesto.9x	<u> </u>		=		1]]		╡		=		= '
Southwest _{0.9x} 0.77 x 1.89 x 31.49 0.85 x 0.7 = 24.54 (79) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 85.9 156.05 239.38 339.95 420.33 434.69 411.85 349.22 273.79 179.44 104.66 72.36 (83) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 359.09 427.11 500.58 585.7 650.69 649.95 617.46 560.02 492.62 413.9 356.98 337.92 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m = 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	<u> </u>		╡╏		1]]		╡		=		= '
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 85.9 156.05 239.38 339.95 420.33 434.69 411.85 349.22 273.79 179.44 104.66 72.36 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 359.09 427.11 500.58 585.7 650.69 649.95 617.46 560.02 492.62 413.9 356.98 337.92 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m = 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	<u> </u>		╡ :		1]]		≓ ¦		=		= '
(83)m= 85.9 156.05 239.38 339.95 420.33 434.69 411.85 349.22 273.79 179.44 104.66 72.36 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 359.09 427.11 500.58 585.7 650.69 649.95 617.46 560.02 492.62 413.9 356.98 337.92 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	Couriwesto.9x	0.77	^	1.89	,	31.49	j	0.85	^ [0.7	=	24.54	(79)
(83)m= 85.9 156.05 239.38 339.95 420.33 434.69 411.85 349.22 273.79 179.44 104.66 72.36 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 359.09 427.11 500.58 585.7 650.69 649.95 617.46 560.02 492.62 413.9 356.98 337.92 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	Color going in w	otto color	ulotod	for oach man	th.		(02)~	- Cum/74\m	(92)m				
Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 359.09 427.11 500.58 585.7 650.69 649.95 617.46 560.02 492.62 413.9 356.98 337.92 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	ĭ			The state of the s	_	34.69 411.85	-			104.66	72.36		(83)
(84)m= 359.09 427.11 500.58 585.7 650.69 649.95 617.46 560.02 492.62 413.9 356.98 337.92 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	` '			!						1			, ,
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)				<u>` </u>	Ť		560	.02 492.62	413.9	356.98	337.92		(84)
Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)		al tampara	oturo /	hooting coop	25)					· ·			
Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)			`			araa fram Tak	olo O	Th1 (°C)				0.4	7(05)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	·	_	•		_		JIE 9	, IIII (C)				21	(65)
(86)m= 0.99 0.99 0.98 0.95 0.89 0.77 0.64 0.7 0.88 0.97 0.99 1 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)				`	Ť			ug ean	Oct	Nov	Doo		
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)			-+		_		 			+			(86)
	· · · <u> </u>	!		ļ		l l	<u> </u>		0.31	0.33	<u>'</u>		(00)
$ (87)^{\text{III}} = \begin{bmatrix} 18.54 & 18.77 & 19.18 & 19.77 & 20.3 & 20.72 & 20.89 & 20.85 & 20.51 & 19.83 & 19.11 & 18.55 \end{bmatrix} $					` 	i	1		40.00	14044	40.55		(97)
	(87)m= 18.54	18.// 1	9.18	19.77 20.3	2	20.72 20.89	20.	გე <u>20.51</u>	19.83	19.11	18.55		(0/)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.11 19.12 19.13 19.17 19.18 19.22 19.22 19.22 19.2 19.18 19.16 19.14	(88)
	(00)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)	7 (00)
(89)m= 0.99 0.99 0.97 0.93 0.83 0.64 0.43 0.49 0.79 0.95 0.99 0.99	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)	_
(90)m= 16.01 16.34 16.94 17.81 18.54 19.05 19.19 19.17 18.84 17.91 16.87 16.03	(90)
$fLA = Living area \div (4) =$	0.55 (91)
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$	
(92)m= 17.39 17.67 18.17 18.88 19.5 19.96 20.12 20.09 19.75 18.96 18.1 17.41	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate	_
(93)m= 17.24 17.52 18.02 18.73 19.35 19.81 19.97 19.94 19.6 18.81 17.95 17.26	(93)
8. Space heating requirement	
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-cal	culate
the utilisation factor for gains using Table 9a	7
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	J
Utilisation factor for gains, hm: (94)m= 0.99 0.98 0.96 0.92 0.84 0.69 0.53 0.59 0.82 0.95 0.98 0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m] (0.1)
(95)m= 354.93 418.79 482.19 539.59 544.15 448.36 324.76 328.8 402.45 391.61 350.47 334.7	(95)
Monthly average external temperature from Table 8]
(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m]	1
(97)m= 1470.76 1424.78 1291.8 1069.88 828.12 548.47 354.44 370.89 585.36 887.93 1187.26 1446.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m	_
(98)m= 830.17 676.03 602.35 381.81 211.27 0 0 0 0 369.26 602.48 827.25	7
Total per year (kWh/year) = Sum(98) _{15,912} =	4500.62 (98)
Total per year (kWh/year) = Sum(98) _{15,912} = Space heating requirement in kWh/m²/year	4500.62 (98) 93.22 (99)
Space heating requirement in kWh/m²/year	
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP)	
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating:	93.22 (99)
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system	93.22 (99)
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 (202) = 1 - (201) = (204) = (202) × [1 - (203)] =	93.22 (99) 0 (201) 1 (202) 1 (204)
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1	93.22 (99) 0 (201) 1 (202) 1 (204)
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, %	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206) 0 (208)
Space heating requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 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	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206)
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, %	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206) 0 (208)
Space heating requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 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 Space heating requirement (calculated above) 830.17 676.03 602.35 381.81 211.27 0 0 0 0 369.26 602.48 827.25	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206) 0 (208) kWh/year
Space heating requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 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 Space heating requirement (calculated above)	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206) 0 (208)
Space heating requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 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 Space heating requirement (calculated above) 830.17 676.03 602.35 381.81 211.27 0 0 0 0 369.26 602.48 827.25 (211)m = {[(98)m x (204)] } x 100 ÷ (206)	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206) 0 (208) kWh/year
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 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 Space heating requirement (calculated above) 830.17 676.03 602.35 381.81 211.27 0 0 0 0 369.26 602.48 827.25 (211)m = {[(98)m x (204)] } x 100 ÷ (206) 918.33 747.82 666.31 422.35 233.71 0 0 0 0 408.47 666.47 915.1 Total (kWh/year) =Sum(211) _{15.1012} =	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206) 0 (208) kWh/year (211)
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) (202) = 1 - (201) = Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 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 Space heating requirement (calculated above) 830.17 676.03 602.35 381.81 211.27 0 0 0 0 369.26 602.48 827.25 (211)m = {[(98)m x (204)] } x 100 ÷ (206) 918.33 747.82 666.31 422.35 233.71 0 0 0 0 0 408.47 666.47 915.1	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206) 0 (208) kWh/year (211)
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 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 Space heating requirement (calculated above) 830.17 676.03 602.35 381.81 211.27 0 0 0 0 369.26 602.48 827.25 (211) m = {[(98)m x (204)]} x 100 ÷ (206) 918.33 747.82 666.31 422.35 233.71 0 0 0 0 408.47 666.47 915.1 Total (kWh/year) =Sum(211) ₁₅₁₀₁₂ = Space heating fuel (secondary), kWh/month	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206) 0 (208) kWh/year (211)
Space heating requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of total heating 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, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating requirement (calculated above) 830.17 676.03 602.35 381.81 211.27 0 0 0 0 369.26 602.48 827.25 (211)m = {[(98)m x (204)] } x 100 ÷ (206) 918.33 747.82 666.31 422.35 233.71 0 0 0 0 408.47 666.47 915.1 Total (kWh/year) =Sum(211) _{1.8.1012} = Space heating fuel (secondary), kWh/month = {[(98)m x (201)]} x 100 ÷ (208)	93.22 (99) 0 (201) 1 (202) 1 (204) 90.4 (206) 0 (208) kWh/year (211)

Water heating								
Output from water heater (calculated above) 160.31 140.04 145.7 129.23 125.11 1	10.19 105.57	117.69	118.99	135.49	144.64	156.55		
Efficiency of water heater							80.3	(216)
(217)m= 88.6 88.49 88.24 87.61 86.36	80.3 80.3	80.3	80.3	87.45	88.25	88.63		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m								
· · · — — — — — — — — — — — — — — — — —	37.23 131.47	146.56	148.18	154.94	163.89	176.64		
		Tota	al = Sum(2				1855.6	(219)
Annual totals Space heating fuel used, main system 1				k'	Wh/year	•	kWh/year	7
							4978.56	<u> </u>
Water heating fuel used							1855.6	
Electricity for pumps, fans and electric keep-hot							1	
central heating pump:						30		(230c)
boiler with a fan-assisted flue						45		(230e)
Total electricity for the above, kWh/year		sum	of (230a)	(230g) =			75	(231)
Electricity for lighting							224.78	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)	(237b)	=				7133.94	(338)
12a. CO2 emissions – Individual heating system	s including m	icro-CHF)					
	Energy kWh/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x			0.2	16	=	1075.37	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.2	16	=	400.81	(264)
Space and water heating	(261) + (262)	+ (263) + ((264) =				1476.18	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	38.93	(267)
Electricity for lighting	(232) x			0.5	19	=	116.66	(268)
Total CO2, kg/year			sum o	of (265)(271) =		1631.76	(272)
Dwelling CO2 Emission Rate			(272)	÷ (4) =			33.8	(273)

El rating (section 14)

(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50 Printed on 23 November 2021 at 13:24:58

Proiect Information:

Assessed By: Neil Ingham (STRO010943) Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 55.35m²

Site Reference: 11-12 Grenville Street - LEAN

Plot Reference: Unit 5

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

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

21.06 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

33.54 kg/m²

Fail

Excess emissions = 12.48 kg/m² (59.3 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 57.1 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 102.4 kWh/m²

Excess energy = 45.29 kg/m^2 (79.3 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.11 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	4.18 (max. 2.00)	4.80 (max. 3.30)	Fail

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals 10.00 (design value)

Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Combi boiler

Efficiency 89.5 % SEDBUK2009

Minimum 88.0 % OK

Secondary heating system: None

Fail

Regulations Compliance Report

5 Cylinder insulation							
Hot water Storage:	No cylinder						
6 Controls							
Space heating controls	Space heating controls TTZC by plumbing and electrical services						
Hot water controls:							
	Hot water controls: No cylinder thermostat No cylinder						
Boiler interlock:	Yes		OK				
7 Low energy lights							
Percentage of fixed lights with	low-energy fittings	100.0%					
Minimum		75.0%	OK				
8 Mechanical ventilation							
Not applicable							
9 Summertime temperature							
Overheating risk (Thames valle	ey):	Not significant	OK				
Based on:							
Overshading:		Average or unknown					
Windows facing: North East		3.5m²					
Windows facing: South East		1.95m²					
Windows facing: South West		5.4m²					
Ventilation rate:		8.00					
10 Key features							
Roofs U-value		0.1 W/m²K					
Party Walls U-value		0 W/m²K					

		User De	taile:						
Access Names	Noil Ingham			M	h		CTDO	010042	
Assessor Name: Software Name:	Neil Ingham Stroma FSAP 2012	_	Stroma Softwar					010943 on: 1.0.5.50	
Joitware Hame.		Property Ad			JIVII.		V 01010		
Address :									
1. Overall dwelling dime	ensions:								
Ground floor		Area((-)		ight(m)	l ₍₀₌₎	Volume(m³)	_
	\	55.		a) x		2.6	(2a) =	143.91	(3a)
·	a)+(1b)+(1c)+(1d)+(1e)+(1	n) 55.	,						_
Dwelling volume			(:	3a)+(3b))+(3c)+(3c	d)+(3e)+	(3n) =	143.91	(5)
2. Ventilation rate:	main seconda	r)/	ther		total			m³ per hou	
	heating heating				lotai		10	ill' per floui	_
Number of chimneys	0 + 0	_	0	= _	0		10 =	0	(6a)
Number of open flues	0 + 0	+	0	= _	0	x 2	20 =	0	(6b)
Number of intermittent fa	ns				3	x 1	0 =	30	(7a)
Number of passive vents					0	x 1	0 =	0	(7b)
Number of flueless gas fi	res				0	x 4	0 =	0	(7c)
				_			A : l		_
1.60	(0-)-(01)-(7 - \ . (7 \ . (7 -	- \	_			i	nanges per ho	_
•	ys, flues and fans = (6a)+(6b)+(6b)+(6b)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6a)+(6b)+(6a)+(6b)+(6a)+(6a)+(6b)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a			ntinue fr	30 om (9) to (÷ (5) =	0.21	(8)
Number of storeys in the		u 10 (17), 011	noi wise coi	nanac n	om (5) to ((10)		0	(9)
Additional infiltration	5 ([(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 for r	masonry	constr	uction			0	(11)
if both types of wall are pa deducting areas of openia	resent, use the value corresponding to	o the greater	r wall area ((after					
•	ilgs), if equal user 0.35 floor, enter 0.2 (unsealed) or 0	.1 (sealed	l), else er	nter 0				0	(12)
If no draught lobby, en		`	,,					0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration		0.	.25 - [0.2 x	(14) ÷ 1	00] =			0	(15)
Infiltration rate		(8)	3) + (10) + ((11) + (1	2) + (13) -	+ (15) =		0	(16)
	q50, expressed in cubic metre	-			etre of e	envelope	area	10	(17)
•	ity value, then $(18) = [(17) \div 20] + (18)$							0.71	(18)
Air permeability value applie Number of sides sheltere	es if a pressurisation test has been do	ne or a degre	ee air perm	neability i	is being u	sed	İ		7(10)
Shelter factor	çu .	(2	20) = 1 - [0.	.075 x (1	9)] =			0	(19) (20)
Infiltration rate incorporat	ting shelter factor	(2	21) = (18) x	(20) =				0.71	(21)
Infiltration rate modified f	_							U	 _` ′
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		
,	1 133 3.00		- /-	-	L			I	

Adjusted infiltra	tion rate (allow	ing for shelf	ter and wind	speed) =	(21a) x	(22a)m					
0.9	0.89 0.87	0.78	0.76 0.67	0.67	0.66	0.71	0.76	0.8	0.83]	
Calculate effec	•	rate for the	applicable ca	ase		•		Į.		<u>, </u>	
If mechanical		ondiv N. (22h)	- (22a) × Emy	oguation (NE)\ otho	nuico (22h	s) = (22a)			0	(23a)
	at pump using App)) = (23a)			0	(23b)
	heat recovery: effice	-	_							0	(23c)
· -	d mechanical v	1		, 	, 	ŕ	, 		- ` ` `) ÷ 100] 1	(0.4.)
(24a)m= 0	0 0	0	0 0	0	0	0	0	0	0	J	(24a)
, L	d mechanical v			, , `	MV) (24b	<u>, , , , , , , , , , , , , , , , , , , </u>	2b)m + (2	23b)		7	
(24b)m= 0	0 0	0	0 0	0	0	0	0	0	0]	(24b)
,	ouse extract ve	•	•								
<u> </u>	< 0.5 × (23b),	1 ` ´	` í —	- `	ŕ `		· `		1	1	(5.4.)
(24c)m= 0	0 0	0	0 0	0	0	0	0	0	0]	(24c)
,	entilation or wh = 1, then (24d		•				0.5]			_	
(24d)m= 0.91	0.89 0.88	0.8	0.79 0.73	0.73	0.71	0.75	0.79	0.82	0.85		(24d)
Effective air of	change rate - e	nter (24a) o	r (24b) or (24	lc) or (24	d) in bo	x (25)		-		_	
(25)m= 0.91	0.89 0.88	0.8	0.79 0.73	0.73	0.71	0.75	0.79	0.82	0.85]	(25)
2 Hoot losses	and heat loss	parameter:		•	•				•	-	
	Gross	•	Net A	roo	U-val	110	AXU		k-valu	2	AXk
ELEMENT	area (m²)	Openings m ²	A,		W/m2		(W/I	〈)	kJ/m ² ·		kJ/K
Doors			2.59) x	1.6	=	4.144	Ì			(26)
Windows Type	1		3.5	x1	/[1/(4.8)+	0.04] =	14.09	=			(27)
Windows Type	2		1.95		/[1/(4.8)+	0.04] =	7.85	=			(27)
Windows Type	3		5.4	x1	/[1/(4.8)+	0.04] =	21.74	=			(27)
Walls Type1	53.86	8.9	44.9	6 x	0.3	=	13.49	=			(29)
Walls Type2	16.06	2.59	13.4	7 X	0.22		3.01	= i		7 F	(29)
Walls Type3	3.94	1.95	1.99	_	0.28		0.56	F i		7 7	(29)
Roof Type1	37.6	0	37.6	x	0.1	= =	3.76	=		7	(30)
Roof Type2	5.33	0	5.30	_	0.14		0.75	=		= =	(30)
Roof Type3	13.05	0	13.0	_	0.14		1.83	륵 ;			(30)
Total area of el			129.8	_	0.14		1.00				(31)
Party wall	,		51.2	_	0		0	— [(32)
Party floor			55.3	=						7 F	(32a)
* for windows and i			w U-value calcu		g formula 1	/[(1/U-valu	ue)+0.04] a	L ns given in	paragrapi	 h	(* **/
Fabric heat loss					(26)(30)) + (32) =				71.23	(33)
Heat capacity C	•	,				((28).	(30) + (32	2) + (32a).	(32e) =	5699.9	
Thermal mass i	,	P = Cm - T	FA) in k.l/m²k	(ative Value:	, , ,	` '	250	(35)
For design assess	•		•		recisely the				able 1f	250	(00)
can be used instea											
Thermal bridge											(36)

	heat loss	-1- 1-1- 1						` '	(36) =	05) (5)	ı	90.7	(3
	neat loss ca			, 	Ι.	<u> </u>	I .	` '	= 0.33 × (<u> </u>			
Jar	+	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(0
3)m= 43.1	2 42.37	41.63	38.17	37.52	34.5	34.5	33.94	35.66	37.52	38.83	40.2		(3
eat transfe	r coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
)m= 133.8	32 133.07	132.33	128.87	128.22	125.2	125.2	124.64	126.37	128.22	129.53	130.9		
		II 5) M	/ 01/						Average =		12 /12=	128.87	(;
	arameter (I	 		0.00	0.00		0.05	` ′	= (39)m ÷	<u>` </u>			
)m= 2.42	2 2.4	2.39	2.33	2.32	2.26	2.26	2.25	2.28	2.32	2.34	2.36	0.00	\neg_{ι}
ımber of c	days in mo	nth (Tabl	le 1a)					1	Average =	Sum(40) ₁	12 /12=	2.33	(4
Jar	<u> </u>	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
,							<u> </u>				<u> </u>		`
. Water he	eating ene	rgy requi	rement:								kWh/ye	ear:	
sumed oc	ccupancy,	N								1.	85		(-
	3.9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	349 x (TI	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.	9)			·
	3.9, N = 1						(O.E. N.I.)	00					
	age hot wa nual average		•	•	•	_	` ,		se target o		.08		(
	25 litres per		• .		_	•		a mater at	oo ta.got o	•			
Jar	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	e in litres per	l .				l .		ООР		1101			
)m= 85.8	9 82.77	79.64	76.52	73.4	70.27	70.27	73.4	76.52	79.64	82.77	85.89		
′				l	l				<u>l</u> Total = Su	l m(44) ₁₁₂ =	<u> </u>	936.97	\neg
													- 10
ergy conten	t of hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,ı	m x nm x D	0Tm / 3600		nth (see Ta	ables 1b, 1	c, 1d)	000.01	(·
~ 		used - cal	culated mo	96.16	190 x Vd,r 82.98	76.89	0Tm / 3600 88.24		104.06	ables 1b, 1	c, 1d) 123.35	000.01	(
"								89.29	` I	113.59	123.35	1228.51	`
)m= 127.3		114.95	100.22	96.16	82.98	76.89	88.24	89.29	104.06	113.59	123.35		`
)m= 127.3	37 111.4 s water heati	114.95	100.22	96.16	82.98	76.89	88.24	89.29	104.06	113.59	123.35		((
)m= 127.3 sstantaneou	37 111.4 s water heati	114.95	100.22 of use (no	96.16 hot water	82.98	76.89 enter 0 in	88.24 boxes (46)	89.29) to (61)	104.06 Total = Su	113.59 m(45) ₁₁₂ =	123.35		((
stantaneou)m= 19.1 ater storage	37 111.4 s water heati	114.95 ing at point 17.24	100.22 of use (no	96.16 hot water 14.42	82.98 r storage), 12.45	76.89 enter 0 in 11.53	88.24 boxes (46)	89.29) to (61)	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ =	123.35		(,
m= 127.3 istantaneou m= 19.1 ater storage volu	s water heati 1 16.71 ge loss:	114.95 ing at point 17.24) including	100.22 of use (no 15.03	96.16 hot water 14.42 Dlar or W	82.98 r storage), 12.45 /WHRS	76.89 enter 0 in 11.53 storage	88.24 boxes (46) 13.24 within sa	89.29) to (61)	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ =	123.35		(,
m= 127.3 istantaneou m= 19.1 ater storage volution community herwise if	s water heating loss: ume (litres) y heating a no stored	114.95 ing at point 17.24 including and no ta	of use (no 15.03 ag any so	96.16 96.16 14.42 plar or W velling, e	82.98 r storage), 12.45 /WHRS	76.89 enter 0 in 11.53 storage) litres in	88.24 boxes (46) 13.24 within sa (47)	89.29 0 to (61) 13.39 ame vess	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ =	123.35		((
m= 127.3 stantaneou m= 19.1 ater storage voluceommunity nerwise if	s water heati 1 16.71 ge loss: ume (litres) y heating a no stored ge loss:	114.95 ing at point 17.24) including and no tall hot water	of use (no 15.03 ag any so nk in dw er (this in	96.16 96.16 14.42 Dlar or Welling, encludes i	82.98 r storage), 12.45 /WHRS enter 110	enter 0 in 11.53 storage 0 litres in	88.24 boxes (46) 13.24 within sa (47)	89.29 0 to (61) 13.39 ame vess	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ = 17.04 47)	123.35		(4)
m= 127.3 stantaneou m= 19.1 ater storage volutionerwise if ater storage If manufa	s water heating loss: ume (litres) y heating a no stored ge loss: acturer's de	114.95 ing at point 17.24) including and no ta hot wate eclared le	of use (no 15.03 ng any so nk in dw er (this ir	96.16 96.16 14.42 Dlar or Welling, encludes i	82.98 r storage), 12.45 /WHRS enter 110	enter 0 in 11.53 storage 0 litres in	88.24 boxes (46) 13.24 within sa (47)	89.29 0 to (61) 13.39 ame vess	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ = 17.04 47)	123.35		(4)
estantaneou m= 19.1 ater storage voluceommunity herwise if ater storage frage restorage mperature	s water heating litres; y heating a no stored ge loss: acturer's de e factor fro	114.95 ing at point 17.24 including and no tale hot water eclared learn Table	of use (not) 15.03 Ing any so ank in dwer (this in oss factors)	96.16 96.16 14.42 Dlar or Welling, encludes in the control of t	82.98 r storage), 12.45 /WHRS enter 110	enter 0 in 11.53 storage litres in neous co	88.24 boxes (46) 13.24 within sa (47) embi boil	89.29 10 (61) 13.39 ame ves: ers) ente	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ = 17.04	123.35		(
mstantaneou)m= 19.1 ater storage volu- community herwise if ater storage If manufa	s water heating loss: ume (litres) y heating a no stored ge loss: acturer's dee factor from water	114.95 ing at point 17.24 including and no tale hot water eclared learn Table or storage	of use (no 15.03 ng any so nk in dw er (this ir oss facto 2b , kWh/yo	96.16 96.16 14.42 plar or Wateling, encludes in the properties in the properties of the properties	82.98 * storage), 12.45 /WHRS enter 110 nstantar wn (kWh	enter 0 in 11.53 storage litres in neous conh/day):	88.24 boxes (46) 13.24 within sa (47)	89.29 10 (61) 13.39 ame ves: ers) ente	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ = 17.04	123.35 = 18.5		(4)
m= 127.3 instantaneou m= 19.1 ater storage volution community herwise if ater storage If manufater manufater mergy lost If manufater	s water heating lands and stored ge loss: acturer's does from water acturer's does caturer's does from water acturer's does loss: acturer's does from water acturer's does loss: acturer's does from water acturer's does loss: acturer's does l	114.95 ing at point 17.24 including and no tale hot water and lower than the transfer of the t	of use (not) 15.03 ag any so ank in dwer (this in oss factors) 2b , kWh/yo	96.16 96.16 14.42 plar or W yelling, encludes i	82.98 r storage), 12.45 /WHRS enter 110 nstantar wn (kWh	enter 0 in 11.53 storage 0 litres in neous conh/day):	88.24 boxes (46) 13.24 within sa (47) embi boil	89.29 10 (61) 13.39 ame ves: ers) ente	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ = 17.04	123.35 = 18.5 0		(4 (4 (4 (4)
nstantaneous ns	s water heati 1 16.71 ge loss: ume (litres) y heating a no stored ge loss: acturer's de e factor fro from water acturer's de	114.95 ing at point 17.24 including and no tale hot water eclared learn Table or storage eclared of a factor fr	of use (not) 15.03 Ing any so ank in dweer (this in oss factors) 2b , kWh/ye cylinder form Table	96.16 96.16 14.42 plar or W yelling, encludes i	82.98 r storage), 12.45 /WHRS enter 110 nstantar wn (kWh	enter 0 in 11.53 storage 0 litres in neous conh/day):	88.24 boxes (46) 13.24 within sa (47) embi boil	89.29 10 (61) 13.39 ame ves: ers) ente	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ = 17.04	123.35 = 18.5 0		(.) (.) (.) (.)
estantaneou m= 19.1 ater storage orage volu community herwise if ater storag franctar franctar mperature ergy lost If manufa t water st community	s water heating lands and stored ge loss: acturer's does from water acturer's does caturer's does from water acturer's does loss: acturer's does from water acturer's does loss: acturer's does from water acturer's does loss: acturer's does l	114.95 Ing at point 17.24 including and no tale and no tale and tale are clared learn Table are storage eclared or factor from the eclared or factor from	of use (not) 15.03 Ing any so ank in dweer (this in oss factors) 2b , kWh/ye cylinder form Table	96.16 96.16 14.42 plar or W yelling, encludes i	82.98 r storage), 12.45 /WHRS enter 110 nstantar wn (kWh	enter 0 in 11.53 storage 0 litres in neous conh/day):	88.24 boxes (46) 13.24 within sa (47) embi boil	89.29 10 (61) 13.39 ame ves: ers) ente	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ = 17.04	123.35 = 18.5 0 0 0		(4)
m= 127.3 stantaneou m= 19.1 ater storage volution community herwise if ater storage If manufa mperature ergy lost If manufa t water st community lume fact	s water heating land land land land land land land land	114.95 Ing at point 17.24 Including and no tale and no tale and reclared learn Table are storage eclared of a factor from the see section ble 2a	of use (not) 15.03 ag any so ank in dwer (this in coss factors) 2b , kWh/yo cylinder from Table on 4.3	96.16 96.16 14.42 plar or W yelling, encludes i	82.98 r storage), 12.45 /WHRS enter 110 nstantar wn (kWh	enter 0 in 11.53 storage 0 litres in neous conh/day):	88.24 boxes (46) 13.24 within sa (47) embi boil	89.29 10 (61) 13.39 ame ves: ers) ente	104.06 Total = Su 15.61	113.59 m(45) ₁₁₂ = 17.04	123.35 = 18.5 0		(4)
m= 127.3 mstantaneou m= 19.1 ater storage community herwise if ater storage If manufa mperature hergy lost If manufa to water st community lume fact mperature	s water heati 1 16.71 ge loss: ume (litres) y heating a no stored ge loss: acturer's de e factor fro from water acturer's de orage loss y heating s or from Ta	114.95 Ing at point 17.24 Including and no tale and no tale and rable are storage eclared to a factor from the see section bile 2a are marked and marked	of use (not) 15.03 ag any so ank in dwer (this in oss factor) 2b , kWh/yo cylinder from Table on 4.3	96.16 96.16 14.42 plar or W yelling, encludes in the control of	82.98 r storage), 12.45 /WHRS enter 110 nstantar wn (kWh	enter 0 in 11.53 storage 0 litres in neous co h/day): known:	88.24 boxes (46) 13.24 within sa (47) embi boil	89.29 10 to (61) 13.39 ame vest ers) enter	104.06 Total = Su 15.61 sel er '0' in (113.59 m(45) ₁₁₂ = 17.04	123.35 = 18.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(A) (A) (A) (A) (A) (A) (A) (A) (A) (A)

	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 cylind	er contains	s dedicated	solar sto	rage, (57)ı	n = (56)m	x [(50) – (H11)] ÷ (50	0), else (57	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)
Primai	ry circuit	loss (an	inual) fro	m Table	3							0		(58)
Prima	ry circuit	loss cal	culated f	for each	month (59)m = ((58) ÷ 36	55 × (41)	m				'	
(mo	dified by	factor fr	om Tab	le H5 if t	here is s	olar wat	ter heatir	ng and a	cylinde	r thermo	stat)		_	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Comb	i loss cal	lculated	for each	month (61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	43.77	38.09	40.58	37.74	37.4	34.65	35.81	37.4	37.74	40.58	40.82	43.77		(61)
Total h	neat requ	uired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	171.14	149.49	155.54	137.95	133.56	117.64	112.7	125.64	127.03	144.65	154.41	167.12		(62)
Solar Di	HW input of	calculated	using App	endix G oı	Appendix	: H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	I	
(add a	dditiona	l lines if	FGHRS	and/or \	vwhrs	applies	, see Ap	pendix (3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from wa	ater hea	ter										1	
(64)m=	171.14	149.49	155.54	137.95	133.56	117.64	112.7	125.64	127.03	144.65	154.41	167.12		
								Outp	out from wa	ater heate	r (annual)₁	12	1696.87	(64)
Heat g	gains froi	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m]	_
(65)m=	53.29	46.56	48.37	42.76	41.32	36.26	34.52	38.69	39.12	44.75	47.97	51.96		(65)
inclu	ـــــــــــــــــــــــــــــــــــــ	m in calc	culation of	of (65)m	only if c	vlinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	leating	
	ternal ga				•	•						•		
	olic gain	·												
Metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug					ı	
(66)m=	92.38	92.38	92.38	92.38	92.38				I Sep	I Oct	Nov	Dec		
Liahtir	na aains	(calculat	ted in Ar		92.30	92.38	92.38	92.38	Sep 92.38	Oct 92.38	Nov 92.38	Dec 92.38		(66)
(67)m=	$\overline{}$	<u> </u>		pendix					92.38					(66)
		12.76	10.38	pendix 7.86			92.38 r L9a), a 5.36		92.38					(66) (67)
Applia	nces gai		10.38	7.86	L, equati 5.87	ion L9 oi 4.96	r L9a), a 5.36	lso see 6.96	92.38 Table 5 9.35	92.38	92.38	92.38		` '
		ins (calc	10.38 ulated in	7.86 Append	L, equati 5.87 dix L, equ	ion L9 or 4.96 uation L	5.36 13 or L1	lso see 6.96 3a), also	92.38 Table 5 9.35 see Ta	92.38 11.87 ble 5	92.38	92.38		` '
(68)m=	161.09	ins (calc 162.76	10.38 ulated in	7.86 Append 149.58	L, equati 5.87 dix L, equ 138.26	4.96 uation L	5.36 13 or L1:	lso see 6.96 3a), also	92.38 Table 5 9.35 see Ta	92.38 11.87 ble 5 132.02	92.38	92.38		(67)
(68)m= Cookir	161.09 ng gains	ins (calc 162.76 (calcula	10.38 ulated in 158.55 ted in A	7.86 Append 149.58	L, equati 5.87 dix L, equat 138.26 L, equat	4.96 uation L 127.62	r L9a), a 5.36 13 or L1: 120.51 or L15a)	lso see 6.96 3a), also 118.84), also se	92.38 Table 5 9.35 see Ta 123.05 ee Table	92.38 11.87 ble 5 132.02	92.38	92.38		(67)
(68)m= Cookir (69)m=	161.09 ng gains 32.24	ins (calc 162.76 (calcula 32.24	10.38 ulated in 158.55 ited in Ap	7.86 Append 149.58 Opendix 32.24	L, equati 5.87 dix L, equ 138.26	4.96 uation L	5.36 13 or L1:	lso see 6.96 3a), also	92.38 Table 5 9.35 see Ta	92.38 11.87 ble 5 132.02	92.38 13.85 143.34	92.38 14.76 153.98		(67) (68)
(68)m= Cookir (69)m= Pumps	161.09 ng gains 32.24 s and far	ins (calcula 162.76 (calcula 32.24	10.38 ulated in 158.55 tted in Ap 32.24 (Table 5	7.86 Append 149.58 opendix 32.24 5a)	5.87 dix L, equ 138.26 L, equat 32.24	ion L9 or 4.96 uation L 127.62 tion L15 32.24	r L9a), a 5.36 13 or L1: 120.51 or L15a) 32.24	lso see 6.96 3a), also 118.84), also se 32.24	92.38 Table 5 9.35 see Ta 123.05 ee Table 32.24	92.38 11.87 ble 5 132.02 5 32.24	92.38 13.85 143.34 32.24	92.38 14.76 153.98 32.24		(67) (68) (69)
(68)m= Cookin (69)m= Pumps (70)m=	161.09 ng gains 32.24 s and far	ins (calc 162.76 (calcula 32.24 ns gains	10.38 ulated in 158.55 tted in Al 32.24 (Table 5	7.86 7.86 Append 149.58 Appendix 32.24 5a) 3	L, equati 5.87 dix L, equ 138.26 L, equat 32.24	4.96 uation L ² 127.62 tion L15 32.24	r L9a), a 5.36 13 or L1: 120.51 or L15a)	lso see 6.96 3a), also 118.84), also se	92.38 Table 5 9.35 see Ta 123.05 ee Table	92.38 11.87 ble 5 132.02	92.38 13.85 143.34	92.38 14.76 153.98		(67) (68)
(68)m= Cookir (69)m= Pumps (70)m= Losses	161.09 ng gains 32.24 s and far 3 s e.g. ev	ins (calcula 162.76 (calcula 32.24 ns gains 3	10.38 ulated in 158.55 ted in Ap 32.24 (Table 5	7.86 7.86 Append 149.58 Appendix 32.24 Sa) 3 tive valu	L, equati 5.87 dix L, equati 138.26 L, equati 32.24 3 es) (Tab	4.96 uation L ² 127.62 tion L15 32.24 3	r L9a), a 5.36 13 or L1: 120.51 or L15a) 32.24	lso see 6.96 3a), also 118.84), also se 32.24	92.38 Table 5 9.35 see Ta 123.05 ee Table 32.24	92.38 11.87 ble 5 132.02 5 32.24	92.38 13.85 143.34 32.24	92.38 14.76 153.98 32.24		(67) (68) (69) (70)
(68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	161.09 ng gains 32.24 s and far 3 s e.g. ev -73.9	ins (calc 162.76 (calcula 32.24 ns gains 3 aporatio -73.9	10.38 ulated in 158.55 tted in Ap 32.24 (Table 5 3 on (negat	7.86 7.86 Append 149.58 Appendix 32.24 5a) 3	L, equati 5.87 dix L, equ 138.26 L, equat 32.24	4.96 uation L ² 127.62 tion L15 32.24	r L9a), a 5.36 13 or L1: 120.51 or L15a) 32.24	lso see 6.96 3a), also 118.84), also se 32.24	92.38 Table 5 9.35 see Ta 123.05 ee Table 32.24	92.38 11.87 ble 5 132.02 5 32.24	92.38 13.85 143.34 32.24	92.38 14.76 153.98 32.24		(67) (68) (69)
(68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water	161.09 ng gains 32.24 s and far 3 s e.g. ev -73.9 heating	ins (calc 162.76 (calcula 32.24 ns gains 3 raporatio -73.9 gains (T	10.38 ulated in 158.55 tted in Ap 32.24 (Table 5 3 on (negat -73.9) Table 5)	7.86 7.86 Append 149.58 Appendix 32.24 5a) 3 tive valu -73.9	L, equati 5.87 dix L, equati 138.26 L, equati 32.24 3 es) (Tab -73.9	4.96 uation L 127.62 tion L15 32.24 3 ole 5) -73.9	r L9a), a 5.36 13 or L1: 120.51 or L15a) 32.24 3	lso see 6.96 3a), also 118.84), also se 32.24 3	92.38 Table 5 9.35 9 see Ta 123.05 ee Table 32.24 3	92.38 11.87 ble 5 132.02 5 32.24 3	92.38 13.85 143.34 32.24 3	92.38 14.76 153.98 32.24 3		(67) (68) (69) (70) (71)
(68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	161.09 ng gains 32.24 s and far 3 s e.g. ev -73.9 heating 71.63	ins (calcula 162.76) (calcula 32.24) as gains 3 aporatio -73.9 gains (T	10.38 ulated in 158.55 tted in Ap 32.24 (Table 5 3 on (negator 173.9) Table 5) 65.01	7.86 7.86 Append 149.58 Appendix 32.24 Sa) 3 tive valu	L, equati 5.87 dix L, equati 138.26 L, equati 32.24 3 es) (Tab	3 sle 5) -73.9	r L9a), a 5.36 13 or L1: 120.51 or L15a) 32.24 3 -73.9	lso see 6.96 3a), also 118.84), also se 32.24 3 -73.9	92.38 Table 5 9.35 see Ta 123.05 ee Table 32.24 3 -73.9	92.38 11.87 ble 5 132.02 5 32.24 3 -73.9	92.38 13.85 143.34 32.24 3 -73.9	92.38 14.76 153.98 32.24 3 -73.9		(67) (68) (69) (70)
(68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	161.09 ng gains 32.24 s and far 3 s e.g. ev -73.9 heating 71.63 internal	ins (calcula 162.76) (calcula 32.24) as gains 3 aporatio -73.9 gains (T	10.38 ulated in 158.55 tted in Ap 32.24 (Table 5 3 on (negator 173.9) Table 5) 65.01	7.86 7.86 Append 149.58 Appendix 32.24 5a) 3 tive valu -73.9	L, equati 5.87 dix L, equati 138.26 L, equati 32.24 3 es) (Tab -73.9	3 sle 5) -73.9	r L9a), a 5.36 13 or L1: 120.51 or L15a) 32.24 3	lso see 6.96 3a), also 118.84), also se 32.24 3 -73.9	92.38 Table 5 9.35 see Ta 123.05 ee Table 32.24 3 -73.9	92.38 11.87 ble 5 132.02 5 32.24 3 -73.9	92.38 13.85 143.34 32.24 3 -73.9	92.38 14.76 153.98 32.24 3 -73.9		(67) (68) (69) (70) (71)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation: Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b	٦	FF Table 6c		Gains (W)	
Northeast _{0.9x} 0.77	X	3.5	x	11.28	x	0.85	×	0.7		16.28	(75)
Northeast 0.9x 0.77	X	3.5	x	22.97	x	0.85	x	0.7	= [33.14	(75)
Northeast 0.9x 0.77	X	3.5	x	41.38	X	0.85	x	0.7	<u> </u>	59.72	(75)
Northeast 0.9x 0.77	X	3.5	x	67.96	x	0.85	×	0.7	_ = [98.07	(75)
Northeast 0.9x 0.77	X	3.5	x	91.35	x	0.85	×	0.7	<u> </u>	131.83	(75)
Northeast 0.9x 0.77	X	3.5	x	97.38	X	0.85	x	0.7	=	140.54	(75)
Northeast _{0.9x} 0.77	X	3.5	x	91.1	X	0.85	x	0.7	= [131.47	(75)
Northeast _{0.9x} 0.77	X	3.5	X	72.63	X	0.85	x	0.7	=	104.81	(75)
Northeast 0.9x 0.77	X	3.5	x	50.42	X	0.85	x	0.7	= [72.77	(75)
Northeast _{0.9x} 0.77	X	3.5	x	28.07	X	0.85	x	0.7	= [40.51	(75)
Northeast _{0.9x} 0.77	X	3.5	x	14.2	X	0.85	x	0.7	= [20.49	(75)
Northeast _{0.9x} 0.77	X	3.5	x	9.21	X	0.85	x	0.7	= [13.3	(75)
Southeast 0.9x 0.77	X	1.95	x	36.79	X	0.85	x	0.7	= [29.58	(77)
Southeast 0.9x 0.77	X	1.95	x	62.67	X	0.85	x	0.7	= [50.39	(77)
Southeast 0.9x 0.77	X	1.95	x	85.75	X	0.85	x	0.7	= [68.95	(77)
Southeast 0.9x 0.77	X	1.95	x	106.25	X	0.85	x	0.7	= [85.43	(77)
Southeast 0.9x 0.77	X	1.95	x	119.01	X	0.85	x	0.7	= [95.69	(77)
Southeast 0.9x 0.77	X	1.95	x	118.15	X	0.85	x	0.7	=	95	(77)
Southeast 0.9x 0.77	X	1.95	X	113.91	X	0.85	x	0.7	= [91.59	(77)
Southeast 0.9x 0.77	X	1.95	x	104.39	X	0.85	x	0.7	= [83.94	(77)
Southeast 0.9x 0.77	X	1.95	x	92.85	X	0.85	x [0.7	= [74.66	(77)
Southeast 0.9x 0.77	X	1.95	x	69.27	X	0.85	x	0.7	= [55.69	(77)
Southeast 0.9x 0.77	X	1.95	x	44.07	X	0.85	x	0.7	= [35.44	(77)
Southeast 0.9x 0.77	X	1.95	x	31.49	X	0.85	x	0.7	= [25.32	(77)
Southwest _{0.9x} 0.77	X	5.4	X	36.79]	0.85	x	0.7	= [81.93	(79)
Southwest _{0.9x} 0.77	X	5.4	x	62.67]	0.85	×	0.7	= [139.55	(79)
Southwest _{0.9x} 0.77	X	5.4	x	85.75]	0.85	×	0.7	= [190.94	(79)
Southwest _{0.9x} 0.77	X	5.4	X	106.25]	0.85	x	0.7	= [236.58	(79)
Southwest _{0.9x} 0.77	X	5.4	X	119.01]	0.85	x	0.7	=	264.99	(79)
Southwest _{0.9x} 0.77	X	5.4	X	118.15		0.85	x	0.7	= [263.07	(79)
Southwest _{0.9x} 0.77	X	5.4	X	113.91		0.85	X	0.7	=	253.63	(79)
Southwest _{0.9x} 0.77	X	5.4	X	104.39		0.85	x	0.7	=	232.44	(79)
Southwest _{0.9x} 0.77	X	5.4	X	92.85		0.85	x	0.7	=	206.74	(79)
Southwest _{0.9x} 0.77	X	5.4	X	69.27		0.85	X	0.7	=	154.23	(79)
Southwest _{0.9x} 0.77	X	5.4	X	44.07		0.85	x	0.7	= [98.13	(79)
Southwest _{0.9x} 0.77	X	5.4	X	31.49		0.85	x	0.7	=	70.11	(79)
Solar gains in watts, calcula	$\overline{}$		$\overline{}$	i		n = Sum(74)m .		1. 1			(55)
(83)m= 127.79 223.09 319.		$420.08 \mid 492.5^{\circ}$		98.62 476.7	421	.19 354.17	250.43	154.05	108.73		(83)
Total gains – internal and so		` 	<u> </u>	<u> </u>	050	7 504.00	E00.40	404.50	404 00		(0.4)
(84)m= 428.59 521.61 607.3	²⁵	690.62 745.9	/	35.26 702.68	652	2.7 594.62	508.18	431.58	401.02		(84)

7. Me	an inter	nal temp	perature	(heating	season)								
		during h		· ·		•	from Tal	ole 9, Th	1 (°C)				21	(85)
-		ctor for g	٠.			•			` ,			ļ		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.98	0.95	0.89	0.78	0.66	0.7	0.87	0.96	0.99	0.99		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	18.51	18.75	19.17	19.74	20.26	20.68	20.87	20.84	20.5	19.82	19.08	18.5		(87)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.07	19.08	19.09	19.12	19.13	19.16	19.16	19.17	19.15	19.13	19.12	19.1		(88)
Utilisa	ation fac	ctor for g	ains for	rest of d	welling,	h2,m (se	ee Table	9a)						
(89)m=	0.99	0.98	0.97	0.93	0.83	0.65	0.43	0.49	0.78	0.94	0.98	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to	7 in Tabl	e 9c)				
(90)m=	15.94	16.3	16.9	17.74	18.45	18.97	19.13	19.12	18.79	17.87	16.8	15.94		(90)
									f	LA = Livin	g area ÷ (4	1) =	0.55	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	17.35	17.65	18.15	18.84	19.45	19.92	20.09	20.07	19.73	18.95	18.06	17.35		(92)
Apply	adjustr	nent to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	17.2	17.5	18	18.69	19.3	19.77	19.94	19.92	19.58	18.8	17.91	17.2		(93)
•		iting requ												
		mean int factor fo		•		ed at st	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm):	-	I.			·		l			
(94)m=	0.99	0.98	0.96	0.92	0.84	0.7	0.54	0.59	0.81	0.94	0.98	0.99		(94)
		hmGm	` ` ` 											
(95)m=	423.02	509.69	581.99	633.85	626.35	516.71	378.57	385.12	479.28	476.75	422.54	396.74		(95)
		age exte	i -	i e		1	16.6	16.4	141	10.6	7.1	4.2		(96)
(96)m=	4.3	4.9 e for mea	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(90)
(97)m=		1676.94	r		974.49	646.85	418.3	438.37	693.1	1050.94	1400.52	1702.02		(97)
		g require						ļ						,
(98)m=	970.03	784.39	699.14	451.96	259.01	0	0	0	0	427.2	704.15	971.13		
								Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	5267	(98)
Space	e heatin	g require	ement in	kWh/m²	?/year								95.16	(99)
9a. En	erav red	quiremer	nts – Indi	ividual h	eating s	vstems i	ncludino	ı micro-C	CHP)					
	e heatii					,		,	,,,,					
Fracti	ion of sp	pace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	pace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								90.4	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heatin	g systen	ո, %						0	(208)
												'		

Sepace Nearing Feet Near Ne								
\$\frac{97.033}{104.39} \ \frac{98.14}{8.439} \ \frac{98.16}{8.99.16} \ \frac{9.99}{10.9} \ \frac{0}{0} \ \ \ 0 \		Jun Jul	Aug	Sep Oct	Nov	Dec	kWh/yea	ır
(211) (211) (1(98)m x (204)] x 100 + (208) (265.2 0 0 0 0 472.56 778.93 1074.28 (272)			т. т	<u> </u>	T			
Total No. No		0 0	0	0 427.2	704.15	971.13		
Space heating fuel (secondary), kWh/month				0 470.50	770.00	4074.00		(211)
Space heating fuel (secondary), kWh/month = #(198)m x (2011)] x 100 ± (208) (215)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1073.04 867.68 773.38 499.95 286.52	0 0					F006 00	7(211)
Cation	Space heating fuel (secondary), kW/h/month		rotar (i	Kvvii year) = earii(2 1 17 15,1012	2	5826.33	[(211)
Cation Color Cation Color Cation Cat								
Water heating Output from water heater (calculated above) 171.14 1 49.49 1 55.54 137.95 133.56 117.64 112.7 125.64 127.03 144.65 154.41 167.12 167.12 Efficiency of water heater (217)m 8.8.73 88.62 88.38 87.82 86.69 80.3 80.3 80.3 80.3 80.3 80.3 80.4 88.4 88.76 88.76 88.67 (217)m 88.73 88.62 88.38 87.82 86.69 80.3 80.3 80.3 80.3 80.3 80.3 80.3 80.4 88.4 88.76 188.28 88.7 (217)m 88.73 88.62 88.38 87.82 86.69 80.3 80.3 80.3 80.3 80.3 80.3 80.3 80.3		0 0	0	0 0	0	0		
Output from water heater (calculated above) 171.14 44.94 515.54 137.95 133.56 117.64 112.7 125.64 127.03 144.65 154.41 167.12 Efficiency of water heater		•	Total (kWh/year) =Sum(215),15,101	=	0	(215)
171.14 149.49 155.54 137.95 133.56 117.64 112.7 125.64 127.03 144.65 154.41 167.12	•							_
Efficiency of water heater (217)m= (217)m= (217)m= (218,73)		117.64 112.7	125.64	127 03 144 65	154.41	167 12		
Californ 88.73 88.62 88.38 87.82 86.69 90.3 80.3 80.3 80.3 87.61 88.4 88.76 (217) Fuel for water heating, kWh/month (219)m = (64)m x 100 + (217)m (219)m 192.88 168.7 175.99 157.09 154.07 146.5 140.35 156.46 158.19 165.1 174.67 188.28 (219) (219) (219)m 192.88 168.7 175.99 157.09 154.07 146.5 140.35 156.46 158.19 165.1 174.67 188.28 (219)		117.04 112.7	123.04	127.00	104.41	107.12	80.3	T(216)
Fuel for water heating, kWh/month (219)m = (64)m × 100 + (217)m (219)m = 192.88 168.7 175.99 157.09 154.07 146.5 140.35 156.46 158.19 165.1 174.67 188.28 Total = Sum(219a) =	· · · · · · · · · · · · · · · · · · ·	80.3 80.3	80.3	80.3 87.61	88.4	88.76]
1978.29	Fuel for water heating, kWh/month	l	1		ļ.			
Total = Sum(219a) 1978.29 (219)	` '	440.5	145040	450.40 405.4	174.07	400.00		
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump:	(219)m= 192.88 168.7 175.99 157.09 154.07	146.5 140.35				188.28	1070.00](240)
Space heating fuel used, main system 1 S826.33 1976.29	Annual totals		Total =			•](219)
Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Sum of (230a)(230g) =				.,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		-]
central heating pump: 30 (230c) boiler with a fan-assisted flue 45 (230e) Total electricity for the above, kWh/year sum of (230a)(230g) = 75 (231) Electricity for lighting 253.69 (232) Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 8133.3 (338) 12a. CO2 emissions – Individual heating systems including micro-CHP Energy kWh/year Emission factor kg CO2/kWh kg CO2/year Space heating (main system 1) (211) x 0.216 1258.49 (261) Space heating (secondary) (215) x 0.519 0 (263) Water heating (219) x 0.216 427.31 (264) Space and water heating (261) + (262) + (263) + (264) = 1685.8 (265) Electricity for pumps, fans and electric keep-hot (231) x 0.519 38.93 (267) Electricity for lighting (232) x 0.519 131.66 (268) Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate (272) ÷ (4) = 33.54 (273)	Water heating fuel used						1978.29	j
boiler with a fan-assisted flue	Electricity for pumps, fans and electric keep-hot							J
Total electricity for the above, kWh/year sum of (230a)(230g) = 75 (231) Electricity for lighting 253.69 (232) Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 8133.3 (338) 12a. CO2 emissions – Individual heating systems including micro-CHP Energy kWh/year kg CO2/kWh kg CO2/kWh kg CO2/kWh Space heating (main system 1) (211) × 0.216 = 1258.49 (261) Space heating (secondary) (215) × 0.519 = 0 (263) Water heating (219) × 0.216 = 427.31 (264) Space and water heating (261) + (262) + (263) + (264) = 1685.8 (265) Electricity for pumps, fans and electric keep-hot (231) × 0.519 = 38.93 (267) Electricity for lighting (232) × 0.519 = 131.66 (268) Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate	central heating pump:					30		(230c)
Electricity for lighting Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = State	boiler with a fan-assisted flue					45		(230e)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 8133.3 (338) 12a. CO2 emissions – Individual heating systems including micro-CHP Energy Emission factor kg CO2/kWh kg CO2/year	Total electricity for the above, kWh/year		sum of	f (230a)(230g) =	=		75	(231)
Energy Emission factor kWh/year kg CO2/kWh kg CO2/year	Electricity for lighting						253.69	(232)
Energy kWh/year Emission factor kg CO2/kWh Emissions kg CO2/year Space heating (main system 1) (211) x 0.216 = 1258.49 (261) Space heating (secondary) (215) x 0.519 = 0 (263) Water heating (219) x 0.216 = 427.31 (264) Space and water heating (261) + (262) + (263) + (264) = 1685.8 (265) Electricity for pumps, fans and electric keep-hot (231) x 0.519 = 38.93 (267) Electricity for lighting (232) x 0.519 = 131.66 (268) Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate (272) + (4) = 33.54 (273)	Total delivered energy for all uses (211)(221)	+ (231) + (232))(237b) =				8133.3	(338)
kWh/year kg CO2/kWh kg CO2/year Space heating (main system 1) (211) x 0.216 = 1258.49 (261) Space heating (secondary) (215) x 0.519 = 0 (263) Water heating (219) x 0.216 = 427.31 (264) Space and water heating (261) + (262) + (263) + (264) = = 1685.8 (265) Electricity for pumps, fans and electric keep-hot (231) x 0.519 = 38.93 (267) Electricity for lighting (232) x 0.519 = 131.66 (268) Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate (272) ÷ (4) = 33.54 (273)	12a. CO2 emissions – Individual heating system	ms including m	icro-CHP					
kWh/year kg CO2/kWh kg CO2/year Space heating (main system 1) (211) x 0.216 = 1258.49 (261) Space heating (secondary) (215) x 0.519 = 0 (263) Water heating (219) x 0.216 = 427.31 (264) Space and water heating (261) + (262) + (263) + (264) = 1685.8 (265) Electricity for pumps, fans and electric keep-hot (231) x 0.519 = 38.93 (267) Electricity for lighting (232) x 0.519 = 131.66 (268) Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate (272) ÷ (4) = 33.54 (273)		Energy		Emiss	sion fac	tor	Emissions	
Space heating (secondary) (215) x 0.519 = 0 (263) Water heating (219) x 0.216 = 427.31 (264) Space and water heating (261) + (262) + (263) + (264) = 1685.8 (265) Electricity for pumps, fans and electric keep-hot (231) x 0.519 = 38.93 (267) Electricity for lighting (232) x 0.519 = 131.66 (268) Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate (272) ÷ (4) = 33.54 (273)		kWh/yea	•	kg CO	2/kWh		kg CO2/yea	r
Water heating (219) x 0.216 = 427.31 (264) Space and water heating (261) + (262) + (263) + (264) = 1685.8 (265) Electricity for pumps, fans and electric keep-hot (231) x 0.519 = 38.93 (267) Electricity for lighting (232) x 0.519 = 131.66 (268) Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate (272) ÷ (4) = 33.54 (273)	Space heating (main system 1)	(211) x		0.2	16	=	1258.49	(261)
Space and water heating (261) + (262) + (263) + (264) = 1685.8 (265) Electricity for pumps, fans and electric keep-hot (231) x 0.519 = 38.93 (267) Electricity for lighting (232) x 0.519 = 131.66 (268) Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate (272) ÷ (4) = 33.54 (273)	Space heating (secondary)	(215) x		0.5	19	=	0	(263)
Electricity for pumps, fans and electric keep-hot (231) x	Water heating	(219) x		0.2	16	=	427.31	(264)
Electricity for lighting (232) x 0.519 = 131.66 (268) Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate (272) ÷ (4) = 33.54 (273)	Space and water heating	(261) + (262)	+ (263) + (26	64) =			1685.8	(265)
Total CO2, kg/year sum of (265)(271) = 1856.39 (272) Dwelling CO2 Emission Rate (272) ÷ (4) = 33.54 (273)	Electricity for pumps, fans and electric keep-hot	(231) x		0.5	19	=	38.93	(267)
Dwelling CO2 Emission Rate (272) ÷ (4) = 33.54 (273)	Electricity for lighting	(232) x		0.5	19	=	131.66	(268)
	Total CO2, kg/year			sum of (265)(271) =		1856.39	(272)
El rating (section 14)	Dwelling CO2 Emission Rate			$(272) \div (4) =$			22.54	(273)
				(= / - (- /			33.54	J(270)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50 Printed on 23 November 2021 at 13:24:57

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:**

Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.37m² Site Reference: 11-12 Grenville Street - LEAN

Plot Reference: Unit 6

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

Fuel factor: 1.00 (mains gas)

23.76 kg/m² Target Carbon Dioxide Emission Rate (TER)

Dwelling Carbon Dioxide Emission Rate (DER) 34.43 kg/m² Fail

Excess emissions = $10.67 \text{ kg/m}^2 (44.9 \%)$

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 56.2 kWh/m²

95.3 kWh/m² Dwelling Fabric Energy Efficiency (DFEE)

Excess energy = $39.11 \text{ kg/m}^2 (69.6 \%)$

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	3.73 (max. 2.00)	4.80 (max. 3.30)	Fail

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals 10.00 (design value)

Maximum **OK** 10.0

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Combi boiler

Efficiency 89.5 % SEDBUK2009

Minimum 88.0 % OK

Secondary heating system: None Fail

Regulations Compliance Report

5 Cylinder insulation							
Hot water Storage:	No cylinder						
6 Controls							
Space heating controls	Space heating controls TTZC by plumbing and electrical services						
Hot water controls:	No cylinder thermostat						
	No cylinder						
Boiler interlock:	Yes		OK				
7 Low energy lights							
Percentage of fixed lights wit	h low-energy fittings	100.0%					
Minimum		75.0%	OK				
8 Mechanical ventilation							
Not applicable							
9 Summertime temperature							
Overheating risk (Thames va	ılley):	Not significant	OK				
Based on:	•	-					
Overshading:		Average or unknown					
Windows facing: North East		5.19m²					
Ventilation rate:		8.00					
10 Key features							
Roofs U-value		0.1 W/m²K					
Party Walls U-value		0 W/m²K					

		Hee	er Details:						
A a a a a a a a a a Maria a a	Na il la ala ava	USE		- M	L		CTDO	040040	
Assessor Name: Software Name:	Neil Ingham Stroma FSAP 2012)	Stroma Softwa			010943 on: 1.0.5.50			
Contware reame.	Cuoma i Crai 2012		rty Address:		31011.		7 01010	71. 110.0.00	
Address :		·	•						
1. Overall dwelling dime	ensions:								
Ground floor		A	rea(m²)	(10) v		ight(m)	(2a) =	Volume(m ³	(3a)
	-\ . (4 l-\ . (4 -\ . (4 -l\ . (4 -\	. (4.5)		(1a) x	2	65	(2a) =	99.03	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	+(1n)	37.37	(4)	\	I) (O)	(0.)		_
Dwelling volume				(3a)+(3b))+(3c)+(3c	d)+(3e)+	.(3n) =	99.03	(5)
2. Ventilation rate:	main se	condary	other		total			m³ per hou	ır
Number of allipsychia	heating	eating		, _ c			40 =		_
Number of chimneys			0] = [0			0	(6a)
Number of open flues	0 +	0 +	0] = [0		20 =	0	(6b)
Number of intermittent fa				Ĺ	2		10 =	20	(7a)
Number of passive vents	;			L	0	X '	10 =	0	(7b)
Number of flueless gas fi	ires				0	X 4	40 =	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	vs_flues and fans = (6a)+(6b)+(7a)+(7b	o)+(7c) =	Г	20		÷ (5) =	0.2	(8)
	peen carried out or is intended			ontinue fr			. (0) –	0.2	(0)
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber fr resent, use the value corresp			•	ruction			0	(11)
deducting areas of openii		oriding to the g	realer wall are	a (aner					
If suspended wooden t	floor, enter 0.2 (unseale	ed) or 0.1 (se	ealed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
ŭ	s and doors draught str	ipped						0	(14)
Window infiltration			0.25 - [0.2		_			0	(15)
Infiltration rate			(8) + (10)	, , ,	, , ,	, ,		0	(16)
•	q50, expressed in cubi	•	•	•	etre of e	envelope	area	10	(17)
If based on air permeabil	lity Value, then (16) = I(17) es if a pressurisation test has				is boing u	sod		0.7	(18)
Number of sides sheltere		been done or a	degree all per	meability	is being u	seu		0	(19)
Shelter factor	-		(20) = 1 -	0.075 x (1	19)] =			1	(20)
Infiltration rate incorporat	ting shelter factor		(21) = (18)	x (20) =				0.7	(21)
Infiltration rate modified f	or monthly wind speed						'		
Jan Feb	Mar Apr May	Jun Ju	l 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 0.9	5 0.92	1	1.08	1.12	1.18]	
` '			1		L			J	

2-1-11-11-11	0.88	0.86	0.77	0.75	0.67	0.67	0.65	0.7	0.75	0.79	0.82		
	ctive air c	-	ate for t	he appli	cable ca	se		!					
If mechanical			ndiv N (2	3h) _ (23a) v Emy (c	auation (I	VEVV othor	rwico (22h) - (222)			0	(2
If balanced with) = (23a)			0	(2
		-	-	_					2h\ //	00k) r	4 (00.0)	0	(2
a) If balance	o mecha	o l	ntilation 0	with nea	at recove	ery (IVIVI	1R) (248	$\frac{1}{0} = \frac{2}{2}$	20)m + (<i>i</i>	230) x [$\frac{1 - (230)}{1}$	100j]	(2
b) If balance			-									J	(-
4b)m= 0	0	o 0	0	0	0	0	0	0	0	0	0	1	(2
c) If whole h			-						_			J	•
if (22b)m				•	•				5 × (23b)			
1c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(:
d) If natural		on or wh	ole hous	e positiv	re input v	ventilatio	on from I	oft	Į		ļ	J	
if (22b)m				•					0.5]			_	
4d)m= 0.9	0.88	0.87	8.0	0.78	0.72	0.72	0.71	0.75	0.78	0.81	0.84		(
Effective air	change	rate - en	ter (24a) or (24b	o) or (24d	c) or (24	d) in box	(25)				_	
5)m= 0.9	0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.75	0.78	0.81	0.84		(
. Heat losses	e and he	at loce r	aramete	or.									
		·			Not Am		اميدا		A V I I		المراجع الما	_	Λ V Ι.
LEMENT	Gros area	-	Openin m	_	Net Ar A ,n		U-valı W/m2		A X U (W/I	〈)	k-value kJ/m²-l		A X k kJ/K
oors		` '			2.59	x	1.6	=	4.144	, T			(:
indows					5.19	x1,	/[1/(4.8)+	0.04] =	20.9	=			(:
alls Type1	19.6	1	5.19		14.42	=	0.3		4.33	=		$\neg \vdash$	
alls Type2	10.1	=	2.59	_	7.54		0.22	<u> </u>	1.69	-		-	`
oof	37.3	=	0	=	37.33		0.1	<u> </u>	3.73	ન ¦		╡┝	<u> </u>
otal area of e					67.07	=	0.1		0.10				\` ;)
arty wall	,				22.79	=	0		0	— [(
arty Wall						=						╡	==
or windows and	roof winds	N/S 1/SA A	ffective wi	ndow I I-vs	37.33		ı formula 1	/[(1/ -valu	ر مدارمان	s aiven in	naragrant		(:
include the area						ated damig	i Torritula 1	/[(0)+0.0+j a	3 given in	paragrapi	1 3.2	
bric heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				34.79	(
nat capacity	Cm = S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	3063.6	(:
at capacity													=
	parame	ter (TMF	? = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(
nermal mass	•	•		,			ecisely the				able 1f	250	(
nermal mass r design assess n be used instea	· sments who ad of a det	ere the det	tails of the ılation.	construct	ion are not	known pr	ecisely the				able 1f	250	
nermal mass r design assess n be used instea nermal bridge	sments whe ad of a det es:S (L	ere the det tailed calcu x Y) calc	tails of the ulation. culated (construct	ion are not opendix k	known pr	recisely the				able 1f	10.06	
ermal mass r design assess n be used instea ermal bridge etails of therma	sments who ad of a det es:S(L al bridging a	ere the det tailed calcu x Y) calc	tails of the ulation. culated (construct	ion are not opendix k	known pr	recisely the	e indicative	values of		able 1f	10.06	(1
nermal mass or design assess on be used instead nermal bridge details of therma otal fabric hea	esments whe ad of a det es:S(L al bridging a at loss	ere the det tailed calcu x Y) calcu are not kno	tails of the ulation. culated u	constructiusing Ap	ion are not opendix k	known pr	recisely the	e indicative (33) +	(36) =	TMP in T			(1
nermal mass r design assess n be used instea nermal bridge details of therma otal fabric hea entilation hea	sments who ad of a det es: S (L al bridging a at loss ca	ere the del tailed calcu x Y) calcu are not kno	tails of the ulation. culated u own (36) = monthly	constructiusing Ap	ppendix k	t known pr	,	(33) + (38)m	(36) = = 0.33 × (TMP in T)	10.06	(1
nermal mass or design assess on be used instead nermal bridge details of thermal otal fabric head entilation head	ements who ad of a det es : S (L al bridging at loss at loss ca	ere the declarited calculated (x Y) calculated (Mar	tails of the ulation. culated u own (36) = monthly	constructs using Ap = 0.05 x (3	ppendix h	known pr	Aug	(33) + (38)m Sep	(36) = = 0.33 × (TMP in T 25)m x (5 Nov) Dec	10.06	()
nermal mass or design assess on be used instead nermal bridge details of thermal otal fabric hea entilation hea Jan 3)m= 29.43	ements who ad of a det es: S (L al bridging a at loss at loss ca Feb	ere the del tailed calcu x Y) calcu are not know alculated Mar 28.42	tails of the ulation. culated u own (36) = monthly	constructiusing Ap	ppendix k	t known pr	,	(33) + (38)m Sep 24.39	(36) = = 0.33 × (Oct 25.64	25)m x (5 Nov 26.53)	10.06	(;
nermal mass or design assess on be used instead nermal bridge details of thermal otal fabric head entilation head	ements who ad of a det es: S (L al bridging a at loss at loss ca Feb	ere the del tailed calcu x Y) calcu are not know alculated Mar 28.42	tails of the ulation. culated u own (36) = monthly	constructs using Ap = 0.05 x (3	ppendix h	known pr	Aug	(33) + (38)m Sep 24.39	(36) = = 0.33 × (25)m x (5 Nov 26.53) Dec	10.06	(;

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.99	1.97	1.96	1.9	1.89	1.83	1.83	1.82	1.85	1.89	1.91	1.93		
		· 		•	•	•	•	•	Average =	Sum(40) ₁ .	12 /12=	1.9	(40)
Number of day	<u> </u>	1 ·							0.1				
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. Water hea	ting ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occurring TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	o(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		34		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the α	lwelling is	designed t	,		se target o		.99		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								[F					
(44)m= 72.58	69.94	67.3	64.67	62.03	59.39	59.39	62.03	64.67	67.3	69.94	72.58		
										m(44) ₁₁₂ =	L	791.82	(44)
Energy content of	f hot water	used - cal	culated m	onthly = 4 .	190 x Vd,r	n x nm x D	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 107.64	94.14	97.15	84.69	81.27	70.13	64.98	74.57	75.46	87.94	95.99	104.24		—
If instantaneous v	vater heati	ina at point	of use (no	o hot water	r storage).	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	· [1038.2	(45)
(46)m= 16.15	14.12	14.57	12.7	12.19	10.52	9.75	11.19	11.32	13.19	14.4	15.64		(46)
Water storage		14.07	12.7	12.10	10.02	0.70	11.10	11.02	10.10	'	10.04		(12)
Storage volum	ne (litres) includir	ig any s	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	•			_			. ,						
Otherwise if no		hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufact		eclared l	nss fartí	or is kno	wn (k\/\/h	n/day).							(48)
Temperature f				01 10 1(110	WII (ICVVI	ı, aay).					0		(49)
Energy lost fro				ear			(48) x (49)) =			0		(50)
b) If manufact		_	-		or is not		(- / (- /	,			<u> </u>		(00)
Hot water stor	•			le 2 (kW	h/litre/da	ay)					0		(51)
If community he Volume factor	_		on 4.3										(50)
Temperature f			2b							—	0		(52) (53)
Energy lost fro				ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or		_	, 100011/y	oui			() // (0.))	<i>-</i>		0		(55)
Water storage	loss cal	culated t	or each	month			((56)m = ((55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	<u>I</u> m = (56)m	x [(50) – (<u>I</u> H11)] ÷ (5	0), else (5	<u>1</u> 7)m = (56)	m where (H11) is fro	m Appendi	хН	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	nual) fro	m Tahle	 e 3		•		•	•		0		(58)
Primary circuit	•	•			59)m = ((58) ÷ 36	65 × (41)	m					•
(modified by				,	•	. ,	, ,		r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Carebilean reladated f			(04)	(00) - 0	OF (44)	١							
Combi loss calculated f					- ` `		- I	24.00	24.0	T 24.40	1 20 00	1	(61)
(61)m= 36.99 32.19	34.3	31.89	31.61	29.29	30.26	31.6	!	31.89	34.3	34.49	36.99	(50) (04)	(01)
Total heat required for v						`	_			``	` ´ 	(59)m + (61)m 1	(60)
(62)m= 144.63 126.34	131.44	116.58	112.87	99.41	95.25	106.		107.35	122.24	130.49	141.23		(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)													
·	r				 	i 			_			1	(63)
(63)m= 0 0	0	0	0	0	0	0		0	0	0	0	l	(63)
Output from water heat		440.50	110.07	00.44	1 05 05	100	40	407.05	400.04	1 400 40	1 444 00	1	
(64)m= 144.63 126.34	131.44	116.58	112.87	99.41	95.25	106.		107.35	122.24	130.49	141.23	4.404.04	(64)
				_ ,						er (annual)		1434.01	(04)
Heat gains from water h	r					<u> </u>				1	· · · · ·	l] 1	(05)
(65)m= 45.04 39.35	40.88	36.13	34.92	30.64	29.17	32.		33.06	37.81	40.54	43.91		(65)
include (57)m in calcu	ulation o	of (65)m	only if c	ylinder	is in the o	dwelli	ing (or hot w	ater is f	rom com	munity h	neating	
5. Internal gains (see	Table 5	and 5a)):										
Metabolic gains (Table	5), Watt	S										,	
Jan Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(66)m= 66.92 66.92	66.92	66.92	66.92	66.92	66.92	66.9	92	66.92	66.92	66.92	66.92		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m= 10.75 9.54	7.76	5.88	4.39	3.71	4.01	5.2	:1	6.99	8.88	10.36	11.04		(67)
Appliances gains (calcu	ılated in	Append	dix L, eq	uation L	.13 or L1	3a), a	also	see Tal	ble 5	-	-		
(68)m= 114.98 116.17	113.17	106.77	98.69	91.09	86.02	84.8	83	87.83	94.23	102.31	109.91		(68)
Cooking gains (calculat	ed in Ap	pendix	L, equat	ion L15	or L15a), also	o se	e Table	5	•	•	•	
(69)m= 29.69 29.69	29.69	29.69	29.69	29.69	29.69	29.6	69	29.69	29.69	29.69	29.69]	(69)
Pumps and fans gains ((Table 5	a)			•					•	•	•	
(70)m= 3 3	3	3	3	3	3	3	Ì	3	3	3	3]	(70)
Losses e.g. evaporation	n (negati	ive valu	es) (Tab	le 5)		!	!					1	
(71)m= -53.53 -53.53	-53.53	-53.53	-53.53	-53.53	-53.53	-53.	53	-53.53	-53.53	-53.53	-53.53]	(71)
Water heating gains (Ta	able 5)				!						<u>!</u>	ı	
(72)m= 60.53 58.56	54.94	50.19	46.94	42.55	39.21	43.9	95	45.92	50.83	56.31	59.02	1	(72)
Total internal gains =					<u> </u>	<u> </u>					<u> </u>	ı	
(73)m= 232.33 230.35	221.94	208.9	196.09	183.43	175.31	180.	<u> </u>	186.82	200.01	215.06	226.04]	(73)
6. Solar gains:													
Solar gains are calculated u	ısing solar	flux from	Table 6a	and assoc	ciated equa	tions t	to coi	nvert to th	e applica	ble orienta	tion.		
Orientation: Access Fa	actor	Area		Flu	ıx			g_		FF		Gains	
Table 6d		m²		Ta	ble 6a		Ta	able 6b	7	able 6c		(W)	
Northeast 0.9x 0.77	x	5.1	9	х	11.28	x		0.85	x [0.7	=	24.15	(75)
Northeast 0.9x 0.77	x	5.1	9		22.97	X		0.85	x	0.7	= =	49.15	(75)
Northeast 0.9x 0.77	X	5.1		-	41.38	X		0.85	x	0.7	=	88.55	(75)
Northeast 0.9x 0.77	x	5.1			67.96) x		0.85	x	0.7	-	145.43	(75)
Northeast 0.9x 0.77	X	5.1	==	-	91.35	X		0.85	x [0.7	╡ -	195.48	(75)
5.17				<u> </u>		ı L		0.00		J.,		100.70	」` ⁻′

Northeast _{0.9x}	0.77	Х	5.1	9	x	9	7.38	x		0.85	x [0.7	=	208.4	(75)
Northeast _{0.9x}	0.77	X	5.1	9	x	9	91.1	X		0.85	x [0.7	=	194.96	(75)
Northeast _{0.9x}	0.77	X	5.1	9	x	7	2.63	x		0.85	x	0.7	=	155.42	(75)
Northeast _{0.9x}	0.77	х	5.1	9	x	5	0.42	x		0.85	x [0.7	=	107.9	(75)
Northeast _{0.9x}	0.77	X	5.1	9	x	2	8.07	х		0.85	x	0.7	=	60.06	(75)
Northeast _{0.9x}	0.77	X	5.1	9	x	1	14.2	x		0.85	x	0.7	=	30.38	(75)
Northeast _{0.9x}	0.77	X	5.1	9	x	9	9.21	x		0.85	x	0.7	=	19.72	(75)
Solar gains in w	atts, ca	lculated	for eacl	n month				(83)m	n = Si	um(74)m .	(82)m				
(83)m= 24.15	49.15	88.55	145.43	195.48		08.4	194.96	155	.42	107.9	60.06	30.38	19.72		(83)
Total gains – int			` 		<u>`</u>							,			
(84)m= 256.48	279.5	310.49	354.33	391.58	39	1.83	370.27	335	.48	294.72	260.07	245.44	245.76		(84)
7. Mean interna	al temp	erature ((heating	season)										
Temperature d	luring he	eating p	eriods ir	the livii	ng a	area f	rom Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisation factor	or for ga	ins for I	iving are	a, h1,m	(se	е Та	ble 9a)							1	_
Jan	Feb	Mar	Apr	May	ļ	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.99	0.97	0.92	0	.82	0.69	0.7	75	0.92	0.98	0.99	1		(86)
Mean internal	tempera	ature in I	iving are	ea T1 (fo	ollo	w ste	ps 3 to 7	7 in T	able	e 9c)					
(87)m= 18.85	19.01	19.35	19.86	20.35	20	0.74	20.9	20.	86	20.54	19.94	19.35	18.87		(87)
Temperature d	lurina he	eating p	eriods ir	rest of	dwe	ellina	from Ta	hle 9	 9 Th	n2 (°C)		•			
(88)m= 19.34	19.35	19.36	19.4	19.41	r —	9.45	19.45	19.		19.43	19.41	19.39	19.38		(88)
· · · <u> </u>	or for an	ing for r	oot of di	allina	L		a Tabla	00/				<u> </u>	<u> </u>		
Utilisation factors (89)m= 0.99	0.99	0.98	0.96	0.88		.71	0.5	9a) 0.5	57	0.86	0.97	0.99	1		(89)
` '												0.00			(00)
Mean internal		T			Ť	·		r i				1 47.04	40.00		(00)
(90)m= 16.59	16.83	17.32	18.09	18.77	18	9.27	19.41	19	.4	19.05	18.21	17.34	16.63		(90)
										Į.	LA = LIVII	ng area ÷ (4	+) =	0.86	(91)
Mean internal t	 				T T			-	$\overline{}$,			
(92)m= 18.53	18.7	19.06	19.61	20.13		0.53	20.69	20.		20.33	19.7	19.07	18.55		(92)
Apply adjustme					_			T				1 40 00	40.4		(02)
(93)m= 18.38	18.55	18.91	19.46	19.98	20	0.38	20.54	20.	51	20.18	19.55	18.92	18.4		(93)
8. Space heati			on orotur	o obtoin	مط	ot ot	n 11 of	Tobl	ام ۸	oo tha	t Tim	(76)m on	d ro colo	uloto	
Set Ti to the m the utilisation fa					ieu	ai Sie	з р птог	rabi	ie st), so ma	t 11,ff1=	(76)III an	u re-caic	sulate	
Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
Utilisation factor	or for ga	ins, hm	:	-	!										
(94)m= 0.99	0.99	0.98	0.96	0.9	0	.78	0.64	0.	7	0.89	0.97	0.99	0.99		(94)
Useful gains, h	mGm ,	W = (94)m x (84	4)m											
(95)m= 254.68	276.72	304.92	339.58	352.48	30	6.84	238.31	236	.23	262.95	252.77	242.88	244.3		(95)
Monthly average					_										
(96)m= 4.3	4.9	6.5	8.9	11.7	<u> </u>	4.6	16.6	16		14.1	10.6	7.1	4.2		(96)
Heat loss rate					_			- `		· <i>′</i>		1 040 ::	4000 55		(07)
(97)m= 1046.09		909.31	749.26	583.46		5.87	269.79	279		421.01	630.78	843.41	1026.93		(97)
Space heating (98)m= 588.81	require 490.92	449.67	294.97	171.85	/vn/	mont 0	h = 0.02	24 x [om – (95))m] x (4 281.24	432.38	582.28		
(30)111= 300.01	- 730.9∠	448.07	234.31	171.65	<u> </u>	U	U	Щ	<u>'</u>	U	201.24	432.30	302.20		

	Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	3292.12	(98)
Space heating requirement in kWh/m²/year						88.1	(99)
a. Energy requirements – Individual heating systems including	micro-C	CHP)					
Space heating:					г		٦,,,,,
Fraction of space heat from secondary/supplementary system	(000)	(004)			Ļ	0	(201)
Tradition of opado float from main dystom(b)	(202) = 1 -	` '			Ĺ	1	(202)
Fraction of total heating from main system 1	1	(204)					
Efficiency of main space heating system 1	Ĺ	90.4	(206)				
Efficiency of secondary/supplementary heating system, %	0	(208)					
Jan Feb Mar Apr May Jun Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement (calculated above)							
588.81 490.92 449.67 294.97 171.85 0 0	0	0	281.24	432.38	582.28		
211)m = {[(98)m x (204)] } x 100 ÷ (206)		ı	ı	ı			(211)
651.34 543.06 497.42 326.29 190.1 0 0	0	0	311.11	478.29	644.11		_
	Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	F	3641.72	(211)
Space heating fuel (secondary), kWh/month							
= {[(98)m x (201)] } x 100 ÷ (208)	_						
215)m= 0 0 0 0 0 0 0	0 Tata	0	0	0	0		7,
	Tota	l (kWh/yea	ar) =Surri(2	215) _{15,1012}	Ē	0	(215)
Water heating							
Output from water heater (calculated above) 144.63 126.34 131.44 116.58 112.87 99.41 95.25	106.18	107.35	122.24	130.49	141.23		
Efficiency of water heater					 	80.3	(216)
217)m= 88.21 88.13 87.9 87.29 86.11 80.3 80.3	80.3	80.3	87.08	87.84	88.23		 (217)
Fuel for water heating, kWh/month							
(219) m = (64) m x $(100 \div (217)$ m (219) m = $(63.95 \ 143.35 \ 149.54 \ 133.56 \ 131.09 \ 123.8 \ 118.61 \ 133.56 \ 131.09 \ 123.8 \ 118.61 \ 133.56 \ 131.09 \ 123.8 \ 133.56 \ 131.09 \ 123.8 \ 133.56 \$	132.22	133.69	140.37	148.55	160.06		
10.00 110.00 110.01	_	I = Sum(2		1 10.00	100.00	1678.8	(219)
Annual totals		•		Wh/year	. L	kWh/yeaı	┙゛
Space heating fuel used, main system 1			••	, ou.	Γ	3641.72	7
Nater heating fuel used					Ė	1678.8	₹
Electricity for pumps, fans and electric keep-hot					L		_
central heating pump:					30		(2300
boiler with a fan-assisted flue					45		(230
Total electricity for the above, kWh/year	sum	of (230a).	(230g) =			75	(231)
Electricity for lighting						189.76	(232)
Total delivered energy for all uses (211)(221) + (231) + (232)	5585.29	(338)					

Energy kWh/year **Emissions**

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.216	=	786.61	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	362.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1149.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	98.49	(268)
Total CO2, kg/year	sum	of (265)(271) =		1286.65	(272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =		34.43	(273)
El rating (section 14)				79	(274)