

_				_		_		_				
Southwest _{0.9x}	0.77	X	8.12	X	92.85		0.76	X	0.7	=	277.97	(79)
Southwest _{0.9x}	0.77	X	3.42	X	92.85		0.76	X	0.7	=	117.07	(79)
Southwest _{0.9x}	0.77	X	5.31	X	69.27		0.76	X	0.7	=	135.6	(79)
Southwest _{0.9x}	0.77	X	8.12	X	69.27		0.76	X	0.7	=	207.36	(79)
Southwest _{0.9x}	0.77	X	3.42	X	69.27		0.76	x	0.7	=	87.34	(79)
Southwest _{0.9x}	0.77	X	5.31	X	44.07		0.76	x	0.7	=	86.28	(79)
Southwest _{0.9x}	0.77	X	8.12	X	44.07		0.76	x	0.7	=	131.93	(79)
Southwest _{0.9x}	0.77	X	3.42	X	44.07		0.76	x	0.7	=	55.57	(79)
Southwest _{0.9x}	0.77	X	5.31	X	31.49		0.76	x	0.7	=	61.64	(79)
Southwest _{0.9x}	0.77	X	8.12	X	31.49]	0.76	x	0.7	=	94.26	(79)
Southwest _{0.9x}	0.77	X	3.42	X	31.49		0.76	x	0.7	=	39.7	(79)
Northwest 0.9x	0.77	X	0.69	X	11.28	x	0.76	x	0.7	=	2.87	(81)
Northwest 0.9x	0.77	X	1.27	X	11.28	X	0.76	x	0.7	=	5.28	(81)
Northwest 0.9x	0.77	X	0.69	X	22.97	X	0.76	x	0.7	=	5.84	(81)
Northwest 0.9x	0.77	X	1.27	X	22.97	x	0.76	x	0.7	=	10.75	(81)
Northwest 0.9x	0.77	X	0.69	X	41.38	x	0.76	x	0.7	=	10.53	(81)
Northwest 0.9x	0.77	X	1.27	X	41.38	X	0.76	X	0.7	=	19.37	(81)
Northwest 0.9x	0.77	X	0.69	X	67.96	X	0.76	X	0.7	=	17.29	(81)
Northwest 0.9x	0.77	X	1.27	X	67.96	X	0.76	X	0.7	=	31.82	(81)
Northwest 0.9x	0.77	X	0.69	X	91.35	X	0.76	X	0.7	=	23.24	(81)
Northwest 0.9x	0.77	X	1.27	X	91.35	X	0.76	x	0.7	=	42.77	(81)
Northwest 0.9x	0.77	X	0.69	X	97.38	X	0.76	X	0.7	=	24.77	(81)
Northwest 0.9x	0.77	X	1.27	X	97.38	X	0.76	X	0.7	=	45.6	(81)
Northwest _{0.9x}	0.77	X	0.69	X	91.1	X	0.76	X	0.7	=	23.17	(81)
Northwest 0.9x	0.77	X	1.27	X	91.1	X	0.76	X	0.7	=	42.66	(81)
Northwest 0.9x	0.77	X	0.69	X	72.63	X	0.76	X	0.7	=	18.48	(81)
Northwest 0.9x	0.77	X	1.27	X	72.63	x	0.76	x	0.7	=	34.01	(81)
Northwest 0.9x	0.77	X	0.69	X	50.42	x	0.76	x	0.7	=	12.83	(81)
Northwest 0.9x	0.77	X	1.27	X	50.42	X	0.76	X	0.7	=	23.61	(81)
Northwest 0.9x	0.77	X	0.69	X	28.07	X	0.76	X	0.7	=	7.14	(81)
Northwest 0.9x	0.77	X	1.27	X	28.07	X	0.76	X	0.7	=	13.14	(81)
Northwest 0.9x	0.77	X	0.69	X	14.2	X	0.76	X	0.7	=	3.61	(81)
Northwest 0.9x	0.77	X	1.27	X	14.2	X	0.76	X	0.7	=	6.65	(81)
Northwest 0.9x	0.77	X	0.69	X	9.21	X	0.76	X	0.7	=	2.34	(81)
Northwest 0.9x	0.77	X	1.27	X	9.21	X	0.76	X	0.7	=	4.31	(81)
Rooflights _{0.9x}	1	x	12.74	X	20.24	x	0.76	x	0.7	=	123.44	(82)
Rooflights _{0.9x}	1	x	12.74	X	40.55	x	0.76	x	0.7	=	247.33	(82)
Rooflights _{0.9x}	1	x	12.74	X	74.78	x	0.76	x	0.7	=	456.16	(82)
Rooflights _{0.9x}	1	X	12.74	X	130.19	x	0.76	x	0.7] = [794.13	(82)
Rooflights _{0.9x}	1	X	12.74	X	183.82	x	0.76	x	0.7] =	1121.29	(82)
Rooflights 0.9x	1	X	12.74	×	200.21	x	0.76	X	0.7	=	1221.24	(82)



Rooflights 0.9x	1	X	12.	74	x	185.57)	x	0.76	x	0.7	=	1131.99	(82)
Rooflights 0.9x	1	х	12.	74	x	142.19	×	x	0.76	x	0.7	=	867.36	(82)
Rooflights 0.9x	1	X	12.	74	x	93.09	X	x	0.76	x	0.7	=	567.83	(82)
Rooflights 0.9x	1	X	12.	74	x	49.71	×	x	0.76	_ x [0.7	=	303.23	(82)
Rooflights 0.9x	1	x	12.	74	x	25.27	<u> </u>	x	0.76	x	0.7	_ =	154.14	(82)
Rooflights 0.9x	1	x	12.	74	x	16.69	<u> </u>	x =	0.76	_ x [0.7	-	101.83	(82)
Solar gains in	n watts, c	alculated	for eac	h month			(83	3)m = S	um(74)m .	(82)m				
(83)m= 402.26	738.95	1173.16	1756.84	2267.43	23	88.92 2245.3	34 18	839.3	1369.2	858.54	491.14	338.48		(83)
Total gains –	internal a	and solar	(84)m =	(73)m ·	+ (8	33)m , watts	<u> </u>					•		
(84)m= 898.65	1233.08	1649.76	2204.81	2685.2	27	77.82 2616.2	22 22	217.48	1762.8	1281	946.82	819.7		(84)
7. Mean inte	ernal temi	perature	(heating	season)	-								
Temperatur			`			area from T	able	9, Th	1 (°C)				21	(85)
Utilisation fa	•	•			•			,	,					
Jan	Feb	Mar	Apr	May	È	Jun Jul		Aug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.94	0.78	0.55	\vdash	0.38 0.28	-	0.34	0.62	0.93	0.99	1	=	(86)
						4 0 4-			- 0-\				_	
Mean intern	 	20.44	20.82	20.97	DIIO		0 / IN	21	e 9c) 20.97	20.64	20.09	10.60	¬	(87)
(87)m= 19.75	20.03	20.44	20.62	20.97		21 21		21	20.97	20.04	20.09	19.68		(07)
Temperatur					_	_ 	$\overline{}$						_	
(88)m= 19.92	19.92	19.92	19.92	19.92	1	9.92 19.92	2 1	19.92	19.92	19.92	19.92	19.92		(88)
Utilisation fa	actor for g	ains for	rest of d	welling,	h2,	m (see Tab	ole 9a	a)						
(89)m= 1	0.98	0.93	0.74	0.49	(0.21	(0.26	0.53	0.9	0.99	1		(89)
Mean intern	al temper	ature in	the rest	of dwelli	na	T2 (follow s	steps	3 to 7	7 in Tabl	e 9c)	•		_	
(90)m= 18.26		19.25	19.74	19.9	~	9.92 19.92	- i-	19.92	19.9	19.54	18.76	18.17	7	(90)
` '	-!								f	LA = Livir	ng area ÷ (4	4) =	0.47	(91)
M = = = := t = ===	-1.4	 /£ .	41	-11		\	-4 . /	/A £1	A) TO					
Mean intern (92)m= 18.96		19.8	20.25	20.4		$0.42 \boxed{20.42}$		(I — IL 20.42	20.4	20.05	19.38	18.88	7	(92)
Apply adjus											19.30	10.00		(02)
(93)m= 18.81	1	19.65	20.1	20.25	_	0.27 20.27		20.27	20.25	19.9	19.23	18.73	٦	(93)
8. Space he		<u> </u>		20.20		5.2. 25.2.			20.20	10.0	.0.20	10110		
Set Ti to the				re obtain	ed	at step 11	of Ta	able 9t	so tha	t Ti m=(76)m an	d re-ca	lculate	
the utilisatio						стор			-,	, (,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
Jan	Feb	Mar	Apr	May		Jun Jul		Aug	Sep	Oct	Nov	Dec		
Utilisation fa	ctor for g	ains, hm):			•							_	
(94)m= 0.99	0.98	0.92	0.75	0.51	(0.23	(0.29	0.56	0.89	0.99	1		(94)
Usefu <u>l gains</u>	s, hmGm	, W = (94	4)m x (84	4)m									_	
(95)m= 893.85	1207.06	1518.76	1648.78	1377.24	93	30.22 604.2	25 63	36.36	981.52	1145.9	933.54	816.78	<u>:</u>	(95)
Monthly ave		1	·		_		_				1		_	
(96)m= 4.3	4.9	6.5	8.9	11.7		4.6 16.6		16.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	_				_			` ,			T	I	╗	(0=)
(97)m= 2386.5		ļ		<u> </u>		33.26 604.6	!	537.4	1011.36		1995.68	2389.9	4	(97)
Space heati				ſ	/Vh		.024	-\	`	- `		42== -	ิ	
(98)m= 1110.5	7 765.21	480.07	139.29	21.77		0 0		0	0	286.42	764.74	1170.4	3	



Total per year (kWh/year) = Sum(98) _{15,912} =	4738.49	(98)
Space heating requirement in kWh/m²/year	34.4	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		7(204)
Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) (202) = 1 - (201) =	0	(201)
Tradition of space float from main system(s)	1	(202)
Tradition of total floating from main ejection i	1	(204)
Efficiency of main space heating system 1	90.4	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating requirement (calculated above)	kWh/ye	ear
1110.57 765.21 480.07 139.29 21.77 0 0 0 0 286.42 764.74 1170.43		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)		(211)
1228.51 846.47 531.05 154.08 24.08 0 0 0 316.83 845.95 1294.72		, ,
Total (kWh/year) =Sum(211) _{15,1012} =	5241.69	(211)
Space heating fuel (secondary), kWh/month		_
= {[(98)m x (201)]} x 100 ÷ (208)		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 Total (kWh/year) =Sum(215) _{1,5,10,12} =		7(245)
Water heating	0	(215)
Output from water heater (calculated above)		
104.58 99.17 118.04 121.45 126.71 114.83 113.39 123.89 124.11 120.6 105.94 100.63		
Efficiency of water heater	80.3	(216)
(217)m= 89.43 89.11 88.21 85.4 81.64 80.3 80.3 80.3 87.15 89.04 89.51		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m		
(219)m= 116.94 111.28 133.82 142.22 155.21 143.01 141.2 154.29 154.55 138.38 118.99 112.42		
Total = Sum(219a) _{1_12} =	1622.31	(219)
Annual totals kWh/year	kWh/yea	 r
Space heating fuel used, main system 1	5241.69	╛
Water heating fuel used	1622.31	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside 139.75		(230a)
central heating pump:		(230c)
boiler with a fan-assisted flue		(230e)
Total electricity for the above, kWh/year sum of (230a)(230g) =	214.75	(231)
Electricity for lighting	483.11	(232)
Electricity generated by PVs	-690.9	(233)
12a. CO2 emissions – Individual heating systems including micro-CHP		



	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	1132.21 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216 =	350.42 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1482.62 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	111.46 (267)
Electricity for lighting	(232) x	0.519 =	250.74 (268)
Energy saving/generation technologies			
Item 1		0.519	-358.57 (269)
Total CO2, kg/year	sum	of (265)(271) =	1486.24 (272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	10.79 (273)
El rating (section 14)			89 (274)



User Details: STRO007945 **Assessor Name:** Peter Mitchell Stroma Number: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.5 **Software Name:** Property Address: Unit 1 (GF&FF END) LEAN New Dwelling at:, Gordon House, 6 Lissenden Gardens, LONDON, NW5 1LX Address: 1. Overall dwelling dimensions: Volume(m³) Area(m²) Av. Height(m) Ground floor 73.62 (1a) x 2.4 (2a) =176.69 (3a) First floor (1b) x (2b) =(3b) 64.14 3.32 212.94 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)137.76 (4) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n)(5) 389.63 2. Ventilation rate: main secondary other total m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 0 0 0 x 20 =Number of open flues 0 0 0 0 0 (6b) Number of intermittent fans x 10 =(7a)2 20 Number of passive vents x 10 =(7b) 0 0 Number of flueless gas fires x 40 =(7c)n 0 Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = \div (5) = 0.05 (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) (9)0 Additional infiltration [(9)-1]x0.1 =(10)0 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 (12)0 If no draught lobby, enter 0.05, else enter 0 0 (13)Percentage of windows and doors draught stripped (14)0 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 (17)4 If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise (18) = (16)0.25 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)Shelter factor $(20) = 1 - [0.075 \times (19)] =$ 0.78 (20) $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.19

IIIIIIIIIII	ion rate	modifie	101 1110	iluliy wii	id speec									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthl	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		

Infiltration rate modified for monthly wind speed



Wind Factor (22a)m = (22)m	÷ 4								
(22a)m= 1.27 1.25 1.23	1.1 1.08	0.95	0.95 0.92	1	1.08	1.12	1.18		
Adjusted infiltration rate (allo	wing for shelter a	nd wind sn	need) = (21a) x	(22a)m	•		!		
0.25 0.24 0.24	0.21 0.21	0.19	0.19 0.18	0.19	0.21	0.22	0.23		
Calculate effective air chang	I I	1 1			<u> </u>				
If mechanical ventilation:								0	(23a)
If exhaust air heat pump using Ap					o) = (23a)			0	(23b)
If balanced with heat recovery: et					OL)	001.) [4 (00)	0	(23c)
a) If balanced mechanical (24a)m= 0 0 0	ventilation with h	eat recover	$\frac{\text{ry (MVHR) (24)}}{0}$	$\frac{a)m = (2)}{1}$	2b)m + (23b) × [1 – (23c)	÷ 100] 	(24a)
b) If balanced mechanical				•			"		(214)
(24b)m =		0		0	0	0	0		(24b)
c) If whole house extract v									,
if (22b)m < 0.5 × (23b)	•	•			.5 × (23b	o)			
(24c)m= 0 0 0	0 0	0	0 0	0	0	0	0		(24c)
d) If natural ventilation or v					•		•	•	
if (22b)m = 1, then (24	´ı ` ı´ 	- `-		- 		l	T	1	(0.4.1)
(24d)m= 0.53 0.53 0.53	0.52 0.52	0.52	0.52 0.52	0.52	0.52	0.52	0.53		(24d)
Effective air change rate -		- 	<u> </u>	1 	0.50	0.50	0.50	1	(25)
(25)m= 0.53 0.53 0.53	0.52 0.52	0.52	0.52 0.52	0.52	0.52	0.52	0.53		(23)
3. Heat losses and heat los	•								
3. Heat losses and heat loss ELEMENT Gross area (m²)	o parameter: Openings m²	Net Are A ,m			A X U (W/l	K)	k-value kJ/m²·l		A X k kJ/K
ELEMENT Gross	Openings			2K		K)			
ELEMENT Gross area (m²)	Openings	A ,m ²	n² W/m²	2K + 0.04] =	(W/I	K)			kJ/K
ELEMENT Gross area (m²) Windows Type 1	Openings	A ,m ²	1 ² W/m ² x1/[1/(1.4)-	2K + 0.04] = + 0.04] =	(W/l	K)			kJ/K (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2	Openings	5.31 8.12	x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] = + 0.04] =	7.04 10.77 3.35	K)			kJ/K (27) (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2 Windows Type 3	Openings	A ,m ² 5.31 8.12 2.53	x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] = + 0.04] = + 0.04] =	7.04 10.77 3.35	K)			(27) (27) (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4	Openings	A ,m ² 5.31 8.12 2.53 2.53	x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] = + 0.04] = + 0.04] =	7.04 10.77 3.35 3.35	K)			kJ/K (27) (27) (27) (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5	Openings	A ,m ² 5.31 8.12 2.53 2.53 2.53	x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] = + 0.04] = + 0.04] = + 0.04] =	7.04 10.77 3.35 3.35 3.35	K)			kJ/K (27) (27) (27) (27) (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6	Openings	A ,m ² 5.31 8.12 2.53 2.53 2.53 2.53	x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] = + 0.04] = + 0.04] = + 0.04] = + 0.04] = + 0.04] =	7.04 10.77 3.35 3.35 3.35 3.35	K)			kJ/K (27) (27) (27) (27) (27) (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7	Openings	A ,m ² 5.31 8.12 2.53 2.53 2.53 2.53 0.69	x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91	K)			(27) (27) (27) (27) (27) (27) (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8	Openings	A ,m ² 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27	x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9	Openings	A ,m ² 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42	x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Rooflights	Openings m²	A ,m ² 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42 12.74	x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] = - 0.04] =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Gross area (m²) Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Rooflights Walls	Openings m²	A ,m ² 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42 118.27	x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)- x1/[1/(1.4)-	2K + 0.04] = + 0.04] = - 0.04] = = = = =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53 17.836 18.92				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Rooflights Walls 147.2 Roof Type 1 Windows area (m²)	Openings m²	A ,m ² 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42 118.27 9.48	x1/[1/(1.4)- x1/[1	2K + 0.04] = + 0.04] = - 0.04] = = = = =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53 17.836 18.92				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Rooflights Walls 147.2 Roof Type1 9.48 Roof Type2 7 Roofs Type2 1 Roof Type2 Roofs Type 1 9.48 Roof Type2 71.67	Openings m²	A ,m ² 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42 12.74 118.27 9.48 58.93	x1/[1/(1.4)- x1/[1	2K + 0.04] = + 0.04] = - 0.04] = = = = =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53 17.836 18.92				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Rooflights Walls 147.2 Roof Type1 9.48 Roof Type2 71.67 Total area of elements, m²	Openings m²	A ,m ² 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42 12.74 118.27 9.48 58.93 228.35	x1/[1/(1.4)- x1/[1	2K + 0.04] = + 0.04] = - 0.04] = = = = = =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53 17.836 18.92 1.33				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)

(26)...(30) + (32) =

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U)

83.74

(33)



Heat capacity $Cm = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) =(34)0 Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium (35)250 For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges: S (L x Y) calculated using Appendix K (36)16.5 if details of thermal bridging are not known (36) = $0.15 \times (31)$ Total fabric heat loss (33) + (36) =100.24 (37)Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Feb Jan Mar Apr May Jun Jul Aug Sep Oct Nov Dec 68.25 68.1 67.95 67.24 67.11 66.49 66.49 66.38 66.73 67.11 67.38 67.66 (38)(38)m =Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =168.49 168.34 168.19 167.48 167.35 166.73 166.73 166.62 166.97 167.35 167.62 167.9 (39)Average = $Sum(39)_{1...12}/12=$ 167.48 Heat loss parameter (HLP), W/m2K (40)m = (39)m ÷ (4)(40)m=1.22 1.21 1.21 1.21 1.21 1.21 1.21 1.22 1.22 (40)Average = Sum(40)_{1...12} /12= 1.22 Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (41)(41)m=31 28 31 30 31 30 31 31 30 31 30 31 4. Water heating energy requirement: kWh/year: Assumed occupancy, N (42)2.91 if TFA > 13.9, N = 1 + 1.76 x [1 - $\exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 (43)103.38 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Feb May Oct Jan Mar Apr Jun Jul. Aug Sep Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) 113.71 109.58 101.31 113.71 (44)m=105.44 101.31 97.17 93.04 93.04 97.17 105.44 109.58 (44)Total = $Sum(44)_{1...12}$ = 1240.52 Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) 147.49 (45)m =168.63 152.2 132.69 127.32 109.86 101.81 116.82 118.22 137.77 150.39 163.31 (45)Total = $Sum(45)_{1...12}$ = 1626.52 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 25.3 22.12 22.83 20.67 22.56 24.5 (46)(46)m =199 19 1 16 48 15.27 17 52 17.73 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel (47)0 If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): (48)0 Temperature factor from Table 2b 0 (49)Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0 b) If manufacturer's declared cylinder loss factor is not known:



Hot wa	iter stor	age loss	factor fr	om Tabl	le 2 (kW	h/litre/da	ıy)					0	(51)	
	-	neating s		on 4.3										
		from Ta										0	(52)	
•		actor fro										0	(53)	
			_	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0	(54)	
	. ,	(54) in (5	•									0	(55)	
Water	storage	loss cal	culated t	for each	month			((56)m = (55) × (41)	m 				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)	
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)	
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0	(58)	
	-	•	•			59)m = ((58) ÷ 36	65 × (41)	m					
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)	
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	50.96	46.03	50.96	49.32	49.52	45.88	47.41	49.52	49.32	50.96	49.32	50.96	(61)	
Total h	eat red	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	219.59	193.52	203.15	182	176.84	155.75	149.22	166.34	167.53	188.73	199.71	214.27	(62)	
Solar Di		L calculated	usina App	endix G o	r Appendix	H (negati	ı ve quantit\	L /) (enter '0	L ' if no sola	r contribut	ion to wate	r heating)		
						applies						0,		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)	
Output	from w	ater hea	ter	ļ	!	!		!	<u>l</u>	<u> </u>	<u>l</u>			
(64)m=	219.59	193.52	203.15	182	176.84	155.75	149.22	166.34	167.53	188.73	199.71	214.27		
		!	!	!	<u>l</u>	<u>l</u>		Outp	out from w	ater heate	<u>l</u> r (annual)₁	12	2216.65 (64)	
Heat o	ains fro	m water	heating.	. kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m		
(65)m=	68.81	60.55	63.34	56.45	54.71	48	45.7	51.22	51.64	58.55	62.33	67.04	(65)	
	de (57)	n in cal	L	of (65)m	only if c	vlinder i	s in the d	l dwelling	or hot w	ater is fr	om com	munity h	eating	
				and 5a		yiii aa		- Troiling	01 1101 11	4101 10 11	0111 00111	mariney m	oug	
	Ĭ				<i>)</i> ·									
Metab	Jan	s (Table Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	174.76	174.76	174.76	174.76	174.76	174.76	174.76	174.76	174.76	174.76	174.76	174.76	(66)	
` '					<u> </u>	<u> </u>		<u> </u>	<u> </u>	174.70	174.70	174.70	(55)	
(67)m=	9 gairis 68.39	60.74	49.4	37.4	27.96	23.6	25.5	33.15	44.49	56.49	65.94	70.29	(67)	
					<u> </u>	<u> </u>		l .			05.94	70.29	(07)	
		· ` -				uation L					407.50	407.70	(60)	
(68)m=	457.99	462.74	450.76	425.27	393.08	362.84	342.63	337.88	349.85	375.35	407.53	437.78	(68)	
		·				tion L15					I		(00)	
(69)m=	55.39	55.39	55.39	55.39	55.39	55.39	55.39	55.39	55.39	55.39	55.39	55.39	(69)	
•		ns gains	` 											
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)	
Losses	e.g. e	aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-116.51	-116.51	-116.51	-116.51	-116.51	-116.51	-116.51	-116.51	-116.51	-116.51	-116.51	-116.51	(71)	
Water	heating	gains (T	able 5)											
(72)m=	92.49	90.1	85.14	78.4	73.54	66.67	61.43	68.85	71.72	78.7	86.57	90.11	(72)	



Total i	nternal	gains =	:			(66)	m + (67)m	ı + (68)m +	· (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	735.51	730.22	701.95	657.71	611.22	569.75	546.2	556.52	582.7	627.18	676.68	714.82	(73)	

(73)m=	735.51	730.22	701.95	\perp	657.71	611.22	5	69.75	546.2	556	.52	582.7	627.1	8 6/6.68	714	4.82		(73)
	lar gains		icina col	or f	flux from T	Tabla 6	and	Laccoc	iated equa	tione	to con	vort to the	o appli	cable orient	ation			
_			-	aı ı		able 0	aano			110115			е арріі	FF	auon.		Gains	
Orienta		Access F Table 6d	actor		Area m²			Flu Tal	ıx ble 6a			J_ ble 6b		Table 60	;		(W)	
Northea	ast _{0.9x} [0.77		, [2.53		x		11.28	x		0.76	x	0.7		=	10.52	(75)
	ast _{0.9x} [0.77	=	` [2.53	==	x	=	11.28	x		0.76	$\frac{1}{x}$	0.7		=	10.52	(75)
	ast _{0.9x} [0.77	=	、[、[2.53		X		11.28	x		0.76	d x	0.7		=	10.52	(75)
	ast _{0.9x} [0.77	=	` [、[2.53		X		11.28) ^ x		0.76	$\frac{1}{x}$	0.7		=	10.52	(75)
	ast _{0.9x}	0.77	=	、[、[2.53	==	X		22.97	x		0.76	$\frac{1}{x}$	0.7		=	21.42	(75)
	ast _{0.9x}	0.77	=	` [` [2.53		X	<u> </u>	22.97	X		0.76		0.7		=	21.42	(75)
	ast _{0.9x}	0.77	=	· [2.53		X		22.97	X		0.76	X	0.7		=	21.42	(75)
Northea	ast _{0.9x}	0.77	=	, [2.53		Х		22.97	X		0.76	→ ×	0.7		=	21.42	(75)
Northea	ast _{0.9x}	0.77	,	, [2.53		X	_	11.38	X		0.76	X	0.7		=	38.6	(75)
Northea	ast _{0.9x}	0.77		, [2.53	3	X	4	11.38	x		0.76	x	0.7		=	38.6	(75)
Northea	ast _{0.9x}	0.77		κĪ	2.53	3	X	4	11.38	x		0.76	X	0.7		=	38.6	(75)
Northea	ast _{0.9x}	0.77	,	آ	2.53	3	X	4	11.38	X		0.76	×	0.7		=	38.6	(75)
Northea	ast _{0.9x}	0.77	,	<u> </u>	2.53	3	X	6	67.96	x		0.76	x	0.7		=	63.39	(75)
Northea	ast _{0.9x}	0.77	,	· [2.53	3	X	6	67.96	x		0.76	X	0.7		=	63.39	(75)
Northea	ast _{0.9x}	0.77	,	٠ [2.53	3	X	6	67.96	X		0.76	x	0.7		=	63.39	(75)
Northea	ast _{0.9x}	0.77	,	κ [2.53	3	X	6	67.96	X		0.76	x	0.7		=	63.39	(75)
Northea	ast _{0.9x}	0.77)	· [2.53	3	X	9	91.35	X		0.76	X	0.7		=	85.2	(75)
Northea	ast _{0.9x} [0.77)	· [2.53	3	X	9	91.35	X		0.76	X	0.7		=	85.2	(75)
Northea	ast _{0.9x}	0.77)	· [2.53	3	X	9	91.35	X		0.76	X	0.7		=	85.2	(75)
Northea	ast _{0.9x} [0.77)	· [2.53	3	X	ç	91.35	X		0.76	X	0.7		=	85.2	(75)
Northea	ast _{0.9x} [0.77)	<u>،</u> [2.53	3	X	9	97.38	X		0.76	X	0.7		=	90.84	(75)
	ast _{0.9x}	0.77	,	٠ [2.53	3	X	9	97.38	X		0.76	X	0.7		=	90.84	(75)
	ast _{0.9x}	0.77	,	٠ [2.53	3	X	9	97.38	X		0.76	X	0.7		=	90.84	(75)
	ast _{0.9x}	0.77)	<u>،</u> [2.53	3	X	9	97.38	X		0.76	X	0.7		=	90.84	(75)
	ast _{0.9x}	0.77	,	<u> ا</u>	2.53	3	X		91.1	X		0.76	X	0.7		=	84.97	(75)
	ast _{0.9x}	0.77	,	<u> ا</u>	2.53	3	X	!	91.1	X		0.76	X	0.7		=	84.97	(75)
	ast _{0.9x}	0.77	,	٠ <u>ا</u>	2.53	3	X		91.1	X		0.76	X	0.7		=	84.97	(75)
	ast _{0.9x}	0.77	,	<u> ا</u>	2.53	3	X		91.1	X		0.76	X	0.7		=	84.97	(75)
	ast _{0.9x}	0.77	,	<u> ا</u>	2.53	3	X	7	72.63	X		0.76	X	0.7		=	67.74	(75)
	ast _{0.9x}	0.77	,	٠ <u>ا</u>	2.53	3	X	7	72.63	X		0.76	X	0.7		=	67.74	(75)
	ast _{0.9x}	0.77	,	٠ [2.53	3	X	7	72.63	X		0.76	X	0.7		=	67.74	(75)
	ast _{0.9x}	0.77	,	٠ <u>[</u>	2.53	3	X	7	72.63	X		0.76	X	0.7		=	67.74	(75)
	ast _{0.9x}	0.77	,	٠ <u>[</u>	2.53	3	X	5	50.42	X		0.76	X	0.7		=	47.03	(75)
Northea	ast _{0.9x}	0.77)	· [2.53	3	X	5	50.42	X		0.76	X	0.7		=	47.03	(75)



Northeast 0 sk			,		,		,		1		,		_
Northeast 0 sk	Northeast _{0.9x}	0.77	X	2.53	X	50.42	X	0.76	X	0.7] =	47.03	(75)
Northeast 0.9x	<u> </u>	0.77	X	2.53	X	50.42	X	0.76	X	0.7] =	47.03	(75)
Northeast 0, sk	<u> </u>	0.77	X	2.53	X	28.07	X	0.76	X	0.7] =	26.18	(75)
Northeast 0.9x	<u> </u>	0.77	X	2.53	X	28.07	X	0.76	X	0.7	=	26.18	(75)
Northeast 0.6x	<u> </u>	0.77	X	2.53	X	28.07	X	0.76	X	0.7	=	26.18	(75)
Northeast 0, 9x	<u> </u>	0.77	X	2.53	X	28.07	X	0.76	X	0.7	=	26.18	(75)
Northeast 0.6x	<u> </u>	0.77	X	2.53	X	14.2	X	0.76	X	0.7	=	13.24	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	2.53	X	14.2	X	0.76	X	0.7	=	13.24	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	2.53	X	14.2	X	0.76	X	0.7	=	13.24	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	2.53	X	14.2	X	0.76	X	0.7	=	13.24	(75)
Northeast 0.9x	<u> </u>	0.77	X	2.53	X	9.21	X	0.76	X	0.7	=	8.59	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	2.53	X	9.21	X	0.76	X	0.7	=	8.59	(75)
Southwesto, 9x	Northeast _{0.9x}	0.77	X	2.53	X	9.21	X	0.76	X	0.7	=	8.59	(75)
Southwesto, 9x	Northeast _{0.9x}	0.77	X	2.53	X	9.21	X	0.76	X	0.7	=	8.59	(75)
Southwesto, 9x 0.77	Southwest _{0.9x}	0.77	X	5.31	X	36.79]	0.76	X	0.7	=	72.03	(79)
Southwesto, 9x	Southwest _{0.9x}	0.77	X	8.12	X	36.79]	0.76	X	0.7	=	110.15	(79)
Southwest0.9x 0.77 x 8.12 x 62.67 0.76 x 0.7 = 187.62 79 Southwest0.9x 0.77 x 3.42 x 62.67 0.76 x 0.7 = 79.02 79 Southwest0.9x 0.77 x 5.31 x 88.75 0.76 x 0.7 = 167.88 79 Southwest0.9x 0.77 x 8.12 x 88.75 0.76 x 0.7 = 256.71 79 Southwest0.9x 0.77 x 3.42 x 88.75 0.76 x 0.7 = 108.12 79 Southwest0.9x 0.77 x 3.42 x 88.75 0.76 x 0.7 = 268.01 79 Southwest0.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 1818.08 79 Southwest0.9x 0.77 x 3.42 x 106.25 0.76 x 0.7 = 318.08 79 Southwest0.9x 0.77 x 3.42 x 106.25 0.76 x 0.7 = 133.97 79 Southwest0.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 232.98 79 Southwest0.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 366.28 79 Southwest0.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 231.3 79 Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 114.39 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 179 Southwest0.9x 0.77	Southwest _{0.9x}	0.77	X	3.42	X	36.79]	0.76	X	0.7	=	46.39	(79)
Southwest0.9x	Southwest _{0.9x}	0.77	X	5.31	X	62.67]	0.76	X	0.7	=	122.69	(79)
Southwest0.9x	Southwest _{0.9x}	0.77	X	8.12	X	62.67		0.76	X	0.7	=	187.62	(79)
Southwest0.9x 0.77 x 8.12 x 85.75 0.76 x 0.7 = 256.71 (79) Southwest0.9x 0.77 x 3.42 x 85.75 0.76 x 0.7 = 108.12 (79) Southwest0.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 208.01 (79) Southwest0.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 208.01 (79) Southwest0.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 318.08 (79) Southwest0.9x 0.77 x 5.31 x 119.01 0.76 x 0.7 = 232.98 (79) Southwest0.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 232.98 (79) Southwest0.9x 0.777	Southwest _{0.9x}	0.77	X	3.42	X	62.67		0.76	X	0.7	=	79.02	(79)
Southwesto,9x	Southwest _{0.9x}	0.77	X	5.31	X	85.75]	0.76	X	0.7	=	167.88	(79)
Southwesto,9x 0.77 x 5.31 x 106.25	Southwest _{0.9x}	0.77	X	8.12	X	85.75]	0.76	X	0.7	=	256.71	(79)
Southwesto.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 318.08 (79) Southwesto.9x 0.77 x 3.42 x 106.25 0.76 x 0.7 = 133.97 (79) Southwesto.9x 0.77 x 5.31 x 119.01 0.76 x 0.7 = 232.98 (79) Southwesto.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 232.98 (79) Southwesto.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 356.28 (79) Southwesto.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 148.97 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	3.42	X	85.75]	0.76	X	0.7	=	108.12	(79)
Southwesto.9x 0.77 x 3.42 x 106.25 0.76 x 0.7 = 133.97 (79) Southwesto.9x 0.77 x 5.31 x 119.01 0.76 x 0.7 = 232.98 (79) Southwesto.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 356.28 (79) Southwesto.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 356.28 (79) Southwesto.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 150.06 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 148.97 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	5.31	X	106.25]	0.76	X	0.7	=	208.01	(79)
Southwest0.9x 0.77 x 5.31 x 119.01 0.76 x 0.7 = 232.98 (79) Southwest0.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 356.28 (79) Southwest0.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 150.06 (79) Southwest0.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 231.3 (79) Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwest0.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwest0.9x 0.77	Southwest _{0.9x}	0.77	X	8.12	X	106.25]	0.76	X	0.7	=	318.08	(79)
Southwesto.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 356.28 (79) Southwesto.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 150.06 (79) Southwesto.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	3.42	X	106.25]	0.76	X	0.7	=	133.97	(79)
Southwesto.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 150.06 (79) Southwesto.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwesto.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 148.97 (79) Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwesto.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77 <	Southwest _{0.9x}	0.77	X	5.31	X	119.01]	0.76	X	0.7	=	232.98	(79)
Southwest0.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwest0.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 148.97 (79) Southwest0.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwest0.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwest0.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 143.62 (79) Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwest0.9x 0.77 <	Southwest _{0.9x}	0.77	X	8.12	X	119.01]	0.76	X	0.7	=	356.28	(79)
Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 148.97 (79) Southwest0.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwest0.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwest0.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 143.62 (79) Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 204.36 (79) Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77	Southwest _{0.9x}	0.77	X	3.42	X	119.01]	0.76	X	0.7	=	150.06	(79)
Southwesto.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 148.97 (79) Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwesto.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 312.51 (79) Southwesto.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 312.51 (79) Southwesto.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	5.31	X	118.15]	0.76	X	0.7	=	231.3	(79)
Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwesto.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 204.36 (79) Southwesto.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwesto.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwesto.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwesto.9x 0.77	<u> </u>	0.77	X	8.12	X	118.15]	0.76	X	0.7] =	353.7	(79)
Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwesto.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 204.36 (79) Southwesto.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 312.51 (79) Southwesto.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwesto.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwesto.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	3.42	X	118.15]	0.76	x	0.7	=	148.97	(79)
Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 143.62 (79) Southwest0.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 204.36 (79) Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwest0.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	5.31	X	113.91]	0.76	X	0.7] =	223	(79)
Southwest0.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 204.36 (79) Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwest0.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	8.12	X	113.91]	0.76	X	0.7	=	341	(79)
Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwest0.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	3.42	X	113.91]	0.76	X	0.7] =	143.62	(79)
Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwest0.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	L	0.77	X	5.31	X	104.39]	0.76	x	0.7] =	204.36	(79)
Southwesto.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwesto.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	8.12	X	104.39]	0.76	x	0.7] =	312.51	(79)
Southwest _{0.9x} 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	3.42	X	104.39]	0.76	x	0.7] =	131.62	(79)
	Southwest _{0.9x}	0.77	X	5.31	X	92.85]	0.76	X	0.7] =	181.77	(79)
Southwest _{0.9x} 0.77 x 3.42 x 92.85 0.76 x 0.7 = 117.07 (79)	Southwest _{0.9x}	0.77	X	8.12	X	92.85]	0.76	X	0.7] =	277.97	(79)
	Southwest _{0.9x}	0.77	X	3.42	X	92.85]	0.76	X	0.7	=	117.07	(79)



Southwesto, or			_		•		1		i				_
Southwesto or 0.77	Southwest _{0.9x}	0.77	X	5.31	X	69.27		0.76	X	0.7	=	135.6	(79)
Southwest) 9x	<u> </u>	0.77	X	8.12	X	69.27	<u> </u>	0.76	X	0.7	=	207.36	(79)
Southwest) 9x	<u> </u>	0.77	X	3.42	X	69.27		0.76	X	0.7	=	87.34	(79)
Southwesty 9, 0.77	<u> </u>	0.77	X	5.31	X	44.07	_	0.76	X	0.7	=	86.28	(79)
Southwestq.sx 0.77	<u> </u>	0.77	X	8.12	x	44.07		0.76	X	0.7	=	131.93	(79)
Southwesto, sk	Southwest _{0.9x}	0.77	X	3.42	X	44.07		0.76	X	0.7	=	55.57	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	5.31	X	31.49		0.76	X	0.7	=	61.64	(79)
Northwest 0.9x	Southwest _{0.9x}	0.77	X	8.12	x	31.49		0.76	X	0.7	=	94.26	(79)
Northwest 0.9x	Southwest _{0.9x}	0.77	X	3.42	X	31.49		0.76	X	0.7	=	39.7	(79)
Northwest 0.9x	Northwest 0.9x	0.77	X	0.69	X	11.28	X	0.76	X	0.7	=	2.87	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	1.27	x	11.28	X	0.76	X	0.7	=	5.28	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	0.69	x	22.97	X	0.76	X	0.7	=	5.84	(81)
Northwest 0.9x	Northwest 0.9x	0.77	X	1.27	x	22.97	X	0.76	X	0.7	=	10.75	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	0.69	x	41.38	X	0.76	X	0.7	=	10.53	(81)
Northwest 0,9x	Northwest 0.9x	0.77	X	1.27	x	41.38	X	0.76	X	0.7	=	19.37	(81)
Northwest 0, 9x 0.77	Northwest _{0.9x}	0.77	X	0.69	x	67.96	X	0.76	X	0.7	=	17.29	(81)
Northwest 0, 9x 0.77	Northwest _{0.9x}	0.77	X	1.27	X	67.96	X	0.76	X	0.7	=	31.82	(81)
Northwest 0.9x	Northwest 0.9x	0.77	X	0.69	x	91.35	X	0.76	X	0.7	=	23.24	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	1.27	X	91.35	X	0.76	X	0.7	=	42.77	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	0.69	x	97.38	X	0.76	X	0.7	=	24.77	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	1.27	X	97.38	X	0.76	X	0.7	=	45.6	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	0.69	x	91.1	X	0.76	X	0.7	=	23.17	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	1.27	X	91.1	X	0.76	X	0.7	=	42.66	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	0.69	x	72.63	X	0.76	x	0.7	=	18.48	(81)
Northwest 0.9x	Northwest 0.9x	0.77	X	1.27	x	72.63	x	0.76	x	0.7	=	34.01	(81)
Northwest 0.9x	Northwest 0.9x	0.77	X	0.69	x	50.42	x	0.76	x	0.7	=	12.83	(81)
Northwest 0.9x	Northwest 0.9x	0.77	X	1.27	x	50.42	x	0.76	x	0.7	=	23.61	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	0.69	x	28.07	X	0.76	X	0.7	=	7.14	(81)
Northwest 0.9x	Northwest _{0.9x}	0.77	X	1.27	X	28.07	X	0.76	X	0.7	=	13.14	(81)
Northwest 0.9x	<u> </u>	0.77	x	0.69	x	14.2	X	0.76	x	0.7	=	3.61	(81)
Northwest 0.9x	Northwest 0.9x	0.77	X	1.27	x	14.2	X	0.76	X	0.7	=	6.65	(81)
Rooflights 0.9x 1 x 12.74 x 20.24 x 0.76 x 0.7 = 123.44 (82) Rooflights 0.9x 1 x 12.74 x 40.55 x 0.76 x 0.7 = 247.33 (82) Rooflights 0.9x 1 x 12.74 x 74.78 x 0.76 x 0.7 = 456.16 (82) Rooflights 0.9x 1 x 12.74 x 130.19 x 0.76 x 0.7 = 794.13 (82) Rooflights 0.9x 1 x 12.74 x 183.82 x 0.76 x 0.7 = 1121.29 (82) Rooflights 0.9x 1 x 12.74 x 200.21 x 0.76 x 0.7 = 1221.24 (82)	Northwest _{0.9x}	0.77	X	0.69	x	9.21	X	0.76	x	0.7	=	2.34	(81)
Rooflights 0.9x 1 x 12.74 x 40.55 x 0.76 x 0.7 = 247.33 (82) Rooflights 0.9x 1 x 12.74 x 74.78 x 0.76 x 0.7 = 456.16 (82) Rooflights 0.9x 1 x 12.74 x 130.19 x 0.76 x 0.7 = 794.13 (82) Rooflights 0.9x 1 x 12.74 x 183.82 x 0.76 x 0.7 = 1121.29 (82) Rooflights 0.9x 1 x 12.74 x 200.21 x 0.76 x 0.7 = 1221.24 (82)	Northwest 0.9x	0.77	X	1.27	x	9.21	X	0.76	x	0.7	=	4.31	(81)
Rooflights 0.9x 1 x 12.74 x 74.78 x 0.76 x 0.7 = 456.16 (82) Rooflights 0.9x 1 x 12.74 x 130.19 x 0.76 x 0.7 = 794.13 (82) Rooflights 0.9x 1 x 12.74 x 183.82 x 0.76 x 0.7 = 1121.29 (82) Rooflights 0.9x 1 x 12.74 x 200.21 x 0.76 x 0.7 = 1221.24 (82)	Rooflights _{0.9x}	1	X	12.74	X	20.24	X	0.76	X	0.7	=	123.44	(82)
Rooflights 0.9x 1	Rooflights _{0.9x}	1	X	12.74	x	40.55	X	0.76	X	0.7	=	247.33	(82)
Rooflights 0.9x 1 x 12.74 x 183.82 x 0.76 x 0.7 = 1121.29 (82) Rooflights 0.9x 1 x 12.74 x 200.21 x 0.76 x 0.7 = 1221.24 (82)	L	1	X	12.74	x	74.78	X	0.76	x	0.7	=	456.16	(82)
Rooflights 0.9x 1 x 12.74 x 200.21 x 0.76 x 0.7 = 1221.24 (82)	<u> </u>	1	X	12.74	x	130.19	X	0.76	X	0.7	=	794.13	(82)
	Rooflights _{0.9x}	1	X	12.74	x	183.82	X	0.76	X	0.7	=	1121.29	(82)
Rooflights $0.9x$ 1	_	1	x	12.74	x	200.21	X	0.76	X	0.7	=	1221.24	(82)
	Rooflights _{0.9x}	1	X	12.74	x	185.57	X	0.76	x	0.7	=	1131.99	(82)
Rooflights $0.9x$ 1	Rooflights 0.9x	1	x	12.74	X	142.19	X	0.76	X	0.7	=	867.36	(82)



Roofligh	hts _{0.9x}	1	X	12.	74	x 9	93.09	X	0.76	x	0.7	=	567.83	(82)
Roofligh	hts _{0.9x}	1	х	12.	74	x Z	19.71	х	0.76	x	0.7	=	303.23	(82)
Roofligh	hts _{0.9x}	1	х	12.	74	x 2	25.27	x	0.76	x	0.7	=	154.14	(82)
Roofligh	hts _{0.9x}	1	x	12.	74	x 1	16.69	x	0.76	_ x _	0.7	=	101.83	(82)
	_													_
Solar	ains in	watts, ca	alculated	l for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	402.26	738.95		1756.84	i —	2388.92	2245.34	1839.3	1369.2	858.54	491.14	338.48		(83)
Total g	ains – ii	nternal a	nd solar	(84)m =	(73)m ·	+ (83)m	, watts				!			
(84)m=	1137.77	1469.18	1875.1	2414.54	2878.65	2958.67	2791.54	2395.82	1951.9	1485.72	1167.82	1053.3		(84)
7 Me	an inter	nal temp	erature	(heating	season)								
		•	eating p	,		,	from Tak	ole 9 Th	1 (°C)				21	(85)
•		Ū	ains for I			Ū		JIO 0, 111	. (0)					
Otilise	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.97	0.92	0.75	0.53	0.36	0.26	0.32	0.57	0.89	0.98	0.99		(86)
					<u> </u>			<u> </u>	<u> </u>	0.00	0.00	0.00		()
		· ·	ature in	<u>_</u>	·	1	i 	I			l			(0.7)
(87)m=	19.87	20.14	20.51	20.85	20.97	21	21	21	20.97	20.71	20.2	19.81		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	19.9	19.9	19.9	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91		(88)
Utilisa	ation fac	tor for g	ains for ı	rest of d	welling,	h2,m (se	ee Table	9a)						
(89)m=	0.99	0.97	0.89	0.7	0.47	0.3	0.2	0.24	0.49	0.85	0.97	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwalli	na T2 (f	ollow ste	ne 3 to	7 in Tahl			<u>I</u>		
(90)m=	18.42	18.81	19.33	19.76	19.89	19.91	19.91	19.91	19.89	19.61	18.91	18.34		(90)
(00)							1				g area ÷ (4		0.47	(91)
											•	<i>'</i>	0.41	
			ature (fo								l			(00)
(92)m=	19.09	19.43	19.88	20.27	20.39	20.42	20.42	20.42	20.4	20.13	19.51	19.02		(92)
			he mean				i				10.54	40.00		(02)
(93)m=	19.09	19.43	19.88	20.27	20.39	20.42	20.42	20.42	20.4	20.13	19.51	19.02		(93)
			uirement				11 -f	Table O	41	4 T:/	76)	d == ==l=	ulata	
			emanter or gains t	•		ied at St	ерттог	rable 9	o, so ma	t 11,III–(rojiii an	d re-calc	uiate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm	· ·	·						l			
(94)m=	0.99	0.96	0.89	0.72	0.5	0.33	0.23	0.28	0.53	0.86	0.97	0.99		(94)
Usefu	шшы ıl gains,	hmGm ,	, W = (94	4)m x (8	4)m	Į.		Į.	<u>I</u>					
(95)m=	1123.11	1415.29	1675.29	1732.25	1427.35	966.69	636.2	668.42	1026.04	1271.34	1134.72	1043.41		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8	!				!			
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm , W :	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	2492.67	2446.22	2250.95	1903.89	1454.86	969.69	636.59	669.44	1051.31	1594.11	2080.62	2488.29		(97)
Space	e heatin	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=	1018.95	692.79	428.29	123.58	20.47	0	0	0	0	240.14	681.05	1074.98		_
								Tota	l per year	(kWh/year	·) = Sum(9	8) _{15,912} =	4280.26	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								31.07	(99)
-		-												



9a. Energy requirements – Individual heating	systems i	including	micro-C	CHP)					
Space heating:							,	_	7,,,,,
Fraction of space heat from secondary/suppl	ementary	/ system	(202) = 1	_ (201) =				0	(201)
Fraction of space heat from main system(s)			(202) = 1		(203)] -			1	(202)
Fraction of total heating from main system 1 Efficiency of main space heating system 1			(204) - (2	02) ^ [1 -	(200)] =			90.4	(204)
Efficiency of secondary/supplementary heati	na sveten	n %						0	(208)
		Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	١.
Jan Feb Mar Apr May Space heating requirement (calculated above		Jui	Aug	Sep	Oct	NOV	Dec	KVVII/yea	11
1018.95 692.79 428.29 123.58 20.47	0	0	0	0	240.14	681.05	1074.98		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)					_				(211)
1127.16 766.36 473.78 136.71 22.64	0	0	0	0	265.64	753.37	1189.14		_
			Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	4734.8	(211)
Space heating fuel (secondary), kWh/month = $\{[(98)\text{m x}(201)]\}$ x 100 ÷ (208)									
$ \frac{-1}{(215)m} = 0 0 0 0 0 $	0	0	0	0	0	0	0		
	_	ļ.	Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating									_
Output from water heater (calculated above) 219.59	155.75	149.22	166.34	167.53	188.73	199.71	214.27		
Efficiency of water heater	155.75	149.22	100.34	107.55	100.73	199.71	214.21	80.3	(216)
(217)m= 88.43 87.98 86.88 84.1 81.24	80.3	80.3	80.3	80.3	85.66	87.89	88.55		(217)
For the second of the second o	<u>-!</u>	1	ļ						
Fuel for water heating, kWh/month									
(219) m = (64) m x $100 \div (217)$ m	193.96	185.83	207 15	208 64	220 33	227 21	241 98		
	193.96	185.83	207.15 Tota	208.64 al = Sum(2	220.33 19a), 12 =	227.21	241.98	2621.27	T ₍₂₁₉₎
(219) m = (64) m x $100 \div (217)$ m	193.96	185.83		208.64 ol = Sum(2	19a) ₁₁₂ =	227.21 Wh/yeai		2621.27 kWh/year	(219)
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 248.33 $	193.96	185.83			19a) ₁₁₂ =	l			(219)
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 248.33 219.95 233.82 216.41 217.67 $ Annual totals	193.96	185.83			19a) ₁₁₂ =	l		kWh/year	(219)
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1		185.83			19a) ₁₁₂ =	l		kWh/year 4734.8](219)]
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used		185.83			19a) ₁₁₂ =	l		kWh/year 4734.8	(230c)
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-h		185.83			19a) ₁₁₂ =	l		kWh/year 4734.8]
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-heating pump:		185.83	Tota		19a) ₁₁₂ = k 1	Wh/year	30	kWh/year 4734.8	(230c)
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-heating pump: boiler with a fan-assisted flue		185.83	Tota	II = Sum(2	19a) ₁₁₂ = k 1	Wh/year	30	kWh/year 4734.8 2621.27	(230c) (230e)
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-h central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting		185.83	Tota	II = Sum(2	19a) ₁₁₂ = k 1	Wh/year	30	kWh/year 4734.8 2621.27	(230c) (230e) (231)
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-h central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year	ot		Tota	II = Sum(2	19a) ₁₁₂ = k1	Wh/year	30	kWh/year 4734.8 2621.27 75 483.11	(230c) (230e) (231)
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-h central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting	ot		Tota	II = Sum(2	19a) ₁₁₂ = k 1	Wh/year	30	kWh/year 4734.8 2621.27	(230c) (230e) (231)
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-h central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting	ot Fu kV	ıel	Tota	II = Sum(2	19a) ₁₁₂ = k1	Wh/year	30 45	kWh/year 4734.8 2621.27 75 483.11	(230c) (230e) (231)
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-h central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 10a. Fuel costs - individual heating systems:	ot Fu kV (21	i el Vh/year	Tota	II = Sum(2	19a) ₁₁₂ = k1	Wh/year	30 45	kWh/year 4734.8 2621.27 75 483.11 Fuel Cost £/year	(230c) (230e) (231) (232)
(219)m= (64)m x 100 ÷ (217)m (219)m= 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-h central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 10a. Fuel costs - individual heating systems:	Fu kV (21	iel Vh/year	Tota	II = Sum(2	(230g) = Fuel P (Table	Wh/year	30 45 x 0.01 =	kWh/year 4734.8 2621.27 75 483.11 Fuel Cost £/year	(230c) (230e) (231) (232)
(219)m = (64)m x 100 ÷ (217)m (219)m = 248.33 219.95 233.82 216.41 217.67 Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-h central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 10a. Fuel costs - individual heating systems: Space heating - main system 1 Space heating - main system 2	Fu kV (21	iel Vh/year 1) x 3) x 5) x	Tota	II = Sum(2	(230g) = Fuel P (Table	Wh/year	30 45 x 0.01 = x 0.01 =	kWh/year 4734.8 2621.27 75 483.11 Fuel Cost £/year 164.77	(230c) (230e) (231) (232) (240) (241)



Pumps, fans and electric keep-hot (230) to (230g) separately as applicable and apply fuel price according to 1 Table 12a Entergy for lighting (232) (235) (231) (2							_
Remarks Rema	Pumps, fans and electric keep-hot				x 0.01 =		(249)
Additional standing charges (Table 12) one of (233) to (235) x) 13.19 x 0.01 = 0 252 Appendix Q items: repeat lines (253) and (254) as needed Total energy cost (245)(247) + (250)(254) = 4440.61 255 T13SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) SAP rating (Section 12) Energy cost factor (ECF) Energy kWh/hyear Energy kWh/hyear Energy kWh/hyear Energy kGC2/kWh Space heating (main system 1) (211) x 0.216 Fig. 0.216		• .	• • •	· · · · - · · · · · · · · · · · · · · ·			(250)
Common of (233) to (235) x 13.19 x 0.01 = 0 (252)							_
Appendix Q items: repeat lines (253) and (254) as needed		·	one of (233) to (235) x)	12.10	x 0.01 =		- -
Total energy cost	Annendix O items: repeat lines (253) and			13.19		0	_(232)
Energy cost deflator (Table 12) Energy cost factor (ECF)	, , , ,	, ,				449.61	(255)
SAP rating (Section 12)	11a. SAP rating - individual heating sys	tems					
Saperating (Section 12) Sab Sa	Energy cost deflator (Table 12)					0.42	(256)
Part	Energy cost factor (ECF)	[(255) x (256)]	÷ [(4) + 45.0] =			1.03	(257)
Energy kWh/year Emission factor kg CO2/kWh kg CO2/year kg CO2/year kg CO2/kWh kg CO2/year kg CO2/year kg CO2/year kg CO2/year kg CO2/kWh kg CO2/year kg CO2/year kg CO2/year kg CO2/year kg CO2/year kg CO2/kWh kg CO2/year kg CO2/year kg CO2/kWh kg CO2/year kg CO2/kB = 0.216 = 0.0216 = 0.0263 (264) Space and water heating (219) x	SAP rating (Section 12)					85.59	(258)
KWh/year kg CO2/kWh kg CO2/kear	12a. CO2 emissions – Individual heating	g systems ir	ncluding micro-CHP				
Space heating (secondary) (215) x (219) x (219) x (216) = 566.19 (264) Space and water heating (219) x (251) + (262) + (263) + (264) = 1588.91 (265) Electricity for pumps, fans and electric keep-hot (231) x (232) x (232) x (232) x (232) x (232) x (233) = 250.74 (288) Energy saving/generation technologies Total CO2, kg/year CO2 emissions per m² (272) + (4) = 13.64 (273) El rating (section 14) Energy kWh/year Space heating (main system 1) (211) x (211) x (211) x (212) = 5776.45 (261) Space heating (secondary) (215) x (216) x (217) = 16776.45 (261) Space heating (secondary) (215) x (216) x (217) = 10 (263) Energy for water heating (219) x (210) x (210) x (211) x (211) x (212) = 5776.45 (261) Energy for water heating (219) x (210) x (210) x (210) x (211)							
Water heating (219) x	Space heating (main system 1)	((211) x	0.216	=	1022.72	(261)
Space heating (section 14) Energy kWh/year Primary factor P. Energy kWh/year Space heating (secondary) (211) x 1.22 = 5776.45 (261) Space heating (secondary) (211) x 1.22 = 5776.45 (261) Energy for water heating (211) x 1.22 = 5776.45 (261) Space and water heating (219) x 1.22 = 3197.95 (264) Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 0 (283) Energy for water heating (219) x 1.22 = 3197.95 (264) Space and water heating (261) + (262) + (263) + (264) = 8974.41 (265) Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 230.25 (267) Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies 500.0000000000000000000000000000000000	Space heating (secondary)	((215) x	0.519	=	0	(263)
Electricity for pumps, fans and electric keep-hot (231) x	Water heating	((219) x	0.216	=	566.19	(264)
Electricity for lighting (232) x 0.519 = 250.74 (268) Energy saving/generation technologies Total CO2, kg/year sum of (265)(271) = 1878.57 (272) CO2 emissions per m² (272) + (4) = 13.64 (273) El rating (section 14) 86 (274) 13a. Primary Energy Energy kWh/year factor factor space heating (main system 1) (211) x 1.22 = 5776.45 (261) Space heating (secondary) (215) x 3.07 = 0 (263) Energy for water heating (219) x 1.22 = 3197.95 (264) Space and water heating (261) + (262) + (263) + (264) = 8974.41 (265) Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 230.25 (267) Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies Total Primary Energy sum of (265)(271) = 10687.82 (272)	Space and water heating	((261) + (262) + (263) + (26	4) =	<u> </u>	1588.91	(265)
Energy saving/generation technologies Total CO2, kg/year sum of (265)(271) = 1878.57 (272) CO2 emissions per m² (272) + (4) = 13.64 (273) El rating (section 14) 86 (274) 13a. Primary Energy Energy kWh/year factor Space heating (main system 1) (211) x 1.22 = 5776.45 (261) Space heating (secondary) (215) x 3.07 = 0 (263) Energy for water heating (219) x 1.22 = 3197.95 (264) Space and water heating (261) + (262) + (263) + (264) = 8974.41 (265) Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 230.25 (267) Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies 'Total Primary Energy sum of (265)(271) = 10687.82 (272)	Electricity for pumps, fans and electric ke	ep-hot ((231) x	0.519	=	38.93	(267)
Energy kWh/year Primary factor P. Energy kWh/year Space heating (secondary) (211) x 1.22 = 5776.45 (261) Space heating (secondary) (219) x 1.22 = 3.07 = 0 (263) Energy for water heating (219) x 1.22 = 3.197.95 (264) Space and water heating (261) + (262) + (263) + (264) = 8974.41 (265) Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 230.25 (267) Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies 500 mm of (265)(271) = 500 mm of (272) 500 mm of (272) 500 mm of (272)	Electricity for lighting	((232) x	0.519	=	250.74	(268)
El rating (section 14) Energy kWh/year factor Space heating (main system 1) Space heating (secondary) Energy kWh/year Space heating (secondary) (211) x				sum of (265)(271)	=	1878.57	(272)
Energy kWh/year factor Frimary kWh/year Factor Frimary kWh/year Factor F	CO2 emissions per m²			(272) ÷ (4) =		13.64	(273)
Energy kWh/year factor space heating (main system 1) (211) x 1.22 = 5776.45 (261) Space heating (secondary) (215) x 3.07 = 0 (263) Energy for water heating (219) x 1.22 = 3197.95 (264) Space and water heating (261) + (262) + (263) + (264) = 8974.41 (265) Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 230.25 (267) Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies 'Total Primary Energy sum of (265)(271) = 10687.82 (272)	El rating (section 14)					86	(274)
kWh/year factor kWh/year Space heating (main system 1) (211) x 1.22 = 5776.45 (261) Space heating (secondary) (215) x 3.07 = 0 (263) Energy for water heating (219) x 1.22 = 3197.95 (264) Space and water heating (261) + (262) + (263) + (264) = 8974.41 (265) Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 230.25 (267) Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies sum of (265)(271) = 10687.82 (272)	13a. Primary Energy						
Space heating (main system 1) (211) x 1.22 = 5776.45 (261) Space heating (secondary) (215) x 3.07 = 0 (263) Energy for water heating (219) x 1.22 = 3197.95 (264) Space and water heating (261) + (262) + (263) + (264) = 8974.41 (265) Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 230.25 (267) Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies sum of (265)(271) = 10687.82 (272)			• • • • • • • • • • • • • • • • • • • •	•		•	
Energy for water heating (219) x 1.22 = 3197.95 (264) Space and water heating (261) + (262) + (263) + (264) = 8974.41 (265) Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 230.25 (267) Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies 'Total Primary Energy sum of (265)(271) = 10687.82 (272)	Space heating (main system 1)		•		=		(261)
Space and water heating $(261) + (262) + (263) + (264) =$ Electricity for pumps, fans and electric keep-hot $(231) \times (232) \times$	Space heating (secondary)	((215) x	3.07	=	0	(263)
Electricity for pumps, fans and electric keep-hot (231) x 3.07 = 230.25 (267) Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies 'Total Primary Energy sum of (265)(271) = 10687.82 (272)	Energy for water heating	((219) x	1.22	=	3197.95	(264)
Electricity for lighting (232) x 0 = 1483.16 (268) Energy saving/generation technologies 'Total Primary Energy sum of (265)(271) = 10687.82 (272)	Space and water heating	((261) + (262) + (263) + (26	4) =		8974.41	(265)
Energy saving/generation technologies 'Total Primary Energy sum of (265)(271) = 10687.82 (272)	Electricity for pumps, fans and electric ke	ep-hot ((231) x	3.07	=	230.25	(267)
'Total Primary Energy sum of (265)(271) = 10687.82 (272)	Electricity for lighting	((232) x	0	=	1483.16	(268)
Primary energy kWh/m²/year (272) ÷ (4) = 77.58 (273)				sum of (265)(271)	=	10687.82	(272)
	Primary energy kWh/m²/year			(272) ÷ (4) =		77.58	(273)



User Details: Peter Mitchell STRO007945 **Assessor Name:** Stroma Number: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.5 **Software Name:** Property Address: Unit 1 (GF&FF END) LEAN New Dwelling at:, Gordon House, 6 Lissenden Gardens, LONDON, NW5 1LX Address: 1. Overall dwelling dimensions: Volume(m³) Area(m²) Av. Height(m) Ground floor 73.62 (1a) x 2.4 (2a) =176.69 (3a) First floor (1b) x (2b) =(3b) 64.14 3.32 212.94 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)137.76 (4) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n)(5) 389.63 2. Ventilation rate: main secondary other total m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 0 0 0 x 20 =Number of open flues 0 0 0 0 0 (6b) Number of intermittent fans x 10 =(7a)2 20 Number of passive vents x 10 =(7b) 0 0 Number of flueless gas fires x 40 =(7c)n 0 Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = \div (5) = 0.05 (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) (9)0 Additional infiltration [(9)-1]x0.1 =(10)0 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 (12)0 If no draught lobby, enter 0.05, else enter 0 0 (13)Percentage of windows and doors draught stripped (14)0 Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)(8) + (10) + (11) + (12) + (13) + (15) =Infiltration rate 0 (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)4 If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise (18) = (16)0.25 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)Shelter factor $(20) = 1 - [0.075 \times (19)] =$ 0.78 (20) $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.19

Infiltrat	ion rate	modified	d for mo	nthly wir	nd speed							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthl	y avera	ge wind	speed fr	om Tabl	e 7							
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7



Wind Factor (22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjusted infilt	ration rat	e (allowi	na for st	nelter an	d wind s	speed) =	(21a) x	(22a)m	-	-	-		
0.25	0.24	0.24	0.21	0.21	0.19	0.19	0.18	0.19	0.21	0.22	0.23		
Calculate effe		•	rate for t	he appli	cable ca	se		<u> </u>	ļ	ļ	ļ		
If mechanic												0	(23a)
If exhaust air h) = (23a)			0	(23b)
If balanced wit		•	·	•		•		•				0	(23c)
a) If balance	1					- ` 	- 	^ `	r ´ `		<u> </u>	÷ 100]	(0.4.)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance	1		ı —			- 	- ^ ` 	``	 		1		<i>.</i>
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h									F (00L				
	m < 0.5 ×	` 	<u> </u>	, `	,	<u> </u>	, ` ` 	ŕ	`	í – –			(240)
(24c)m= 0	0	0		0	0	0	0	0	0	0	0		(24c)
d) If natural	l ventilation m = 1, the			•	•				0.51				
(24d)m= 0.53	0.53	0.53	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.53		(24d)
Effective air	r change	rate - er	ter (24a	or (24h	o) or (24)	c) or (24	.d) in box	(25)	ļ	ļ	ļ		
(25)m= 0.53	0.53	0.53	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.53		(25)
3 Heat losse	es and he	eat loss r	paramete	er.									
3. Heat losse		·			Net Ar	ea	U-valı	ue	AXU		k-value		A X k
3. Heat losse ELEMENT	es and he Gros area	SS	oaramete Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/l	K)	k-value kJ/m²·ł		A X k kJ/K
	Gros area	SS	Openin	gs		m²		:K		K)			
ELEMENT	Gros area e 1	SS	Openin	gs	A ,r	m² x1	W/m2	(K 0.04] =	(W/I	K)			kJ/K
ELEMENT Windows Typ	Gros area e 1 e 2	SS	Openin	gs	A ,r	m² x1 x1	W/m2 /[1/(1.4)+	0.04] = 0.04] =	7.04	K)			kJ/K (27)
ELEMENT Windows Typ Windows Typ	Gros area e 1 e 2 e 3	SS	Openin	gs	A ,r 5.31 8.12	m² x1 x1 x1	W/m2 /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] = 0.04]	7.04 10.77	K)			kJ/K (27) (27)
ELEMENT Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2 e 3 e 4	SS	Openin	gs	A ,r 5.31 8.12 2.53	m ²	W/m2 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] = 0.04] =	7.04 10.77 3.35	K)			kJ/K (27) (27) (27)
ELEMENT Windows Typ Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5	SS	Openin	gs	A ,r 5.31 8.12 2.53 2.53	m ²	W/m2 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	7.04 10.77 3.35 3.35	K)			kJ/K (27) (27) (27) (27)
ELEMENT Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5 e 6	SS	Openin	gs	A ,r 5.31 8.12 2.53 2.53 2.53	m ²	W/m2 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	7.04 10.77 3.35 3.35 3.35	K)			kJ/K (27) (27) (27) (27) (27)
ELEMENT Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5 e 6	SS	Openin	gs	A ,r 5.31 8.12 2.53 2.53 2.53 2.53	m ²	W/m2 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04]	(W/l 7.04 10.77 3.35 3.35 3.35 3.35 0.91	K)			kJ/K (27) (27) (27) (27) (27) (27) (27)
ELEMENT Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8	SS	Openin	gs	A ,r 5.31 8.12 2.53 2.53 2.53 0.69	m²	W/m2 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68	K)			kJ/K (27) (27) (27) (27) (27) (27)
ELEMENT Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8	SS	Openin	gs	A ,r 5.31 8.12 2.53 2.53 2.53 0.69 1.27 3.42	m ²	W/m2 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] =	(W/I 7.04 10.77 3.35 3.35 3.35 0.91 1.68 4.53				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8	ss (m²)	Openin	gs ²	A ,r 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27	m²	W/m2 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] =	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Windows Typ Rooflights	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 9	es (m²)	Openin m	gs ²	A ,r 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42	m²	W/m2 /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04]	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
Windows Typ Rooflights Walls	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 9	2 8	28.93 0	gs ²	A ,r 5.31 8.12 2.53 2.53 2.53 0.69 1.27 3.42 118.2	m²	W/m2 /[1/(1.4)+ /[1/(1.4)+	(K) $0.04] = 0$	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53 17.836 18.92				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Windows Typ Wooflights Walls Roof Type1	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 9	2 8 8	Openin m	gs ²	A ,r 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42 118.2 9.48 58.93	m ²	W/m2 /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04]	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53 17.836 18.92				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
Windows Typ Rooflights Walls Roof Type1 Roof Type2	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 9	2 8 8	28.93 0	gs ²	A ,r 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42 118.2 9.48	m ²	W/m2 /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04]	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53 17.836 18.92				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)
Windows Typ Rooflights Walls Roof Type1 Roof Type2 Total area of	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 9	2 8 8	28.93 0	gs ²	A ,r 5.31 8.12 2.53 2.53 2.53 2.53 0.69 1.27 3.42 118.2 9.48 58.93 228.3	m²	W/m2 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04]	(W/I 7.04 10.77 3.35 3.35 3.35 3.35 0.91 1.68 4.53 17.836 18.92 1.33				kJ/K (27) (27) (27) (27) (27) (27) (27) (27)

(26)...(30) + (32) =

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U)

83.74

(33)



неат с	apacity	Cm = S(AXK)						((28)	.(30) + (32)	2) + (32a)	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF	P = Cm ÷	+ TFA) ir	ı kJ/m²K			Indica	tive Value:	Medium		250	(35)
	•				constructi	on are not	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated ı	using Ap	pendix l	<						16.5	(36)
if details	Second color Seco													
Total fa	abric he	at loss							(33) +	(36) =			100.24	(37)
Ventila	tion hea	t loss ca	alculated	monthly	y		_		(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	68.25	68.1	67.95	67.24	67.11	66.49	66.49	66.38	66.73	67.11	67.38	67.66		(38)
Heat tr	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	168.49	168.34	168.19	167.48	167.35	166.73	166.73	166.62	166.97	167.35	167.62	167.9		_
Heat lo	oss para	meter (H	HLP), W	/m²K						_		12 /12=	167.48	(39)
(40)m=	1.22	1.22	1.22	1.22	1.21	1.21	1.21	1.21	1.21	1.21	1.22	1.22		
	Description					1.22	(40)							
Numbe	er of day	s in moi	nth (Tab	le 1a)			ı		1					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ing ener	gy requ	irement:								kWh/ye	ear:	
if TF	A > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9))2)] + 0.0	0013 x (1	ΓFA -13.		91		(42)
Reduce	the annua	l average	hot water	usage by	5% if the d	welling is	designed t			se target o		3.38		(43)
	lan	Feh	Mar	Δnr	May	lun	lul	Διια	Sen	Oct	Nov	Dec		
Hot wate					,		_		Оер	Oct	INOV	Dec		
(44)m=	113 71	109 58	105 44	101 31	97 17	93.04	93.04	97 17	101 31	105 44	109 58	113 71		
()		.00.00			0		1 00.0	• • • • • • • • • • • • • • • • • • • •					1240 52	(44)
Energy	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x D	Tm / 3600			. ,		.2.0.02	` ′
(45)m=	168.63	147.49	152.2	132.69	127.32	109.86	101.81	116.82	118.22	137.77	150.39	163.31		
If instan	taneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Γotal = Su	m(45) ₁₁₂ =		1626.52	(45)
(46)m=	25.3	22.12	22.83	19.9	19.1	16.48	15.27	17.52	17.73	20.67	22.56	24.5		(46)
	_													
_		, ,					_		ame ves	sel	(0		(47)
	-	_			•			` '	ers) ente	er '0' in (47)			
	storage		a alono 11		!!	// 144	- /-l ^							
•					or is kno	wn (KVVI	n/ɑay):					0		(48)
•			m Table									0		(49)
Energy	/ lost fro	m water	storage	k\Mh/v	aar			(48) x (49)	۱ –			0		(50)



Hot wa	ater stor	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ıy)					0	(51)
	-	neating s		on 4.3									
		from Ta										0	(52)
•		actor fro										0	(53)
		m water	_	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0	(54)
	. ,	(54) in (5	•									0	(55)
Water	storage	loss cal	culated 1	for each	month			((56)m = (55) × (41)	m 			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (50	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)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3							0	(58)
	-	loss cal	•			59)m = ((58) ÷ 36	65 × (41)	m				
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)		
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m					
(61)m=	50.96	46.03	50.96	49.32	49.52	45.88	47.41	49.52	49.32	50.96	49.32	50.96	(61)
Total h	neat req	uired for	water h	eating ca	alculated	l for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m
(62)m=	219.59	193.52	203.15	182	176.84	155.75	149.22	166.34	167.53	188.73	199.71	214.27	(62)
Solar Di	HW input	calculated	using App	endix G o	· Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	r heating)	
		I lines if										3,	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
Output	t from w	ater hea	ter	!				ı					
(64)m=	219.59	193.52	203.15	182	176.84	155.75	149.22	166.34	167.53	188.73	199.71	214.27	
			<u> </u>					Outp	out from wa	ater heate	r (annual)₁	12	2216.65 (64)
Heat g	ains fro	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	1
(65)m=	68.81	60.55	63.34	56.45	54.71	48	45.7	51.22	51.64	58.55	62.33	67.04	(65)
inclu	ude (57)	m in cal	culation o	of (65)m	only if c	vlinder i	s in the c	Ldwellina	or hot w	ater is fr	om com	munity h	eating
		ains (see				,							
	Ĭ				<i>)</i> •								
Metab	Jan	s (Table Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.63	145.63	145.63	145.63	145.63	145.63	145.63	145.63	145.63	145.63	145.63	145.63	(66)
` '		(calcula	<u> </u>		ļ		<u> </u>						,
(67)m=	27.36	24.3	19.76	14.96	11.18	9.44	10.2	13.26	17.8	22.6	26.37	28.12	(67)
			l								20.57	20.12	(07)
	nces ga	ins (calc	ulated ir	ı Abbeni	iix L. ea	uauon L	13 OF L 1.	sa). aisc	see ra	bie 5			
(68)m=	200.05	240.02	202.04							i	070.05	202.24	(69)
	306.85	310.03	302.01	284.93	263.37	243.1	229.56	226.38	234.4	251.48	273.05	293.31	(68)
	ng gains	(calcula	ited in A	284.93 ppendix	263.37 L, equat	243.1 tion L15	229.56 or L15a)	226.38), also se	234.4 ee Table	251.48 5			
(69)m=	ng gains 37.56	(calcula 37.56	ated in A 37.56	284.93 ppendix 37.56	263.37	243.1	229.56	226.38	234.4	251.48	273.05 37.56	293.31	(68) (69)
(69)m= Pumps	ng gains 37.56 and fa	(calcula 37.56 ns gains	ted in A 37.56 (Table \$	284.93 ppendix 37.56	263.37 L, equat 37.56	243.1 tion L15 37.56	229.56 or L15a) 37.56	226.38), also se 37.56	234.4 ee Table 37.56	251.48 5 37.56	37.56	37.56	(69)
(69)m= Pumps (70)m=	ng gains 37.56 s and fa	37.56 ns gains	37.56 (Table \$	284.93 ppendix 37.56 5a)	263.37 L, equat 37.56	243.1 tion L15 37.56	229.56 or L15a)	226.38), also se	234.4 ee Table	251.48 5			
(69)m= Pumps (70)m= Losses	ng gains 37.56 s and fa 3 s e.g. ev	37.56 ns gains 3	37.56 (Table §	284.93 ppendix 37.56 5a) 3	263.37 L, equal 37.56 3 es) (Tab	243.1 tion L15 37.56 3	229.56 or L15a) 37.56	226.38), also se 37.56	234.4 ee Table 37.56	251.48 5 37.56	37.56	37.56	(69) (70)
(69)m= Pumps (70)m= Losses	ng gains 37.56 s and fa 3 s e.g. ev	37.56 ns gains	37.56 (Table \$	284.93 ppendix 37.56 5a)	263.37 L, equat 37.56	243.1 tion L15 37.56	229.56 or L15a) 37.56	226.38), also se 37.56	234.4 ee Table 37.56	251.48 5 37.56	37.56	37.56	(69)
(69)m= Pumps (70)m= Losses (71)m=	37.56 s and fa 3 s e.g. ev -116.51	37.56 ns gains 3	37.56 (Table \$ 3 on (nega	284.93 ppendix 37.56 5a) 3	263.37 L, equal 37.56 3 es) (Tab	243.1 tion L15 37.56 3	229.56 or L15a) 37.56	226.38), also se 37.56	234.4 ee Table 37.56	251.48 5 37.56	37.56	37.56	(69) (70)



Total i	nternal	gains =				(66)	m + (67)m	ı + (68)m +	- (69)m + (70)m + (7	1)m + (72)	m	
(73)m=	496.38	494.12	476.6	447.98	417.78	388.9	370.88	378.18	393.61	422.47	455.68	481.23	(73)

(73)m=	496.38	494.12	4/6.6	447.9	3 417.7	8 .	388.9	370.88	3/8	.18	393.61	422.4	7 455.68	481.2	23		(73)
	lar gain		usina sol:	ar flux fro	ım Tahle 6	sa and	d assoc	riated equa	tions t	to cor	overt to th	e annlic	able orientat	ion			
	_	Access F	_			a and	Flu		lions			e applic	FF	.1011.		Gains	
Offerit		Table 6d	actor	Are m				ble 6a			g_ able 6b		Table 6c			(W)	
Northe	ast _{0.9x} [0.77	x		2.53] x	_	11.28	x		0.76	x	0.7	\neg	=	10.52	(75)
	ast _{0.9x} [0.77	^	-	2.53	」^]x	=	11.28) ^ x		0.76	^ x	0.7	\dashv	 	10.52	(75)
	ast _{0.9x} [0.77	^	-	2.53]		11.28) ^ x		0.76	^ x	0.7	\dashv	 	10.52	(75)
	ast _{0.9x} [0.77	^	-	2.53] ^] x		11.28] ^ x		0.76	$\frac{1}{x}$	0.7		- I - I	10.52	(75) (75)
	ast _{0.9x}	0.77	^	-	2.53] ^] x	=	22.97) ^ x		0.76	^ x	0.7	=	 	21.42	(75)
	ast _{0.9x} [0.77	^	-	2.53	」 ^] x	=	22.97	x		0.76		0.7	_	 	21.42	(75)
	ast _{0.9x}	0.77	x	-	2.53] x		22.97	X		0.76	X	0.7	\equiv	=	21.42	(75)
	ast _{0.9x}	0.77		-	2.53]]		22.97	X		0.76	X	0.7	=	=	21.42	(75)
Northe	ا ast _{0.9x} [0.77	x	-	2.53) x		41.38	X		0.76	×	0.7		=	38.6	(75)
Northe	ast _{0.9x}	0.77	×		2.53	X		41.38	X		0.76	×	0.7		=	38.6	(75)
Northe	ast _{0.9x}	0.77	x		2.53	x		41.38	X		0.76	×	0.7		=	38.6	(75)
Northe	ast _{0.9x}	0.77	×		2.53	×		41.38	x		0.76	×	0.7		=	38.6	(75)
Northe	ast _{0.9x}	0.77	×		2.53	x		67.96	x		0.76	×	0.7		=	63.39	(75)
Northe	ast _{0.9x}	0.77	×		2.53	x	(67.96	x		0.76	×	0.7		=	63.39	(75)
Northe	ast _{0.9x}	0.77	х		2.53	x	(67.96	x		0.76	x	0.7		=	63.39	(75)
Northe	ast _{0.9x}	0.77	×		2.53	x	(67.96	X		0.76	x	0.7		= [63.39	(75)
Northe	ast _{0.9x} [0.77	х		2.53	x	(91.35	X		0.76	X	0.7		=	85.2	(75)
Northe	ast _{0.9x} [0.77	х		2.53	x	(91.35	x		0.76	X	0.7		=	85.2	(75)
Northe	ast _{0.9x} [0.77	Х		2.53	X	(91.35	X		0.76	X	0.7		= [85.2	(75)
Northe	ast _{0.9x}	0.77	X		2.53	X	Ó	91.35	X		0.76	X	0.7		=	85.2	(75)
Northe	ast _{0.9x} [0.77	X		2.53	X	(97.38	X		0.76	X	0.7		=	90.84	(75)
	ast _{0.9x}	0.77	х		2.53	X	9	97.38	X		0.76	X	0.7		=	90.84	(75)
	ast _{0.9x}	0.77	х		2.53	X	9	97.38	X		0.76	X	0.7		= [90.84	(75)
	ast _{0.9x}	0.77	×		2.53	X		97.38	X		0.76	X	0.7		= [90.84	(75)
	ast _{0.9x}	0.77	х		2.53	X		91.1	X		0.76	X	0.7		=	84.97	(75)
	ast _{0.9x}	0.77	×		2.53	X		91.1	X		0.76	X	0.7		=	84.97	(75)
	ast _{0.9x}	0.77	×		2.53	X		91.1	X		0.76	X	0.7		=	84.97	(75)
	ast _{0.9x}	0.77	×		2.53	X		91.1	X		0.76	X	0.7		=	84.97	(75)
	ast _{0.9x}	0.77	×		2.53	X		72.63	X		0.76	X	0.7		=	67.74	(75)
	ast _{0.9x}	0.77	×		2.53	X		72.63	X		0.76	X	0.7	_	=	67.74	(75)
	ast _{0.9x}	0.77	Х		2.53	X		72.63	X	<u> </u>	0.76	X	0.7	_	=	67.74	(75)
	ast _{0.9x}	0.77	×		2.53	X		72.63	X		0.76	X	0.7	_	=	67.74	(75)
	ast _{0.9x}	0.77	×		2.53	X	<u></u> ;	50.42	X		0.76	X	0.7	_	=	47.03	(75)
Northe	ast _{0.9x}	0.77	X		2.53	X		50.42	X		0.76	X	0.7		=	47.03	(75)



Northeast 0 sk			,		,		,		1		,		_
Northeast 0 sk	Northeast _{0.9x}	0.77	X	2.53	X	50.42	X	0.76	X	0.7] =	47.03	(75)
Northeast 0.9x	<u> </u>	0.77	X	2.53	X	50.42	X	0.76	X	0.7] =	47.03	(75)
Northeast 0, sk	<u> </u>	0.77	X	2.53	X	28.07	X	0.76	X	0.7] =	26.18	(75)
Northeast 0.9x	<u> </u>	0.77	X	2.53	X	28.07	X	0.76	X	0.7	=	26.18	(75)
Northeast 0.6x	<u> </u>	0.77	X	2.53	X	28.07	X	0.76	X	0.7	=	26.18	(75)
Northeast 0, 9x	<u> </u>	0.77	X	2.53	X	28.07	X	0.76	X	0.7	=	26.18	(75)
Northeast 0.6x	<u> </u>	0.77	X	2.53	X	14.2	X	0.76	X	0.7	=	13.24	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	2.53	X	14.2	X	0.76	X	0.7	=	13.24	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	2.53	X	14.2	X	0.76	X	0.7	=	13.24	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	2.53	X	14.2	X	0.76	X	0.7	=	13.24	(75)
Northeast 0.9x	<u> </u>	0.77	X	2.53	X	9.21	X	0.76	X	0.7	=	8.59	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	2.53	X	9.21	X	0.76	X	0.7	=	8.59	(75)
Southwesto, 9x	Northeast _{0.9x}	0.77	X	2.53	X	9.21	X	0.76	X	0.7	=	8.59	(75)
Southwesto, 9x	Northeast _{0.9x}	0.77	X	2.53	X	9.21	X	0.76	X	0.7	=	8.59	(75)
Southwesto, 9x 0.77	Southwest _{0.9x}	0.77	X	5.31	X	36.79]	0.76	X	0.7	=	72.03	(79)
Southwesto, 9x	Southwest _{0.9x}	0.77	X	8.12	X	36.79]	0.76	X	0.7	=	110.15	(79)
Southwest0.9x 0.77 x 8.12 x 62.67 0.76 x 0.7 = 187.62 79 Southwest0.9x 0.77 x 3.42 x 62.67 0.76 x 0.7 = 79.02 79 Southwest0.9x 0.77 x 5.31 x 88.75 0.76 x 0.7 = 167.88 79 Southwest0.9x 0.77 x 8.12 x 88.75 0.76 x 0.7 = 256.71 79 Southwest0.9x 0.77 x 3.42 x 88.75 0.76 x 0.7 = 108.12 79 Southwest0.9x 0.77 x 3.42 x 88.75 0.76 x 0.7 = 268.01 79 Southwest0.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 1818.08 79 Southwest0.9x 0.77 x 3.42 x 106.25 0.76 x 0.7 = 318.08 79 Southwest0.9x 0.77 x 3.42 x 106.25 0.76 x 0.7 = 133.97 79 Southwest0.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 232.98 79 Southwest0.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 366.28 79 Southwest0.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 231.3 79 Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 333.7 79 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.07 9 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 114.39 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 341.02 179 Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 179 Southwest0.9x 0.77	Southwest _{0.9x}	0.77	X	3.42	X	36.79]	0.76	X	0.7	=	46.39	(79)
Southwest0.9x	Southwest _{0.9x}	0.77	X	5.31	X	62.67]	0.76	X	0.7	=	122.69	(79)
Southwest0.9x	Southwest _{0.9x}	0.77	X	8.12	X	62.67		0.76	X	0.7	=	187.62	(79)
Southwest0.9x 0.77 x 8.12 x 85.75 0.76 x 0.7 = 256.71 (79) Southwest0.9x 0.77 x 3.42 x 85.75 0.76 x 0.7 = 108.12 (79) Southwest0.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 208.01 (79) Southwest0.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 208.01 (79) Southwest0.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 318.08 (79) Southwest0.9x 0.77 x 5.31 x 119.01 0.76 x 0.7 = 232.98 (79) Southwest0.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 232.98 (79) Southwest0.9x 0.777	Southwest _{0.9x}	0.77	X	3.42	X	62.67		0.76	X	0.7	=	79.02	(79)
Southwesto,9x	Southwest _{0.9x}	0.77	X	5.31	X	85.75]	0.76	X	0.7	=	167.88	(79)
Southwesto,9x 0.77 x 5.31 x 106.25	Southwest _{0.9x}	0.77	X	8.12	X	85.75]	0.76	X	0.7	=	256.71	(79)
Southwesto.9x 0.77 x 8.12 x 106.25 0.76 x 0.7 = 318.08 (79) Southwesto.9x 0.77 x 3.42 x 106.25 0.76 x 0.7 = 133.97 (79) Southwesto.9x 0.77 x 5.31 x 119.01 0.76 x 0.7 = 232.98 (79) Southwesto.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 232.98 (79) Southwesto.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 356.28 (79) Southwesto.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 148.97 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	3.42	X	85.75]	0.76	X	0.7	=	108.12	(79)
Southwesto.9x 0.77 x 3.42 x 106.25 0.76 x 0.7 = 133.97 (79) Southwesto.9x 0.77 x 5.31 x 119.01 0.76 x 0.7 = 232.98 (79) Southwesto.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 356.28 (79) Southwesto.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 356.28 (79) Southwesto.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 150.06 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 148.97 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	5.31	X	106.25]	0.76	X	0.7	=	208.01	(79)
Southwest0.9x 0.77 x 5.31 x 119.01 0.76 x 0.7 = 232.98 (79) Southwest0.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 356.28 (79) Southwest0.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 150.06 (79) Southwest0.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 231.3 (79) Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwest0.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwest0.9x 0.77	Southwest _{0.9x}	0.77	X	8.12	X	106.25]	0.76	X	0.7	=	318.08	(79)
Southwesto.9x 0.77 x 8.12 x 119.01 0.76 x 0.7 = 356.28 (79) Southwesto.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 150.06 (79) Southwesto.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	3.42	X	106.25]	0.76	X	0.7	=	133.97	(79)
Southwesto.9x 0.77 x 3.42 x 119.01 0.76 x 0.7 = 150.06 (79) Southwesto.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwesto.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwesto.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 148.97 (79) Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwesto.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77 <	Southwest _{0.9x}	0.77	X	5.31	X	119.01]	0.76	X	0.7	=	232.98	(79)
Southwest0.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 231.3 (79) Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwest0.9x 0.77 x 5.31 x 118.15 0.76 x 0.7 = 148.97 (79) Southwest0.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwest0.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwest0.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 143.62 (79) Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwest0.9x 0.77 <	Southwest _{0.9x}	0.77	X	8.12	X	119.01]	0.76	X	0.7	=	356.28	(79)
Southwest0.9x 0.77 x 8.12 x 118.15 0.76 x 0.7 = 353.7 (79) Southwest0.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 148.97 (79) Southwest0.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwest0.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwest0.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 143.62 (79) Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 204.36 (79) Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77	Southwest _{0.9x}	0.77	X	3.42	X	119.01]	0.76	X	0.7	=	150.06	(79)
Southwesto.9x 0.77 x 3.42 x 118.15 0.76 x 0.7 = 148.97 (79) Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwesto.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 312.51 (79) Southwesto.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 312.51 (79) Southwesto.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	5.31	X	118.15]	0.76	X	0.7	=	231.3	(79)
Southwesto.9x 0.77 x 5.31 x 113.91 0.76 x 0.7 = 223 (79) Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwesto.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 204.36 (79) Southwesto.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwesto.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwesto.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwesto.9x 0.77	<u> </u>	0.77	X	8.12	X	118.15]	0.76	X	0.7] =	353.7	(79)
Southwesto.9x 0.77 x 8.12 x 113.91 0.76 x 0.7 = 341 (79) Southwesto.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 143.62 (79) Southwesto.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 204.36 (79) Southwesto.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 312.51 (79) Southwesto.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwesto.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwesto.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	3.42	X	118.15]	0.76	x	0.7	=	148.97	(79)
Southwest0.9x 0.77 x 3.42 x 113.91 0.76 x 0.7 = 143.62 (79) Southwest0.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 204.36 (79) Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwest0.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	5.31	X	113.91]	0.76	X	0.7] =	223	(79)
Southwest0.9x 0.77 x 5.31 x 104.39 0.76 x 0.7 = 204.36 (79) Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwest0.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	8.12	X	113.91]	0.76	X	0.7	=	341	(79)
Southwest0.9x 0.77 x 8.12 x 104.39 0.76 x 0.7 = 312.51 (79) Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwest0.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	3.42	X	113.91]	0.76	x	0.7] =	143.62	(79)
Southwest0.9x 0.77 x 3.42 x 104.39 0.76 x 0.7 = 131.62 (79) Southwest0.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwest0.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	L	0.77	X	5.31	X	104.39]	0.76	x	0.7] =	204.36	(79)
Southwesto.9x 0.77 x 5.31 x 92.85 0.76 x 0.7 = 181.77 (79) Southwesto.9x 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	8.12	X	104.39]	0.76	X	0.7] =	312.51	(79)
Southwest _{0.9x} 0.77 x 8.12 x 92.85 0.76 x 0.7 = 277.97 (79)	Southwest _{0.9x}	0.77	X	3.42	X	104.39]	0.76	x	0.7] =	131.62	(79)
	Southwest _{0.9x}	0.77	X	5.31	X	92.85]	0.76	X	0.7] =	181.77	(79)
Southwest _{0.9x} 0.77 x 3.42 x 92.85 0.76 x 0.7 = 117.07 (79)	Southwest _{0.9x}	0.77	X	8.12	X	92.85]	0.76	X	0.7] =	277.97	(79)
	Southwest _{0.9x}	0.77	X	3.42	X	92.85]	0.76	X	0.7	=	117.07	(79)



		,				,						_
Southwest _{0.9x}	0.77	X	5.31	X	69.27	_	0.76	X	0.7	=	135.6	(79)
Southwest _{0.9x}	0.77	X	8.12	X	69.27	<u> </u>	0.76	X	0.7	=	207.36	(79)
Southwest _{0.9x}	0.77	X	3.42	X	69.27]	0.76	X	0.7	=	87.34	(79)
Southwest _{0.9x}	0.77	X	5.31	X	44.07]	0.76	X	0.7	=	86.28	(79)
Southwest _{0.9x}	0.77	X	8.12	X	44.07		0.76	X	0.7	=	131.93	(79)
Southwest _{0.9x}	0.77	X	3.42	X	44.07		0.76	X	0.7	=	55.57	(79)
Southwest _{0.9x}	0.77	X	5.31	X	31.49]	0.76	X	0.7	=	61.64	(79)
Southwest _{0.9x}	0.77	X	8.12	x	31.49		0.76	X	0.7	=	94.26	(79)
Southwest _{0.9x}	0.77	x	3.42	x	31.49		0.76	x	0.7	=	39.7	(79)
Northwest 0.9x	0.77	x	0.69	X	11.28	x	0.76	x	0.7	=	2.87	(81)
Northwest _{0.9x}	0.77	x	1.27	x	11.28	x	0.76	x	0.7	=	5.28	(81)
Northwest _{0.9x}	0.77	x	0.69	x	22.97	x	0.76	x	0.7	=	5.84	(81)
Northwest 0.9x	0.77	x	1.27	x	22.97	x	0.76	x	0.7	=	10.75	(81)
Northwest _{0.9x}	0.77	x	0.69	X	41.38	x	0.76	X	0.7	=	10.53	(81)
Northwest _{0.9x}	0.77	x	1.27	x	41.38	x	0.76	x	0.7] =	19.37	(81)
Northwest _{0.9x}	0.77	x	0.69	x	67.96	x	0.76	x	0.7	=	17.29	(81)
Northwest _{0.9x}	0.77	x	1.27	X	67.96	x	0.76	x	0.7	=	31.82	(81)
Northwest 0.9x	0.77	x	0.69	x	91.35	x	0.76	x	0.7	=	23.24	(81)
Northwest _{0.9x}	0.77	X	1.27	X	91.35	x	0.76	X	0.7	=	42.77	(81)
Northwest 0.9x	0.77	x	0.69	X	97.38	X	0.76	x	0.7	=	24.77	(81)
Northwest _{0.9x}	0.77	x	1.27	x	97.38	x	0.76	x	0.7	=	45.6	(81)
Northwest _{0.9x}	0.77	x	0.69	x	91.1	X	0.76	x	0.7	=	23.17	(81)
Northwest 0.9x	0.77	x	1.27	X	91.1	X	0.76	x	0.7	=	42.66	(81)
Northwest 0.9x	0.77	x	0.69	X	72.63	X	0.76	x	0.7	=	18.48	(81)
Northwest _{0.9x}	0.77	x	1.27	x	72.63	X	0.76	x	0.7	=	34.01	(81)
Northwest _{0.9x}	0.77	x	0.69	X	50.42	X	0.76	x	0.7	=	12.83	(81)
Northwest 0.9x	0.77	x	1.27	X	50.42	X	0.76	x	0.7	=	23.61	(81)
Northwest _{0.9x}	0.77	X	0.69	X	28.07	X	0.76	X	0.7	=	7.14	(81)
Northwest _{0.9x}	0.77	X	1.27	X	28.07	X	0.76	X	0.7	=	13.14	(81)
Northwest _{0.9x}	0.77	X	0.69	X	14.2	X	0.76	X	0.7	=	3.61	(81)
Northwest _{0.9x}	0.77	X	1.27	X	14.2	X	0.76	X	0.7	=	6.65	(81)
Northwest 0.9x	0.77	X	0.69	X	9.21	x	0.76	x	0.7] =	2.34	(81)
Northwest _{0.9x}	0.77	X	1.27	X	9.21	X	0.76	X	0.7	=	4.31	(81)
Rooflights _{0.9x}	1	X	12.74	X	20.24	X	0.76	X	0.7	=	123.44	(82)
Rooflights 0.9x	1	X	12.74	x	40.55	X	0.76	x	0.7] =	247.33	(82)
Rooflights 0.9x	1	x	12.74	x	74.78	x	0.76	x	0.7] =	456.16	(82)
Rooflights 0.9x	1	X	12.74	x	130.19	X	0.76	x	0.7] =	794.13	(82)
Rooflights 0.9x	1	X	12.74	X	183.82	x	0.76	x	0.7] =	1121.29	(82)
Rooflights 0.9x	1	x	12.74	x	200.21	x	0.76	X	0.7] =	1221.24	(82)
Rooflights 0.9x	1	X	12.74	x	185.57	X	0.76	x	0.7] =	1131.99	(82)
Rooflights 0.9x	1	X	12.74	X	142.19	X	0.76	X	0.7	=	867.36	(82)



Rooflig	hts _{0.9x}	1	x	12.	74	x g	3.09	X	0.76	x	0.7	=	567.83	(82)
Rooflig	hts _{0.9x}	1	x	12.	74	x 4	9.71	х	0.76	x	0.7	=	303.23	(82)
Rooflig	hts _{0.9x}	1	x	12.	74	x 2	25.27	X	0.76	_ x _	0.7		154.14	(82)
Rooflig	hts _{0.9x}	1	x	12.	74	x 1	6.69	x	0.76	i x i	0.7	=	101.83	(82)
	_													
Solar o	nains in	watts ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	402.26	738.95	1173.16			2388.92	2245.34	1839.3	1369.2	858.54	491.14	338.48		(83)
Total g	ıains – ir	nternal a	ınd solar	(84)m =	= (73)m ·	+ (83)m	, watts		<u>I</u>			<u>I</u>		
(84)m=	898.65	1233.08	1649.76	2204.81	2685.2	2777.82	2616.22	2217.48	1762.8	1281	946.82	819.7		(84)
7 Me	an inter	nal temn	erature	(heating	season	١								
		•	eating p	`		,	from Tak	olo 0. Th	1 (°C)				21	(85)
		Ū	٠.			•		л е э, тп	1 (C)				21	(03)
Utilisa			ains for I			Ì		A	Con	0-4	Nav	Dag		
(00)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(86)
(86)m=	1	0.99	0.94	0.79	0.56	0.38	0.28	0.34	0.62	0.93	0.99	1		(00)
Mean	interna	temper	ature in l	iving are	ea T1 (fo	llow ste	ps 3 to 7	in Tabl	e 9c)			· · · · · · · · · · · · · · · · · · ·		
(87)m=	19.71	20	20.41	20.81	20.97	21	21	21	20.96	20.63	20.06	19.65		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	19.9	19.9	19.9	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91		(88)
Utilisa	ation fac	tor for a	ains for r	est of d	welling	h2 m (se	e Table	9a)						
(89)m=	1	0.98	0.93	0.75	0.5	0.32	0.21	0.26	0.54	0.9	0.99	1		(89)
	·	4	_4	U4	- £ -l II:	TO /f	- 11 4 -	0 4- '	7 : T-l-l	- 0-\				
(90)m=	18.19	18.61	ature in 1	19.71	19.88	ng 12 (10	19.91	19.91	7 IN Tabl	e 9c) 19.51	18.71	18.11		(90)
(90)111=	10.19	10.01	19.19	19.71	19.00	19.91	19.91	19.91	<u> </u>	LA = Livin			0.47	(91)
										L/ C LIVIII	g aroa · (-	•)	0.47	(91)
Mean		temper	ature (fo		ole dwe			+ (1 – fL						
(92)m=	18.9	19.25	19.76	20.22	20.39	20.42	20.42	20.42	20.39	20.03	19.34	18.83		(92)
			he mean									1		
(93)m=	18.9	19.25	19.76	20.22	20.39	20.42	20.42	20.42	20.39	20.03	19.34	18.83		(93)
			uirement							. —				
			ernal ter or gains เ	•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
uio ui	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm		ividy	Juli	<u> </u>	7149	ССР	000	1101			
(94)m=	0.99	0.98	0.93	0.76	0.53	0.35	0.24	0.3	0.57	0.9	0.99	1		(94)
	LI II gains.	hmGm .	W = (94		L 4)m		<u> </u>							
(95)m=	894.03		1527.01	, ,		965.62	636.04	667.94	1012.99	1155.07	934.28	816.88		(95)
Montl	nly avera	age exte	rnal tem	perature	from Ta	able 8	<u> </u>							
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]		ı		
(97)m=	2459.91	2416.38	2229.7	1896.45	1453.69	969.56	636.57	669.38	1049.69	1577.81	2051.89	2456.05		(97)
Space	e heating	g require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	1165.01	811.7	522.8	158.7	26.66	0	0	0	0	314.52	804.68	1219.55		
														_
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	5023.63	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year			Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	5023.63 36.47	(98)



9a. Energy requirements	– Individua	heating s	vstems i	ncluding	micro-C	CHP)					
Space heating:	—aividda	_noating-0	уотонно і	o.aamg	,-1111010-C	~ II)					
Fraction of space heat fr	om second	ary/supple	ementary	system						0	(201)
Fraction of space heat fr	om main s	vstem(s)			(202) = 1	- (201) =				1	(202)
Fraction of total heating	from main	system 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space	heating sy	stem 1								90.4	(206)
Efficiency of secondary/s	supplemen	ary heatin	g systen	n, %						0	(208)
Jan Feb	Mar Ap	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement			i 	i			1			1	
1165.01 811.7 5	22.8 158.	26.66	0	0	0	0	314.52	804.68	1219.55		
(211) m = {[(98)m x (204)]			i	i	1		1	ı	ı	1	(211)
1288.73 897.9 57	78.32 175.5	6 29.49	0	0	0	0	347.92	890.13	1349.05		-
					lota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	5557.11	(211)
Space heating fuel (seco	• ,	h/month									
= {[(98)m x (201)] } x 100 (215)m= 0 0	÷ (208)	0	0	0	T 0	0	0	0	0		
(213)111- 0 0							ar) =Sum(2	_		0	(215)
Water heating							, (- 715,1012		0	(2.0)
Output from water heater	(calculated	above)									
	03.15 182	176.84	155.75	149.22	166.34	167.53	188.73	199.71	214.27		
Efficiency of water heater		•					!			80.3	(216)
(217)m= 88.63 88.26 8	37.33 84.7	81.49	80.3	80.3	80.3	80.3	86.33	88.19	88.73		(217)
Fuel for water heating, kV		•	•	•			•				
(219) m = (64) m x $100 \div$ (219)m= 247.76 219.25 23	(217)m _{32.64} 214.8	6 217	193.96	185.83	207.15	208.64	218.62	226.44	241.48		
(219)111- 247.70 219.25 23	32.04 214.0	0 217	193.90	100.00		I = Sum(2		220.44	241.40	2613.61	(219)
Annual totals					1010	. Guiii(E		Wh/yeaı		kWh/yea	
Space heating fuel used,	main syste	m 1					K.	vviii y cai		5557.11	<u>'</u>
Water heating fuel used	,									2613.61	╡
G		ده ددده ا	_							2010.01	
Electricity for pumps, fans	s and electr	іс кеер-по	ı							ı	
central heating pump:									30		(230c
boiler with a fan-assisted	d flue								45		(230e
Total electricity for the ab	ove, kWh/y	ear			sum	of (230a).	(230g) =			75	(231)
Electricity for lighting										483.11	(232)
12a. CO2 emissions – Ir	ndividual he	ating syst	ems incl	uding mi	icro-CHF)					
				i ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	
Space heating (main syst	em 1)		(21	1) x			0.2	16	=	1200.34	(261)
Space heating (secondar	y)		(21	5) x			0.5	19	=	0	(263)
Water heating			(21	9) x			0.2	16	=	564.54	(264)
Space and water heating			(26	1) + (262)	+ (263) + (264) =				1764.88	(265)
										1101.00	(



Electricity for pumps, fans and electric keep-hot (231) x 0.519 = 38.93 (267) Electricity for lighting (232) x 0.519 = 250.74 (268)

Energy saving/generation technologies

Total CO2, kg/year sum of (265)...(271) = 209

Total CO2, kg/year sum of (265)...(271) = 2054.54 (272) **Dwelling CO2 Emission Rate** $(272) \div (4) =$ 14.91 (273)

El rating (section 14)



User Details: STRO007945 **Assessor Name:** Peter Mitchell Stroma Number: Stroma FSAP 2012 Version: 1.0.4.5 **Software Name: Software Version:** Property Address: Unit 6 (GFEND) CLEAN New Dwelling at:, Gordon House, 6 Lissenden Gardens, LONDON, NW5 1LX Address: 1. Overall dwelling dimensions: Volume(m³) Area(m²) Av. Height(m) Ground floor 96.54 (1a) x 2.4 (2a) =231.7 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)96.54 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =231.7 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b)0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = \div (5) = (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) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)Λ 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 (12)0 If no draught lobby, enter 0.05, else enter 0 (13)n Percentage of windows and doors draught stripped (14)0 Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)4 If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise (18) = (16)0.2 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)3 $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78 $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.16 Infiltration rate modified for monthly wind speed Jan Feb Oct Mar Apr May Jun Jul Aug Sep Nov Dec Monthly average wind speed from Table 7 (22)m=5.1 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor $(22a)m = (22)m \div 4$

1.23

1.1

1.08

0.95

0.95

0.92

1

1.08

1.12

1.18

(22a)m

1.27

1.25



94.5page 2 of 39)

Average = Sum(39)_{1...12} /12=

0.2	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18		
Calculate effe		_	rate for t	he appli	cable ca	se		<u> </u>	<u> </u>			<u> </u>	
If mechanic												0.5	(23
If exhaust air I) = (23a)			0.5	(23
If balanced wi		-	-	_		•						0	(23
a) If balanc	_		—	—		- ` ` 	- ´ ` -	ŕ	 	- ´ -	1 – (23c)	÷ 100]	
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balanc			ı —	ı —		 	- ^ `	``	 			1	(0
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole				•	•				E (00k	. \			
<u> </u>	m < 0.5 > 0.5	0.5	nen (240 0.5	0.5 = (230)	0.5	0.5	c) = (22t 0.5	0.5 m + 0.	5 × (230 0.5	0.5	0.5	1	(2
′	ļ	<u> </u>	<u> </u>	l			ļ		0.5	0.5	0.5		(2.
d) If natural	i ventilati m = 1, th			•	•				0.51				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective ai	r change	rate - er	ıter (24a) or (24	o) or (24	c) or (24	d) in bo	(25)			<u> </u>	l	
25)m= 0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		(2
					<u> </u>	<u> </u>		l .	!				
3. Heat loss													
ELEMENT	Gros area		Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I		k-value kJ/m²·		A X k kJ/K
Vindows Typ		()			7.39		/[1/(1.2)+		8.46			•	(27
Vindows Typ					3.5	=	/[1/(1.2)+	l l	4.01	=			(2
Vindows Typ					8.26 x1/[1/(1.2)+0.04] = 9.46					\dashv			(2
Vindows Typ					$\begin{array}{ c c c c c c c c c c c c c c c c c c c$					=			(2
Vindows Typ					$\begin{array}{ c c c c c c c c c c c c c c c c c c c$					=			(2
Valls		44	22.0			=		= [╡ ,			(2)
otal area of	108.		32.6	9	75.45	=	0.16		12.07				
	elements	9, 111			108.1	=							(3
Party wall					19.25	_	0	=	0	닠 ¦		╡	(3:
Party wall	, , ,		· · ·		15.26		0	= [0				(3:
for windows an * include the are						ated using	i formula 1	/[(1/U-vaiu	ie)+0.04] a	as given in	paragrapr	1 3.2	
abric heat lo				•			(26)(30) + (32) =				49.5	(3:
leat capacity	Cm = S	(A x k)						((28)	(30) + (32	2) + (32a).	(32e) =	0	(3-
hermal mas	s parame	eter (TMF	P = Cm +	· TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design asses	ssments wh	ere the de	tails of the	construct	ion are no	t known pi	ecisely the	indicative	values of	TMP in Ta	able 1f		
an be used inst													
hermal bridg	,	•		•	•	K						6.79	(3
details of therm otal fabric he		are not kn	own (36) =	= 0.15 x (3	11)			(33) +	(36) =			50.00	
entilation he		alculated	l monthly	M.					= 0.33 × (25)m v (5))	56.29	(3
Jan	Feb	Mar	·	, 	Jun	Jul	Λιια	Sep	Oct	Nov	Dec]	
38)m= 38.23	38.23	38.23	Apr 38.23	May 38.23	38.23	38.23	Aug 38.23	38.23	38.23	38.23	38.23		(3
′		<u> </u>	50.23	50.23	50.23	30.23	30.23	<u> </u>	<u> </u>	<u> </u>	30.23	I	(5)
leat transfer	1	 	I .	I .	Ι.	Ι.	Ι.		= (37) + (T .	1	
39)m= 94.52	94.52	94.52	94.52	94.52	94.52	94.52	94.52	94.52	94.52	94.52	94.52	1	



Heat lo	ss para	meter (F	HLP), W	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98		
`										L Average =	Sum(40) ₁	12 /12=	0.98	(40)
Numbe	r of day	s in mo	nth (Tab	le 1a)										_
Į	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. Wat	ter heat	ing enei	gy requi	rement:								kWh/ye	ear:	
if TF				[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	ΓFA -13.		71		(42)
Reduce t	the annua	l average	hot water	usage by	es per da 5% if the d vater use, l	welling is	designed t			se target o		.45		(43)
Γ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ir	litres per	day for ea	ch month	Vd,m = fa	ctor from	able 1c x	(43)			!			
(44)m=	108.29	104.35	100.42	96.48	92.54	88.6	88.6	92.54	96.48	100.42	104.35	108.29		
Enoravo	ontont of	hat water	used sel	ouloted m	anthly = 1	100 v Vd n	n v nm v [Tm / 2600			m(44) ₁₁₂ =		1181.35	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	160.59	140.45	144.94	126.36	121.24	104.63	96.95	111.25	112.58	131.2	143.22	155.52	1548.94	(45)
Total = $Sum(45)_{112}$ = If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)												1548.94	(43)	
(46)m=	24.09	21.07	21.74	18.95	18.19	15.69	14.54	16.69	16.89	19.68	21.48	23.33		(46)
Water 5	_													
_		• •			olar or W		_		ame ves	sei		0		(47)
	•	•			/elling, e ncludes i			` '	ers) ente	er '∩' in <i>(</i>	(47)			
Waters			not wate	, (ano n	ioidaco i	notantai	10000 00	TIDI DOII	010) 0110) III (71)			
a) If ma	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature fa	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
,				•	loss fact									
		•	tactor fr ee secti		le 2 (kW	h/litre/da	ıy)					0		(51)
	-	eaung s from Ta		011 4.3								0		(52)
			m Table	2b								0		(53)
•			storage		ear			(47) x (51)) x (52) x (53) =		0		(54)
		54) in (5	-	,	Jul			() ()	, (==, (,		0		(55)
Waters	storage	loss cal	culated t	or each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	r contains	dedicate	l d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	loss (ar	nual) fro	m Table				•				0		(58)
-		•	•		month (59)m = ((58) ÷ 36	65 × (41)	m					* *
-					here is s	•		, ,		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	35 × (41)m						
(61)m=	50.96	46.03	50.96	47.58	47.16	43.69	45.15	47.16	47.58	50.96	49.32	50.96	1	(61)
Total h	neat requ	uired for	water he	ـــــــــ eating ca	alculated	for eacl	h month	(62)m =	: 0.85 × 1	 (45)m +	(46)m +	(57)m +	ı · (59)m + (61)m	
(62)m=	211.55	186.48	195.9	173.94	168.4	148.32	142.1	158.41	160.16	182.16	192.53	206.48	1	(62)
Solar DI	HW input o	calculated	using App	endix G or	Appendix	x H (negativ	ve quantit	y) (enter 'C)' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	I lines if	FGHRS	and/or V	NWHRS	applies,	, see Ap	pendix (3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	31.8	23.57	17.43	10.72	9.02	7.72	7.39	8.33	8.37	12.67	24.09	33.01		(63) (G2)
WWHR	S -51.74	-45.53	-46.47	-38.23	-35.5	-29.28	-24.78	-30.01	-30.88	-38.18	-44.22	-50.01		(63) (G10)
Outpu	t from wa	ater hea	ter											
(64)m=	126.18	115.73	130.17	123.27	122.18	109.75	108.3	118.38	119.19	129.48	122.44	121.62		_
								Out	put from wa	ater heater	r (annual)₁	12	1446.69	(64)
Heat g	ains froi	m water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	ı + (61)n	n] + 0.8 x	κ [(46)m	+ (57)m	+ (59)m	<u> </u>	
(65)m=	66.14	58.21	60.93	53.91	52.1	45.71	43.52	48.78	49.33	56.36	59.95	64.45		(65)
inclu	ıde (57)ı	m in calc	culation o	of (65)m	only if c	cylinder is	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. In	ternal ga	ains (see	e Table 5	and 5a):									
Metab	olic gain	ıs (Table	e 5), Watt	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	162.31	162.31	162.31	162.31	162.31	162.31	162.31	162.31	162.31	162.31	162.31	162.31		(66)
Lightin	ig gains	(calcula	ted in Ar	pendix	L, equat	tion L9 or	 r L9a), а	lso see	Table 5	1		1	1	
(67)m=	55.86	49.61	40.35	30.54	22.83	19.28	20.83	27.07	36.34	46.14	53.85	57.41]	(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	374.04	377.93	368.14	347.32	321.04	296.33	279.83	275.95	285.73	306.55	332.84	357.54]	(68)
Cookir	າg gains	(calcula	ited in A	ppendix	L, equa	tion L15	or L15a), also s	ee Table	5			J	
(69)m=	53.94	53.94	53.94	53.94	53.94	53.94	53.94	53.94	53.94	53.94	53.94	53.94]	(69)
Pumps	s and far	ns gains	(Table 5	 ja)				.1	.1		1		J	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3]	(70)
Losses	s e.g. ev	/aporatic	on (negat	tive valu	es) (Tal	ole 5)							1	
(71)m=	-108.2	-108.2	-108.2	-108.2	-108.2	-108.2	-108.2	-108.2	-108.2	-108.2	-108.2	-108.2]	(71)
Water	heating	gains (T	 ∫able 5)						.1	<u> </u>		<u> </u>	1	
(72)m=	88.89	86.62	81.9	74.87	70.03	63.49	58.5	65.57	68.51	75.76	83.26	86.63	1	(72)
Total i	internal	gains =	: :			(66)	m + (67)n	n + (68)m ·	+ (69)m + ((70)m + (7	1)m + (72)	<u> </u>	1	
(73)m=	629.83	625.19	601.43	563.78	524.94	490.13	470.2	479.62	501.62	539.49	580.99	612.61]	(73)
	lar gains	5:												
			using solar	r flux from	Table 6a	and associ	ated equa	ations to co	onvert to th	ne applicat	ole orientat	tion.		
Orient		Access F Table 6d		Area m²		Flu: Tab	x ole 6a	1	g_ Table 6b	Ta	FF able 6c		Gains (W)	
Northe	ast _{0.9x} [0.77	x	7.3	30	x 1	1.28) x	0.76	x	0.7		30.74	(75)
	ast _{0.9x} [0.77					1.28] x	0.76	╡ _╺ ╞	0.7	╡ .	34.36](75)
	ast _{0.9x}	0.77					22.97]	0.76	^	0.7	╡ -	62.57](75)
	U.UX	0.77	^	1.3	,9	^	2.91	J ^ L_	0.76	」^ ∟	0.7		02.37](/3)



Northeast _{0.9x}	0.77	X	8.26	X	22.97	X	0.76	X	0.7	=	69.94	(75)
Northeast _{0.9x}	0.77	X	7.39	x	41.38	x	0.76	x	0.7	=	112.74	(75)
Northeast _{0.9x}	0.77	X	8.26	X	41.38	X	0.76	X	0.7	=	126.01	(75)
Northeast _{0.9x}	0.77	X	7.39	X	67.96	X	0.76	X	0.7	=	185.15	(75)
Northeast _{0.9x}	0.77	X	8.26	X	67.96	x	0.76	x	0.7	=	206.94	(75)
Northeast _{0.9x}	0.77	X	7.39	X	91.35	x	0.76	X	0.7	=	248.87	(75)
Northeast _{0.9x}	0.77	X	8.26	X	91.35	X	0.76	X	0.7	=	278.17	(75)
Northeast _{0.9x}	0.77	X	7.39	X	97.38	x	0.76	X	0.7	=	265.33	(75)
Northeast _{0.9x}	0.77	X	8.26	X	97.38	X	0.76	X	0.7	=	296.56	(75)
Northeast _{0.9x}	0.77	X	7.39	X	91.1	X	0.76	X	0.7	=	248.21	(75)
Northeast _{0.9x}	0.77	X	8.26	X	91.1	X	0.76	X	0.7	=	277.43	(75)
Northeast _{0.9x}	0.77	X	7.39	X	72.63	X	0.76	X	0.7	=	197.87	(75)
Northeast _{0.9x}	0.77	X	8.26	X	72.63	X	0.76	X	0.7	=	221.17	(75)
Northeast _{0.9x}	0.77	X	7.39	X	50.42	X	0.76	X	0.7	=	137.37	(75)
Northeast _{0.9x}	0.77	X	8.26	X	50.42	X	0.76	X	0.7	=	153.54	(75)
Northeast _{0.9x}	0.77	X	7.39	X	28.07	X	0.76	x	0.7	=	76.47	(75)
Northeast _{0.9x}	0.77	X	8.26	X	28.07	X	0.76	X	0.7	=	85.47	(75)
Northeast _{0.9x}	0.77	X	7.39	X	14.2	X	0.76	X	0.7	=	38.68	(75)
Northeast _{0.9x}	0.77	X	8.26	X	14.2	X	0.76	X	0.7	=	43.23	(75)
Northeast _{0.9x}	0.77	X	7.39	X	9.21	X	0.76	X	0.7	=	25.1	(75)
Northeast _{0.9x}	0.77	X	8.26	X	9.21	X	0.76	X	0.7	=	28.06	(75)
Southeast _{0.9x}	0.77	X	3.5	X	36.79	X	0.76	X	0.7	=	47.48	(77)
Southeast _{0.9x}	0.77	X	5.28	X	36.79	X	0.76	X	0.7	=	71.62	(77)
Southeast _{0.9x}	0.77	X	3.5	X	62.67	X	0.76	X	0.7	=	80.87	(77)
Southeast _{0.9x}	0.77	X	5.28	X	62.67	x	0.76	X	0.7	=	122	(77)
Southeast _{0.9x}	0.77	X	3.5	X	85.75	X	0.76	X	0.7	=	110.65	(77)
Southeast _{0.9x}	0.77	X	5.28	X	85.75	X	0.76	X	0.7	=	166.93	(77)
Southeast _{0.9x}	0.77	X	3.5	X	106.25	X	0.76	X	0.7	=	137.1	(77)
Southeast _{0.9x}	0.77	X	5.28	X	106.25	X	0.76	X	0.7	=	206.83	(77)
Southeast _{0.9x}	0.77	X	3.5	X	119.01	X	0.76	X	0.7	=	153.57	(77)
Southeast _{0.9x}	0.77	X	5.28	X	119.01	X	0.76	X	0.7	=	231.67	(77)
Southeast _{0.9x}	0.77	X	3.5	X	118.15	X	0.76	X	0.7	=	152.46	(77)
Southeast _{0.9x}	0.77	X	5.28	X	118.15	X	0.76	X	0.7	=	229.99	(77)
Southeast _{0.9x}	0.77	X	3.5	X	113.91	X	0.76	X	0.7	=	146.98	(77)
Southeast _{0.9x}	0.77	X	5.28	X	113.91	X	0.76	X	0.7	=	221.74	(77)
Southeast _{0.9x}	0.77	X	3.5	X	104.39	X	0.76	x	0.7	=	134.7	(77)
Southeast _{0.9x}	0.77	X	5.28	X	104.39	X	0.76	x	0.7	=	203.21	(77)
Southeast _{0.9x}	0.77	X	3.5	X	92.85	X	0.76	X	0.7	=	119.81	(77)
Southeast _{0.9x}	0.77	X	5.28	X	92.85	X	0.76	X	0.7	=	180.75	(77)
Southeast _{0.9x}	0.77	X	3.5	X	69.27	X	0.76	X	0.7] =	89.38	(77)
Southeast 0.9x	0.77	X	5.28	X	69.27	X	0.76	X	0.7	=	134.84	(77)



Southeast 0.9x	0.77	х	3.9	5	X	44.07	7 X		0.76	x	0.7	=	56.87	(77)
Southeast 0.9x	0.77	x	5.2	28	X	44.07	7 X		0.76	x	0.7	=	85.79	(77)
Southeast 0.9x	0.77	х	3.5	5	X	31.49) x		0.76	x	0.7	=	40.63	(77)
Southeast 0.9x	0.77	х	5.2	28	X	31.49) x		0.76	x	0.7	=	61.29	(77)
Southwest _{0.9x}	0.77	x	8.2	26	X	36.79	9		0.76	x	0.7	=	112.05	(79)
Southwest _{0.9x}	0.77	X	8.2	26	X	62.67	7		0.76	- x	0.7	=	190.86	(79)
Southwest _{0.9x}	0.77	x	8.2	26	X	85.75	5		0.76	- x	0.7		261.14	(79)
Southwest _{0.9x}	0.77	X	8.2	26	X	106.2	5		0.76	- x	0.7	=	323.56	(79)
Southwest _{0.9x}	0.77	x	8.2	26	X	119.0	1		0.76	= x =	0.7	=	362.42	(79)
Southwest _{0.9x}	0.77	х	8.2	26	X	118.1	5		0.76	x	0.7	=	359.8	(79)
Southwest _{0.9x}	0.77	x	8.2	26	X	113.9	1		0.76	x	0.7	=	346.88	(79)
Southwest _{0.9x}	0.77	x	8.2	26	X	104.39	9		0.76	= x =	0.7	=	317.9	(79)
Southwest _{0.9x}	0.77	x	8.2	26	X	92.85	5		0.76	X	0.7	=	282.76	(79)
Southwest _{0.9x}	0.77	X	8.2	26	X	69.27	7		0.76	X	0.7	=	210.94	(79)
Southwest _{0.9x}	0.77	X	8.2	26	X	44.07	7		0.76	x	0.7	=	134.21	(79)
Southwest _{0.9x}	0.77	x	8.2	26	X	31.49)		0.76	x	0.7	=	95.89	(79)
Solar gains in	watts, cal	lculated	for eacl	h month	1		(83)	m = Su	m(74)m	.(82)m			_	
(83)m= 296.25		777.46	1059.59	1274.7				74.85	874.23	597.1	358.77	250.98		(83)
Total gains – i	nternal an	nd solar	(84)m =	(73)m	+ (8	83)m , wa	atts						•	
(84)m= 926.08	1151.44	1378.89	1623.37	1799.64	17	794.27 171	11.43 15	54.47	1375.85	1136.58	939.76	863.59		(84)
7. Mean inter	nal tempe	erature (heating	season	2)									
			ricating	Scasoi	')									
Temperature	during he					area from	n Table 9	9, Th1	(°C)				21	(85)
Temperature Utilisation fac	· ·	eating p	eriods ir	n the livi	ing			9, Th1	(°C)				21	(85)
·	· ·	eating p	eriods ir	n the livi	ing	ee Table	9a)	9, Th1 Aug	(°C)	Oct	Nov	Dec	21	(85)
Utilisation fac	tor for gai	eating points	eriods ir	the livi	ing n (s	ee Table Jun J	9a) Jul /		` ′	Oct 0.78	Nov 0.95	Dec 0.99	21	(85)
Utilisation fac	Feb 0.94	eating points for li Mar 0.85	eriods ir iving are Apr _{0.67}	n the livi ea, h1,m May	ing n (s	ee Table Jun J	9a) Jul /	Aug .28	Sep 0.47		+		21	
Utilisation factors Jan (86)m= 0.98 Mean interna	Feb 0.94	eating points for li Mar 0.85	eriods ir iving are Apr _{0.67}	n the livi ea, h1,m May	ing n (s	ee Table Jun J 0.34 0. w steps 3	9a) Jul / .24 0 3 to 7 in	Aug .28	Sep 0.47		+		21	
Utilisation factors Jan (86)m= 0.98 Mean interna (87)m= 20.33	Feb 0.94 tempera 20.56	eating points for line Mar 0.85 ature in l	eriods ir iving are Apr 0.67 iving are 20.95	n the livi ea, h1,m May 0.48 ea T1 (f	ing n (s	ee Table Jun 0.34 0. w steps 3 21	9a) Jul / .24 0 3 to 7 in	Aug .28 Table 21	Sep 0.47 9c) 21	0.78	0.95	0.99	21	(86)
Utilisation factors Jan	Feb 0.94 tempera 20.56	eating points for line Mar 0.85 ature in l	eriods ir iving are Apr 0.67 iving are 20.95	n the livi ea, h1,m May 0.48 ea T1 (f	ing n (s collo	ee Table Jun J 0.34 0. w steps 3 21 2 velling from	9a) Jul / .24 0 3 to 7 in 21 m Table	Aug .28 Table 21	Sep 0.47 9c) 21	0.78	0.95	0.99	21	(86)
Utilisation factors Jan (86)m= 0.98 Mean interna (87)m= 20.33 Temperature (88)m= 20.1	rtor for gainer feb 0.94 I tempera 20.56 during he 20.1	eating points for line Mar 0.85 ature in l 20.8 eating points 20.1	eriods in iving are 0.67 iving are 20.95 eriods in 20.1	n the living the hand may 0.48 the a T1 (for 20.99 the rest of 20.1	ing (s	ee Table Jun J 0.34 0. w steps 3 21 2 velling from 20.1 26	9a) Jul / .24 0 3 to 7 in 21 m Table 0.1 2	Aug .28 Table 21 9, Th 0.1	Sep 0.47 9c) 21 2 (°C)	0.78	0.95	0.99	21	(86)
Utilisation factors Jan (86)m= 0.98 Mean internare 20.33 Temperature 20.1 Utilisation factors	Feb 0.94 I tempera 20.56 during he 20.1	eating points for line Mar 0.85 atture in l 20.8 eating points for r	eriods ir iving are Apr 0.67 iving are 20.95 eriods ir 20.1	n the livi ea, h1,m May 0.48 ea T1 (f 20.99 n rest of 20.1 welling,	ing (s)	ee Table Jun J 0.34 0. w steps 3 21 2 relling from 20.1 2 m (see T	9a) Jul / .24 0 3 to 7 in 21 m Table 0.1 2 Table 9a)	Aug	Sep 0.47 9c) 21 2 (°C) 20.1	20.91	20.58	0.99 20.26 20.1	21	(86)
Utilisation factors (86)m= 0.98 Mean internare (87)m= 20.33 Temperature (88)m= 20.1 Utilisation factors (89)m= 0.97	reperted to the following here to for gale to 1.93	eating points for line of the	eriods in iving are Apr 0.67 iving are 20.95 eriods in 20.1 est of do 0.63	n the living the hand may not the living not the li	ing n (s	ee Table Jun	9a) Jul / .24 0 3 to 7 in 21 m Table 0.1 2 Table 9a) .19 0	Aug	Sep 0.47 9c) 21 2 (°C) 20.1 0.41	20.91	0.95	0.99	21	(86) (87) (88)
Utilisation factors Jan (86)m= 0.98 Mean interna (87)m= 20.33 Temperature (88)m= 20.1 Utilisation factors (89)m= 0.97 Mean internal	rtor for galler Feb 0.94 I tempera 20.56 during he 20.1 ctor for galler 0.93 I tempera	eating points for line of ture in land 20.8 eating points for round 10.82 eating in ture in the land 10.82 eating points for round 10.82 eating points for r	eriods in iving are 0.67 iving are 20.95 eriods in 20.1 est of do 0.63 the rest	n the living the hand the living the livi	ing (see) (see	ee Table Jun J 0.34 0. w steps 3 21 2 velling from 20.1 20 m (see T 0.29 0. T2 (follow	9a) Jul	Aug	Sep 0.47 9c) 21 2 (°C) 20.1 0.41 in Table	0.78 20.91 20.1 0.74 e 9c)	0.95 20.58 20.1	0.99 20.26 20.1 0.98	21	(86) (87) (88) (89)
Utilisation factors Jan	reperted to the following here to for gale to 1.93	eating points for line of the	eriods in iving are Apr 0.67 iving are 20.95 eriods in 20.1 est of do 0.63	n the living the hand may not the living not the li	ing (see) (see	ee Table Jun J 0.34 0. w steps 3 21 2 velling from 20.1 20 m (see T 0.29 0. T2 (follow	9a) Jul	Aug	Sep 0.47 29c) 21 2 (°C) 20.1 0.41 in Table 20.1	0.78 20.91 20.1 0.74 99c) 20.01	0.95 20.58 20.1 0.94	0.99 20.26 20.1 0.98		(86) (87) (88) (89)
Utilisation factors (86)m= 0.98 Mean internation (87)m= 20.33 Temperature (88)m= 20.1 Utilisation factors (89)m= 0.97 Mean internation (90)m= 19.23	rtor for gain stor for gain st	eating points for line at line in land 20.8 eating points for range 20.1 eating for range 20.82 eating 20.82	eriods in iving are 0.67 o.67 o.95 eriods in 20.1 est of do 0.63 ohe rest 20.05	n the living the livin	ing (s	ee Table Jun J 0.34 0. w steps 3 21 2 velling from 1 20.1 2 m (see T 0.29 0. T2 (follow 20.1 2)	9a) Jul	Aug	Sep 0.47 21 2 (°C) 20.1 in Table 20.1	0.78 20.91 20.1 0.74 99c) 20.01	0.95 20.58 20.1	0.99 20.26 20.1 0.98	0.52	(86) (87) (88) (89)
Utilisation factors Jan	tor for gall Feb 0.94 I tempera 20.56 during he 20.1 tor for gall 0.93 I tempera 19.56 I tempera	eating points for II Mar 0.85 ture in I 20.8 eating points for r 0.82 ture in t 19.87	eriods in iving are Apr 0.67 iving are 20.95 eriods in 20.1 est of do 0.63 the rest 20.05	n the living the livin	ing (s (s color)	ee Table Jun	9a) Jul	Aug	Sep 0.47 9c) 21 2 (°C) 20.1 0.41 in Table 20.1 ft. A) × T2	0.78 20.91 20.1 0.74 900) 20.01 A = Livin	0.95 20.58 20.1 0.94 19.59 ng area ÷ (4	0.99 20.26 20.1 0.98 19.14		(86) (87) (88) (89) (90) (91)
Utilisation factors Jan	tor for gain stor for gain sto	eating points for line at line in land 20.8 eating points for range of the land at line in the land at line (for 20.35).	eriods in iving are Apr 0.67 iving are 20.95 eriods in 20.1 est of do 0.63 the rest 20.05 er the whole 20.51	n the living the livin	ing (s	ee Table Jun	9a) Jul	Aug	Sep 0.47 90) 21 2 (°C) 20.1 0.41 in Table 20.1 ft. A) × T2 20.56	0.78 20.91 20.1 0.74 2 9c) 20.01 A = Livit	0.95 20.58 20.1 0.94	0.99 20.26 20.1 0.98		(86) (87) (88) (89)
Utilisation factors Jan	tor for gales of the second se	eating points for II Mar 0.85 ture in I 20.8 eating points for r 0.82 ture in t 19.87 ture (for 20.35) e mean	eriods in iving are Apr 0.67 iving are 20.95 eriods in 20.1 est of do 0.63 the rest 20.05 er the what 20.51 internal	n the living the high man the living and the living	ing (s (s color)) in (s color)	ee Table Jun	9a) Jul	Aug	Sep 0.47 99c) 21 2 (°C) 20.1 0.41 in Table 20.1 ft A) × T2 20.56 re appro	0.78 20.91 20.1 0.74 900) 20.01 A = Livit	0.95 20.58 20.1 0.94 19.59 ng area ÷ (4) 20.1	0.99 20.26 20.1 0.98 19.14 19.72		(86) (87) (88) (89) (90) (91) (92)
Utilisation factors Jan (86)m= 0.98 Mean interna (87)m= 20.33 Temperature (88)m= 20.1 Utilisation factors (89)m= 0.97 Mean interna (90)m= 19.23 Mean interna (92)m= 19.8 Apply adjustnown (93)m= 19.65	tor for gain series for for gain series for ga	eating points for II Mar 0.85 ature in I 20.8 eating points for r 0.82 ature in t 19.87 ature (for 20.35) e mean 20.2	eriods in iving are Apr 0.67 iving are 20.95 eriods in 20.1 est of do 0.63 the rest 20.05 er the whole 20.51	n the living the livin	ing (s (s color)) in (s color)	ee Table Jun	9a) Jul	Aug	Sep 0.47 90) 21 2 (°C) 20.1 0.41 in Table 20.1 ft. A) × T2 20.56	0.78 20.91 20.1 0.74 2 9c) 20.01 A = Livit	0.95 20.58 20.1 0.94 19.59 ng area ÷ (4	0.99 20.26 20.1 0.98 19.14		(86) (87) (88) (89) (90) (91)
Utilisation factors Jan	tor for gainer for for gainer for	eating points for II Mar 0.85 ature in II 20.8 eating points for r 0.82 ature in t 19.87 ature (for 20.35) e mean 20.2 irement	eriods in iving are Apr 0.67 iving are 20.95 eriods in 20.1 est of do 0.63 the rest 20.05 er the wh 20.51 internal 20.36	n the living the high may 0.48 ea T1 (for 20.99 en rest of 20.1 excelling, 0.44 end 20.09 end dwelling the dwelling control of dwelling control of dwelling control end dwelling	ing (s (s (s) ling) (s) (s) (s) (s) (s) (s) (s) (s) (s) (s	ee Table Jun	9a) Jul	Aug	Sep 0.47 99c) 21 2 (°C) 20.1 0.41 in Table 20.1 ft A) × T2 20.56 re appro 20.41	0.78 20.91 20.1 0.74 9 9c) 20.01 A = Livit 20.47 priate 20.32	0.95 20.58 20.1 0.94 19.59 ng area ÷ (4) 20.1 19.95	0.99 20.26 20.1 0.98 19.14 19.72 19.57	0.52	(86) (87) (88) (89) (90) (91) (92)
Utilisation factors Jan (86)m= 0.98 Mean interna (87)m= 20.33 Temperature (88)m= 20.1 Utilisation factors (89)m= 0.97 Mean interna (90)m= 19.23 Mean interna (92)m= 19.8 Apply adjustra (93)m= 19.65	tor for gainer for gainer for for gainer for	eating points for line at line in land 20.8 eating points for rand 20.1 eating points for rand 20.35 eating points for rand ture (for 20.35 eating points for rand terman	eriods in iving are Apr 0.67 iving are 20.95 eriods in 20.1 est of do 0.63 the rest 20.05 er the wheeler 20.51 internal 20.36 enperature	n the living the livin	ing (s (s (s) ling) (s) (s) (s) (s) (s) (s) (s) (s) (s) (s	ee Table Jun	9a) Jul	Aug	Sep 0.47 99c) 21 2 (°C) 20.1 0.41 in Table 20.1 ft A) × T2 20.56 re appro 20.41	0.78 20.91 20.1 0.74 9 9c) 20.01 A = Livit 20.47 priate 20.32	0.95 20.58 20.1 0.94 19.59 ng area ÷ (4) 20.1 19.95	0.99 20.26 20.1 0.98 19.14 19.72 19.57	0.52	(86) (87) (88) (89) (90) (91) (92)

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb



l Itilie:	ation fac	tor for a	ains, hm											
(94)m=	0.97	0.92	0.82	0.64	0.45	0.31	0.21	0.24	0.43	0.75	0.94	0.98		(94)
			, W = (94			0.0.	V-2 ·	V-2 ·	56	00	0.0	0.00		, ,
(95)m=	899.15		1135.39	<u> </u>	818.03	549.15	360.55	379.39	593.7	850.56	880.3	845.23		(95)
Montl	hly aver	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for me	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1450.6	1420.31	1295.06		823.12	549.58	360.59	379.48	596.53	919.06	1214.82	1452.54		(97)
			ement fo							i 	r			
(98)m=	410.28	238.89	118.79	27.43	3.78	0	0	0	0	50.96	240.85	451.84		٦
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1542.82	(98)
Space	Space heating requirement in kWh/m²/year												15.98	(99)
9a. En	ergy red	quiremer	nts – Indi	vidual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heatii	•										ı		_
	Fraction of space heat from secondary/supplementary system												0	(201)
Fracti	Fraction of space heat from main system(s) (202) = 1 – (201) =												1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =												1	(204)	
Efficiency of main space heating system 1												90.4	(206)	
Efficiency of secondary/supplementary heating system, %												0	(208)	
	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												kWh/yea	- ar
Space heating requirement (calculated above)														
	410.28	238.89	118.79	27.43	3.78	0	0	0	0	50.96	240.85	451.84		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20	06)									(211)
	453.85	264.26	131.41	30.34	4.18	0	0	0	0	56.37	266.43	499.82		_
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1706.66	(211)
•		• ,	econdar	• •	month									
		l	00 ÷ (20			_	_	_						
(215)m=	0	0	0	0	0	0	0	O Tota	0 L (Id\A/b/voc	0	0	0		7(045)
187 4								TUId	ii (KVVII/yea	ar) –Surri(z	215) _{15,1012}		0	(215)
	heating t from w		ter (calc	ulated al	hove)									
Output	126.18	115.73	130.17	123.27	122.18	109.75	108.3	118.38	119.19	129.48	122.44	121.62		
Efficie	ncy of w	ater hea	ıter					l	l .	<u> </u>	<u> </u>		80.3	(216)
(217)m=	87.8	86.84	84.82	81.97	80.57	80.3	80.3	80.3	80.3	82.92	86.72	88.05		(217)
Fuel fo	r water	heating,	kWh/mo	onth										
, ,) ÷ (217)											
(219)m=	143.7	133.27	153.46	150.39	151.65	136.67	134.87	147.42	148.43	156.15	141.19	138.13		٦
A	.14-4 !							rota	l = Sum(2		Alla t	_	1735.35	(219)
	al totals heating		ed, main	system	1					K\	Wh/year	[1706.66	٦
	_			5,500111] 7
	•	fuel use			_								1735.35	_
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								