

			User	Details:						
Assessor Name:	Peter Mitcl	hell		Strom	a Num	ber:		STRO	007945	
Software Name:	Stroma FS	AP 2012		Softwa	are Ver	rsion:		Versio	n: 1.0.3.15	
				Address						
Address :		ng at:, Gorde	on House, (3 Lissend	en Garde	ens, LON	NDON, N	W5 1LX		
1. Overall dwelling dim	ensions:		Δr	ea(m²)		Av. Hei	iaht(m)		Volume(m ³)	
Ground floor				96.54	(1a) x		2.4	(2a) =	231.7	(3a)
Total floor area TFA = (1	1a)+(1b)+(1c)+	(1d)+(1e)+	(1n)	96.54	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	231.7	(5)
2. Ventilation rate:	•								<u>,</u> ,	
Number of chimneys	main heating	heat	ndary ing o + [other	7 = Г	total	x 4	10 =	m ³ per hour	(6a)
Number of open flues		╡╷┝━━		0	」	0	×2	20 =	0	(60)
Number of intermittent fa	0		b +	0	JĽ	-		0 =	-	
					Ļ	2		ļ	20	(7a)
Number of passive vents					Ĺ	0		0 =	0	(7b)
Number of flueless gas f	fires					0	X 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimne	•				ļ	20		÷ (5) =	0.09	(8)
If a pressurisation test has Number of storeys in t			roceed to (17)	, otherwise (continue tr	om (9) to (16)	[0	(9)
Additional infiltration		5)					[(9)-	1]x0.1 =	0	(10)
Structural infiltration: (0.25 for steel o	r timber fram	ne or 0.35 f	or mason	ry constr	uction			0	(11)
if both types of wall are µ deducting areas of open			ling to the gre	ater wall are	ea (after					_
If suspended wooden		,	or 0.1 (sea	led), else	enter 0				0	(12)
If no draught lobby, er			1						0	(13)
Percentage of window Window infiltration	/s and doors di	augnt stripp	ea	0.25 - [0.2	2 x (14) ÷ 1	001 =			0	(14)
Infiltration rate					+ (11) + (1	-	⊦ (15) =		0	(15)
Air permeability value	, q50, expresse	ed in cubic n	netres per h					area	4	(17)
If based on air permeab					•		•		0.29	(18)
Air permeability value appli		on test has bee	en done or a d	egree air pe	rmeability	is being us	sed			_
Number of sides shelter Shelter factor	ed			(20) – 1 -	[0.075 x (1	9)1 -			3	(19)
Infiltration rate incorpora	ating shelter fac	tor		(20) = 1 (21) = (18)		[0]] –		l	0.78	(20)
Infiltration rate modified	-			() () // (20)			l	0.22	(21)
Jan Feb	Mar Apr	· ·	un Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s	·			1						
(22)m= 5.1 5	4.9 4.4	<u> </u>	.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	\sim 1	I I	1	1	1	1	I		I	
(22a)m = 1.27 1.25	22)m ÷ 4 1.23 1.1	1.08 0.	95 0.95	0.92	1	1.08	1.12	1.18		
			0.00							



Adjust	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m		-	-		
.	0.28	0.28	0.27	0.24	0.24	0.21	0.21	0.21	0.22	0.24	0.25	0.26		
	ate effec echanica		•	rate for t	he appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) x Fmv (e	equation (N5)) . othei	wise (23b) = (23a)			0	(23a)
				iency in %						, (,			0	(23c)
			-	entilation	-					2h)m + (23h) 🗸 [ʻ	1 – (23c)	-	(200)
(24a)m=					0				0			1 - (230)	÷ 100]	(24a)
		-		entilation	-	-	-	-	-	_	23h)	-		
(24b)m=					0				0	0	0	0		(24b)
				ntilation of						Ů	Ů	Ů		
,				then (24	•	•				.5 × (23b))			
(24c)m=	, <i>,</i>	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	n or wh	ole hous	e positiv	/e input v	ventilatio	on from l	oft	ļ	Į			
,				m = (22		•				0.5]				
(24d)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in boy	(25)	-				
(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53		(25)
3 He	at losse	s and he	at loss i	paramete	ər.									
	IENT	Gros		Openin		Net Ar	ea	U-valı	Je	AXU		k-value	9	AXk
		area		m		A ,r		W/m2		(W/	K)	kJ/m²·l		kJ/K
Windo	ws Type	e 1				7.39	x1,	/[1/(1.2)+	0.04] =	8.46				(27)
Windo	ws Type	2				3.5	x1.	/[1/(1.2)+	0.04] =	4.01				(27)
Windo	ws Type	e 3				8.26	x1.	/[1/(1.2)+	0.04] =	9.46				(27)
Windo	ws Type) 4				8.26		/[1/(1.2)+	0.04] =	9.46	=			(27)
Windo	ws Type	e 5				5.28		/[1/(1.2)+	0.04] =	6.05				(27)
Walls		108.	14	32.6	9	75.45	; x	0.16		12.07				(29)
	area of e			02.0	<u> </u>	108.1		0.110	I		L			(31)
Party			,			19.25		0		0				(32)
Party						·			=		╡╏			
		roof wind		effective wi	ndowlly	15.26			= = /[(1/)/2	0		naragraph		(32)
				nternal wal			aleu using	nonnula n	/[(1/0-vaic	ie/+0.0+j c	is given in	paragraph	10.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				49.5	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMI	- = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For des	ign assess	sments wh	ere the de	tails of the	construct	ion are not	t known pr	ecisely the	indicative	e values of	TMP in Ta	able 1f		
	used inste											1		
	-		,	culated (• •		<						6.79	(36)
	s of therma abric he		are not kr	10wn (36) =	= 0.15 x (3	1)			(33) +	(36) =			56.00	(37)
			alculater	d monthly	J						25)m x (5)		56.29	(37)
v Gritik	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	41.29	41.17	41.05	40.51	40.41	39.93	39.93	39.84	40.11	40.41	40.61	40.83		(38)
													l	(/
	ransfer o	1	1	06.0	06 7	06.00	06.00	06.40	· · ·	= (37) + (37)	r	07.40	l	
(39)m=	97.58	97.47	97.35	96.8	96.7	96.22	96.22	96.13	96.41	96.7	96.91 Sum(39)1	97.12	06.0-	(20)
Stroma	FSAP 201	2 Version	1.0.3.15	(SAP 9.92)) - http://ww	ww.stroma	.com			rveraye =	Jun(39)1	12/12=	ဗပ.ရာ	<u>age 2 o^{f 39)} (</u>



Heat loss parameter (HLP), W/m ² K (40)m = $(39)m \div (4)$														
(40)m=	1.01	1.01	1.01	1	1	1	1	1	1	1	1	1.01		_
Numbe	er of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40) _{1.}	12 /12=	1	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ting ene	rgy requi	rement:								kWh/ye	ear:	
if TF			N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	-A -13.9)2)] + 0.(0013 x (⁻	TFA -13.		71		(42)
Annua <i>Reduce</i>	l averag	je hot wa al average	ater usag hot water	usage by	5% if the c	welling is	designed			se target o		.45		(43)
not more	e that 125	litres per j	person per	[.] day (all w	ater use, l	hot and co.	ld)	1	r	r	1		I	
l lot wot	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			r day for ea					, <i>,</i>					l	
(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	4404.05	
Energy o	content of	hot water	used - cal	culated me	onthly = 4.	190 x Vd,r	n x nm x D)))))))))))))))))))			m(44) ₁₁₂ = ables 1b, 1		1181.35	(44)
(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		
		1			1	1			-	l Total = Su	m(45) ₁₁₂ =		1548.94	(45)
lf instan	taneous w	vater heati	ng at point	of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)					
(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)
	storage) includin		alar ar M		storago	within or		col			l	(47)
-		. ,	and no ta				-			501		0		(47)
		•	hot wate		•			` '	ers) ente	er '0' in (47)			
	storage			,					,	,	,			
a) If m	nanufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
			r storage					(48) x (49)) =			0		(50)
•			eclared o factor fr	•								0		(51)
		-	see section		0 2 (101	n, na 0, ac	'y /					0		(01)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
			r storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
	. ,	(54) in (5			_							0		(55)
Water	storage	loss cal	culated f	or each	month	i	r	((56)m = (55) × (41)ı	m	i		I.	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain:	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	IX H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
	•	•	nnual) fro									0		(58)
	•		culated f			,	. ,	. ,			-1-1)			
(moo (59)m=	dified by		rom Tab	0 H5 If t		olar wat	er heatil	ng and a	cylinde	r thermo	stat)	0		(59)
(59)11=	0			U			U		U	U		U		(00)



Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (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		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for each	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(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		(62)
Solar DH	IW input o	calculated	using App	endix G or	Appendix	H (negativ	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or V	WWHRS	applies,	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	32.95	24.43	18.45	11.02	9.08	7.72	7.39	8.33	8.37	13.08	24.75	33.99		(63) (G2)
WWHRS	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
Output	from w	ater hea	ter											
(64)m=	125.02	114.87	129.14	122.98	122.13	109.75	108.3	118.38	119.19	129.07	121.78	120.64		
I								Outp	out from w	ater heate	r (annual)₁	12	1441.25	(64)
Heat g	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	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	de (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the c	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal da	ains (see	e Table 5	5 and 5a):	•		-					-	
			e 5), Wat											
Melabl	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)
						ion L9 or							i	
(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	1	(67)
						uation L ²							l	
(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	1	(68)
											002.01	001.01	1	()
(69)m=	53.94	53.94	53.94	53.94	L, equal 53.94	ion L15 53.94	53.94	53.94	53.94	53.94	53.94	53.94	I	(69)
					55.94	55.94	55.94	55.94	55.94	55.94	55.94	55.94	İ	(00)
			(Table 5	r í	0		0						I	(70)
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	l I	(70)
		·	- <u>`</u>	tive valu	<i>,</i> ,	,							I	
(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)
1		gains (T	· · · · ·					·	i		·		I	
(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		(72)
Total i	nternal	gains =				(66)	m + (67)m	n + (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m		
(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)
	ar gains													
-			•		Table 6a a	and associ	•	tions to co	onvert to th	e applicat		ion.		
Orienta		Access F Fable 6d		Area m²		Flu Tat	x ble 6a	Т	g_ able 6b	Та	FF able 6c		Gains (W)	
Northea	ast 0.9x	0.77	x	7.3	9	× 1	1.28	x	0.76	 × [0.7	=	30.74	(75)

х

x

8.26

7.39

х

x

11.28

22.97

х

x

0.76

0.76

0.77

0.77

Northeast 0.9x

Northeast 0.9x

34.36

62.57

0.7

0.7

=

=

X

x

(75)

(75)



Northeast 0.9x	0.77	x	8.26	×	22.97	×	0.76	×	0.7] =	69.94	(75)
Northeast 0.9x	0.77	」 ^] x	7.39	l ^ l x	41.38	l x	0.76	l x	0.7	- _	112.74	(75)
Northeast 0.9x	0.77] x	8.26	l 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	×	91.35	×	0.76	×	0.7	=	248.87	(75)
Northeast 0.9x	0.77	x	8.26	×	91.35	x	0.76	×	0.7	=	278.17	(75)
Northeast 0.9x	0.77] x	7.39	×	97.38	×	0.76	×	0.7	j =	265.33	(75)
Northeast 0.9x	0.77	x	8.26	×	97.38	×	0.76	×	0.7	=	296.56	(75)
Northeast 0.9x	0.77	x	7.39	×	91.1	×	0.76	×	0.7] =	248.21	(75)
Northeast 0.9x	0.77	x	8.26	×	91.1	×	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	×	50.42	x	0.76	x	0.7	=	137.37	(75)
Northeast 0.9x	0.77	x	8.26	×	50.42	×	0.76	×	0.7	=	153.54	(75)
Northeast 0.9x	0.77	x	7.39	x	28.07	×	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	×	14.2	×	0.76	×	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	×	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	×	62.67	×	0.76	×	0.7	=	122	(77)
Southeast 0.9x	0.77	x	3.5	×	85.75	×	0.76	×	0.7	=	110.65	(77)
Southeast 0.9x	0.77	x	5.28	×	85.75	x	0.76	×	0.7	=	166.93	(77)
Southeast 0.9x	0.77	x	3.5	×	106.25	×	0.76	×	0.7	=	137.1	(77)
Southeast 0.9x	0.77	X	5.28	×	106.25	×	0.76	×	0.7	=	206.83	(77)
Southeast 0.9x	0.77	×	3.5	×	119.01	×	0.76	×	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	×	118.15	×	0.76	×	0.7	=	152.46	(77)
Southeast 0.9x	0.77	X	5.28	×	118.15	×	0.76	×	0.7	=	229.99	(77)
Southeast 0.9x	0.77	X	3.5	×	113.91	X	0.76	X	0.7	=	146.98	(77)
Southeast 0.9x	0.77	X	5.28	×	113.91	×	0.76	×	0.7	=	221.74	(77)
Southeast 0.9x	0.77	X	3.5	X	104.39	×	0.76	X	0.7	=	134.7	(77)
Southeast 0.9x	0.77	×	5.28	×	104.39	×	0.76	×	0.7	=	203.21	(77)
Southeast 0.9x	0.77	×	3.5	×	92.85	×	0.76	×	0.7] =	119.81	(77)
Southeast 0.9x	0.77	×	5.28	×	92.85	×	0.76	×	0.7	=	180.75	(77)
Southeast 0.9x	0.77	×	3.5	×	69.27	×	0.76	×	0.7	=	89.38	(77)
Southeast 0.9x	0.77	x	5.28	x	69.27	×	0.76	×	0.7	=	134.84	(77)



												_		
Southeast 0.9x	0.77	×	3.5	x	4	4.07	x	0.76	x	0.7		=	56.87	(77)
Southeast 0.9x	0.77	x	5.28	x	4	4.07	×	0.76	x	0.7		= [85.79	(77)
Southeast 0.9x	0.77	x	3.5	x	3	1.49	×	0.76	x	0.7		=	40.63	(77)
Southeast 0.9x	0.77	×	5.28	x	3	1.49	×	0.76	x	0.7		=	61.29	(77)
Southwest _{0.9x}	0.77	×	8.26	x	3	6.79	ΙΓ	0.76	×	0.7		=	112.05	(79)
Southwest0.9x	0.77	x	8.26	x	6	2.67	ÌĒ	0.76	×	0.7		=	190.86	(79)
Southwest0.9x	0.77	x	8.26	x	8	5.75	Ì	0.76	x	0.7		=	261.14	(79)
Southwest0.9x	0.77	x	8.26	x	10	06.25	ÌĒ	0.76	×	0.7		=	323.56	(79)
Southwest _{0.9x}	0.77	x	8.26	x	1'	19.01	Ì	0.76	×	0.7		=	362.42	(79)
Southwest0.9x	0.77	x	8.26	x	1'	18.15		0.76	x	0.7		= [359.8	(79)
Southwest _{0.9x}	0.77	x	8.26	x	11	13.91		0.76	x	0.7		=	346.88	(79)
Southwest _{0.9x}	0.77	x	8.26	x	10	04.39] [0.76	x	0.7		= [317.9	(79)
Southwest _{0.9x}	0.77	x	8.26	x	9	2.85] [0.76	x	0.7		=	282.76	(79)
Southwest _{0.9x}	0.77	x	8.26	x	6	9.27		0.76	x	0.7		=	210.94	(79)
Southwest0.9x	0.77	x	8.26	x	4	4.07	[0.76	x	0.7		=	134.21	(79)
Southwest0.9x	0.77	x	8.26	x	3	1.49] [0.76	x	0.7		=	95.89	(79)
Solar gains in	watts, calcu	lated	for each mon	:h			(83)m =	= Sum(74)m	.(82)m					
(83)m= 296.25			1059.59 1274.		304.13		1074.	85 874.23	597.1	358.77	250.9	98		(83)
			(84)m = (73)n	<u> </u>	,		·							
(84)m= 926.08	1151.44 137	78.89	1623.37 1799.6	4 17	794.27	1711.43	1554.	47 1375.85	1136.5	8 939.76	863.5	59		(84)
7. Mean inte	rnal tempera	iture (heating seaso	n)										
			heating seaso eriods in the liv		area f	rom Tab	ole 9, [°]	Th1 (°C)					21	(85)
Temperature	e during heat	ing pe		ving			ole 9, ⁻	Th1 (°C)					21	(85)
Temperature	e during heat	ing pe	eriods in the li	ving m (s			ole 9, ⁻ Au		Oct	Nov	De	c	21	(85)
Temperature Utilisation fa	e during heat ctor for gains Feb	ing pe s for li	eriods in the liv	ving m (s /	ee Ta	ble 9a)		g Sep	Oct 0.79	Nov 0.96	De 0.99	_	21	(85)
Temperature Utilisation fa Jan (86)m= 0.98	e during heat ctor for gains Feb 1 0.95 0	ing pe s for li Mar .86	eriods in the liv ving area, h1, Apr May	/ing m (s /	ee Ta Jun ^{0.34}	ble 9a) Jul 0.25	Au 0.28	g Sep 0.48				_	21	
Temperature Utilisation fa Jan (86)m= 0.98	e during heat ctor for gains Feb 1 0.95 0 al temperatur	ing pe s for li Mar .86	eriods in the living area, h1, Apr May 0.69 0.49	ving m (s /	ee Ta Jun ^{0.34}	ble 9a) Jul 0.25	Au 0.28	g Sep 0.48)	21	
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28	e during heat ctor for gains Feb 1 0.95 0 al temperatur 20.52 20	ing pe s for li Mar .86 re in li).77	eriods in the living area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99	ving m (s /	ee Ta Jun ^{0.34} w ste ²¹	ble 9a) Jul 0.25 ps 3 to 7 21	Au 0.28 7 in Ta 21	g Sep 0.48 able 9c) 20.99	0.79	0.96	0.99)	21	(86)
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28	e during heat ctor for gains Feb 1 0.95 0 al temperatur 20.52 20 e during heat	ing pe s for li Mar .86 re in li).77	eriods in the liv ving area, h1, Apr May 0.69 0.49 iving area T1	ving m (s / (follo of dw	ee Ta Jun ^{0.34} w ste ²¹	ble 9a) Jul 0.25 ps 3 to 7 21	Au 0.28 7 in Ta 21	g Sep 0.48 ble 9c) 20.99 Th2 (°C)	0.79	0.96	0.99	2	21	(86)
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07	e during heat ctor for gains Feb 1 0.95 0 al temperatur 20.52 20 e during heat 20.08 20	ing person	eriods in the living area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.94 20.99 eriods in rest of 20.08	ving m (s / (follo of dw	ee Ta Jun 0.34 ww ste 21 /elling 20.09	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09	Au 0.28 7 in Ta 21 able 9, 20.09	g Sep 0.48 ble 9c) 20.99 Th2 (°C)	0.79	0.96	0.99	2	21	(86) (87)
Temperature Utilisation fa Jan (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa	e during heat ctor for gains Feb 1 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains	ing person	eriods in the living area, h1,AprMay0.690.49iving area T120.9420.9420.99eriods in rest of20.08est of dwelling	ving m (s / (follo of dw 1, h2,	ee Ta Jun 0.34 ww ste 21 velling 20.09 ,m (se	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 ee Table	Au 0.28 7 in Ta 21 able 9, 20.09 9a)	g Sep 0.48 ble 9c) 20.99 Th2 (°C) 9 20.08	0.79 20.9 20.08	0.96 20.55 20.08	0.99 20.22 20.00) 2 8	21	(86) (87) (88)
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98	e during heat ctor for gains Feb N 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0	ing person	Periods in the live ving area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 20.08 20.08 est of dwelling 0.64	ving m (s / / (follo f dw 2 i, h2,	ee Ta Jun 0.34 21 velling 20.09 ,m (se 0.29	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 re Table 0.2	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23	g Sep 0.48 able 9c) 20.99 Th2 (°C) 9 20.08	0.79 20.9 20.08 0.75	0.96	0.99) 2 8	21	(86) (87)
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98 Mean interna	e during heat ctor for gains Feb 1 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur	ing person	eriods in the living area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 20.08 est of dwelling 0.64 0.45 he rest of dwe	(follo (follo)))))))))))))	ee Ta Jun 0.34 ww ste 21 velling 20.09 ,m (se 0.29 T2 (fo	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 the Table 0.2 bllow ste	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23 9ps 3 t	g Sep 0.48 bble 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table	0.79 20.9 20.08 0.75 9 9c)	0.96 20.55 20.08 0.94	0.99 20.22 20.04 0.98	2 8 3	21	(86) (87) (88) (89)
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98	e during heat ctor for gains Feb 1 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur	ing person	Periods in the live ving area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 20.08 20.08 est of dwelling 0.64	(follo (follo)))))))))))))	ee Ta Jun 0.34 21 velling 20.09 ,m (se 0.29	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 re Table 0.2	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23	g Sep 0.48 able 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table 9 20.08	0.79 20.9 20.08 0.75 9 9c) 19.98	0.96 20.55 20.08 0.94 19.54	0.99	2 8 3		(86) (87) (88) (89) (90)
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98 Mean interna	e during heat ctor for gains Feb 1 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur	ing person	eriods in the living area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 20.08 est of dwelling 0.64 0.45 he rest of dwe	(follo (follo)))))))))))))	ee Ta Jun 0.34 ww ste 21 velling 20.09 ,m (se 0.29 T2 (fo	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 the Table 0.2 bllow ste	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23 9ps 3 t	g Sep 0.48 able 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table 9 20.08	0.79 20.9 20.08 0.75 9 9c) 19.98	0.96 20.55 20.08 0.94	0.99	2 8 3	21	(86) (87) (88) (89)
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98 Mean interna (90)m= 19.15	e during heat ctor for gains Feb M 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur 19.48 19	ing pe s for li Mar .86 re in li 0.77 ing pe 0.08 s for re .83 re in t 0.82	eriods in the living area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 20.08 est of dwelling 0.64 0.45 he rest of dwe	ving m (s / (follo 0 f dw 2 1, h2, 1 1, h2, 2 2	ee Ta Jun 0.34 w ste 21 velling 20.09 ,m (se 0.29 T2 (fo 20.09	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 ee Table 0.2 bllow ste 20.09	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23 eps 3 t 20.09	g Sep 0.48 bble 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table 9 20.08	0.79 20.9 20.08 0.75 9 9c) 19.98	0.96 20.55 20.08 0.94 19.54	0.99	2 8 3		(86) (87) (88) (89) (90)
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98 Mean interna (90)m= 19.15 Mean interna (92)m= 19.73	e during heat ctor for gains Feb M 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur 19.48 19 al temperatur 20.02 20	ing pe ing pe	eriods in the live ving area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 est of dwelling 0.64 0.64 0.45 he rest of dwelling 20.07 the whole dw 20.55	ving m (s /	ee Ta Jun 0.34 w ste 21 velling 20.09 m (se 0.29 T2 (fc 20.09 g) = fl 20.56	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 the Table 0.2 bllow ste 20.09 LA × T1 20.56	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23 eps 3 t 20.09 + (1 – 20.50	g Sep 0.48 ble 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table 9 20.08 fL 6 20.55	0.79 20.9 20.08 0.75 9 9c) 19.98 A = Liv 20.45	0.96 20.55 20.08 0.94 19.54 ring area ÷ (4	0.99	2 8 6		(86) (87) (88) (89) (90)
Temperature Utilisation fa Jan (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98 Mean interna (90)m= 19.15 Mean interna (92)m= 19.73 Apply adjust	e during heat ctor for gains Feb N 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur 19.48 19 al temperatur 20.02 20 ment to the r	ing pe s for li Mar .86 re in li 0.77 ing pe 0.08 s for re .83 re in t 0.82 re (for 0.31 mean	eriods in the living area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 20.08 est of dwelling 0.64 0.45 he rest of dwe 20.02 20.07 the whole dw 20.5 20.55 internal tempo	ving m (s /	ee Ta Jun 0.34 w ste 21 velling 20.09 m (se 0.29 T2 (fc 20.09 g) = fl 20.56	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 the Table 0.2 bllow ste 20.09 LA × T1 20.56	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23 eps 3 t 20.09 + (1 – 20.50	g Sep 0.48 ble 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table 9 20.08 fL 6 20.55	0.79 20.9 20.08 0.75 9 9c) 19.98 A = Liv 20.45	0.96 20.55 20.08 0.94 19.54 ring area ÷ (4	0.99 20.22 20.02 0.98 19.00	2 8 6		(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fa (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98 Mean interna (90)m= 19.15 Mean interna (92)m= 19.73	e during heat ctor for gains Feb N 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur 19.48 19 al temperatur 20.02 20 ment to the r	ing pe ing pe	eriods in the live ving area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 est of dwelling 0.64 0.64 0.45 he rest of dwelling 20.07 the whole dw 20.55	ving m (s /	ee Ta Jun 0.34 w ste 21 velling 20.09 m (se 0.29 T2 (fc 20.09 g) = fl 20.56	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 the Table 0.2 bllow ste 20.09 LA × T1 20.56	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23 eps 3 t 20.09 + (1 – 20.50	g Sep 0.48 ble 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table 9 20.08 fL fLA) × T2 6 20.55 /here appro	0.79 20.9 20.08 0.75 9 9c) 19.98 A = Liv 20.45	0.96 20.55 20.08 0.94 19.54 ring area ÷ (4	0.99 20.22 20.02 0.98 19.00	9 2 8 3 6 6		(86) (87) (88) (89) (90) (91)
Temperature Utilisation fa Jan (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98 Mean interna (90)m= 19.15 Mean interna (92)m= 19.73 Apply adjust	e during heat ctor for gains Feb M 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur 19.48 19 al temperatur 20.02 20 ment to the r 19.87 20	ing pe ing pe	eriods in the living area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 20.08 est of dwelling 0.64 0.45 he rest of dwe 20.02 20.07 the whole dw 20.5 20.55 internal tempo	ving m (s /	ee Ta Jun 0.34 21 22 20.09 ,m (se 0.29 T2 (fc 20.09 g) = fl 20.56 ire fro	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 e Table 0.2 bllow ste 20.09 _A × T1 20.56 m Table	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23 eps 3 t 20.09 + (1 – 20.50	g Sep 0.48 ble 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table 9 20.08 ft fLA) × T2 6 20.55 /here appro	0.79 20.9 20.08 0.75 9 9c) 19.98 A = Liv 20.45 priate	0.96 20.55 20.08 0.94 19.54 ring area ÷ (4 20.06	0.99 20.22 20.02 0.98 19.00 19.00	9 2 8 3 6 6		(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fa Jan (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98 Mean interna (90)m= 19.15 Mean interna (92)m= 19.73 Apply adjust (93)m= 19.58 8. Space hea Set Ti to the	e during heat ctor for gains Feb N 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur 19.48 19 al temperatur 20.02 20 ment to the r 19.87 20 ating require mean intern	ing period ing period	eriods in the living area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 est of dwelling 0.64 0.64 0.45 he rest of dwelling 20.07 the whole dw 20.55 internal tempor 20.4 apperature obta 0.45	ving m (s /	ee Ta Jun 0.34 21 22 20.09 m (se 0.29 T2 (fc 20.09 g) = fl 20.56 ire fro 20.41	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 e Table 0.2 bllow ste 20.09 _A × T1 20.56 m Table 20.41	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23 9a) 0.23 9a) 0.23 + (1 – 20.09 + (1 – 20.50 4e, w 20.4	g Sep 0.48 ble 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table 9 20.08 ft fLA) × T2 6 20.55 /here appro 1 20.4	0.79 20.9 20.08 0.75 9 9c) 19.98 A = Liv 20.45 priate 20.3	0.96 20.55 20.08 0.94 19.54 ring area ÷ (4 20.06 19.91	0.99 20.22 20.02 0.98 19.00 19.00 19.00 19.5	2 8 3 6 6	0.52	(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fa Jan (86)m= 0.98 Mean interna (87)m= 20.28 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.98 Mean interna (90)m= 19.15 Mean interna (92)m= 19.73 Apply adjust (93)m= 19.58 8. Space hea Set Ti to the	e during heat ctor for gains Feb M 0.95 0 al temperatur 20.52 20 e during heat 20.08 20 ctor for gains 0.93 0 al temperatur 19.48 19 al temperatur 20.02 20 ment to the r 19.87 20 ating require mean intern factor for gains	ing period ing period	eriods in the livering area, h1, Apr May 0.69 0.49 iving area T1 20.94 20.99 eriods in rest of 20.08 20.08 20.08 est of dwelling 0.64 0.64 0.45 he rest of dwelling 20.02 20.07 • the whole dw 20.55 20.4	ving m (s / / follo of dw 2 / / / / / / / / / / / / / / / / / /	ee Ta Jun 0.34 21 22 20.09 m (se 0.29 T2 (fc 20.09 g) = fl 20.56 ire fro 20.41	ble 9a) Jul 0.25 ps 3 to 7 21 from Ta 20.09 e Table 0.2 bllow ste 20.09 _A × T1 20.56 m Table 20.41	Au 0.28 7 in Ta 21 able 9, 20.09 9a) 0.23 9a) 0.23 9a) 0.23 + (1 – 20.09 + (1 – 20.50 4e, w 20.4	g Sep 0.48 ble 9c) 20.99 Th2 (°C) 9 20.08 0.42 0 7 in Table 9 20.08 fL 6 20.55 1 20.4 1 20.4	0.79 20.9 20.08 0.75 9 9c) 19.98 A = Liv 20.45 priate 20.3	0.96 20.55 20.08 0.94 19.54 ing area ÷ (4 20.06 19.91 =(76)m and	0.99 20.22 20.02 0.98 19.00 19.00 19.00 19.5	2 8 3 6 6 1 1	0.52	(86) (87) (88) (89) (90) (91) (92)



Utilisa	ation fac	ctor for g	ains, hm	n:										
(94)m=	0.97	0.93	0.83	0.66	0.46	0.31	0.21	0.25	0.44	0.76	0.94	0.98		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	900.37	1069.49	1147.89	1063.32	834.77	558.23	366.33	385.19	604.17	860.75	882.84	845.86		(95)
Mont	nly aver	age exte	rnal terr	perature	e 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 rat	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1491.17	1458.86	1329.75	1108.06	841.03	558.76	366.38	385.3	607.57	938.19	1241.34	1487.03		(97)
Space	e heatin	ng require	ement fo	r each n	nonth, k	Wh/mont	h = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	439.56	261.66	135.3	32.22	4.66	0	0	0	0	57.62	258.12	477.03		_
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	1666.16	(98)
Space	e heatin	ng require	ement in	kWh/m²	/year							[17.26	(99)
9a. En	erav rea	quiremer	nts – Ind	ividual h	eating s	vstems i	ncludina	ı micro-C	CHP)			L		_
	e heati													
•		pace hea	at from s	econdar	y/supple	mentary	system					[0	(201)
Fract	ion of s	bace hea	at from m	nain syst	em(s)			(202) = 1 ·	– (201) =			Ī	1	(202)
Fracti	ion of to	otal heati	na from	main sve	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
		main spa	•	-					<i>,</i> -			l	90.4	(206)
				•••		~ ~ ~ ~ ~ ~ ~	. 0/					l		
ETTICI	ency of	seconda	ry/suppi	ementar	y neatin	g system	1, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	r	ng require	r È	r										
	439.56	261.66	135.3	32.22	4.66	0	0	0	0	57.62	258.12	477.03		
(211)m	ו = {[(98	3)m x (20		· · · ·)6)									(211)
	486.24	289.45	149.67	35.64	5.15	0	0	0	0	63.73	285.53	527.69		-
								Tota	ll (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1843.1	(211)
•		ng fuel (s		• ·	month									
		01)]}x1		Î				1						
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		-
								lota	ıl (kWh/yea	ar) = Sum(2)	215) _{15,10} 12		0	(215)
	heating	-												
Output	t from w 125.02	vater hea 114.87	ter (calc 129.14	ulated a		109.75	109.2	118.38	119.19	129.07	121.78	120.64		
F#:cic.				122.96	122.13	109.75	108.3	110.30	119.19	129.07	121.76	120.64		
		ater hea	i	00.04						00.47		00.40	80.3	(216)
(217)m=		87.06	85.17	82.21	80.63	80.3	80.3	80.3	80.3	83.17	86.9	88.16		(217)
		heating, m x 100)												
` '	142.15	131.94	151.63	149.59	151.47	136.67	134.87	147.42	148.43	155.19	140.15	136.84		
	L	1	I	1	I	I	L	Tota	l = Sum(2 ⁻	19a) ₁₁₂ =	I		1726.36	(219)
Annua	al totals										Wh/year	. l	kWh/year	
		, g fuel use	ed, main	system	1]	1843.1	1
Water	heating	fuel use	d									L [1726.36	i
			-										1120.00	1

Electricity for pumps, fans and electric keep-hot



central heating pump:			30 (230	
boiler with a fan-assisted flue			45 (230	
Total electricity for the above, kWh/year	sum o	f (230a)(230g) =	75 (231	
Electricity for lighting			394.57 (232	2)
10a. Fuel costs - individual heating systems:				
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48 × 0.0	01 = 64.14 (240))
Space heating - main system 2	(213) x	0 × 0.0	01 = 0 (241	I)
Space heating - secondary	(215) x	13.19 × 0.0	01 = 0 (242	2)
Water heating cost (other fuel)	(219)	3.48 × 0.0	01 = 60.08 (247	7)
Pumps, fans and electric keep-hot	(231)	13.19 × 0.0	01 = 9.89 (249	€)
(if off-peak tariff, list each of (230a) to (230g) se Energy for lighting	eparately as applicable an (232)	d apply fuel price according))
Additional standing charges (Table 12)			120 (251	1)
	one of (233) to (235) x)	13.19 × 0.0	01 = 0 (252	2)
Appendix Q items: repeat lines (253) and (254)	as needed			
Total energy cost(245)((247) + (250)(254) =		306.15 (255	5)
11a. SAP rating - individual heating systems				
Energy cost deflator (Table 12)			0.42 (256	5)
Energy cost factor (ECF) [(255) x	(256)] ÷ [(4) + 45.0] =		0.91 (257	7)
SAP rating (Section 12)			87.33 (258	3)
12a. CO2 emissions – Individual heating syste	ems including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	398.11 (261	I)
Space heating (secondary)	(215) x	0.519 =	0 (263	3)
Water heating	(219) x	0.216 =	372.89 (264	4)
Space and water heating	(261) + (262) + (263) + (26	64) =	771 (265	5)
Electricity for pumps, fans and electric keep-ho	t (231) x	0.519 =	38.93 (267	7)
Electricity for lighting	(232) x	0.519 =	204.78 (268	3)
Energy saving/generation technologies Total CO2, kg/year		sum of (265)(271) =	1014.71 (272	2)
CO2 emissions per m ²				
		(272) ÷ (4) =	10.51 (273	3)
El rating (section 14)		(272) ÷ (4) =	10.51 (273 90 (274	



	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	= 2248.58 (261)
Space heating (secondary)	(215) x	3.07	= 0 (263)
Energy for water heating	(219) x	1.22	= 2106.16 (264)
Space and water heating	(261) + (262) + (263)	+ (264) =	4354.74 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	= 230.25 (267)
Electricity for lighting	(232) x	0	= 1211.32 (268)
Energy saving/generation technologies 'Total Primary Energy		sum of (265)(271) =	5796.31 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	60.04 (273)



			User L	Details:						
Assessor Name:	Peter Mitch	nell		Strom	a Num	ber:		STRO	007945	
Software Name:	Stroma FS	AP 2012		Softwa	are Ver	sion:		Versio	n: 1.0.3.15	
			Property	Address:	: Unit 6 (GFEND) CLEAN	J		
Address :	New Dwellir	ng at:, Gordon	House, 6	Lissende	en Garde	ens, LOI	NDON, N	W5 1LX	(
1. Overall dwelling dim	ensions:									
			Are	a(m²)		Av. He	ight(m)		Volume(m ³)
Ground floor			9	96.54	(1a) x	2	2.4	(2a) =	231.7	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+((1d)+(1e)+(1n)	96.54	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	231.7	(5)
2. Ventilation rate:										
Number of chimneys	main heating	second heating		other	7 = [total	x 4	40 =	m ³ per hou	_
Number of open flues	0		╡ᆠ┝	0	」 - L ヿ ゠ Γ	0		20 =	0	(6a)
Number of intermittent fa		+ 0		0		0		10 =	0	(6b) (7a)
Number of passive vents						0		0 =	0	(74) (7b)
Number of flueless gas t						0	x 4	40 =	0	(7c)
						0			Ū	
								Air ch	anges per ho	ur
Infiltration due to chimne	-					20		÷ (5) =	0.09	(8)
If a pressurisation test has			eed to (17),	otherwise c	continue fro	om (9) to ((16)		-	
Number of storeys in t Additional infiltration	ne aweiling (ne	5)					[(0).	•1]x0.1 =	0	(9) (10)
Structural infiltration: () 25 for steel or	timber frame	or 0 35 fo	r masonr	v constr	uction	[(3)	1,0.1 -	0	
if both types of wall are p deducting areas of open	present, use the va	lue corresponding			•				0	
If suspended wooden	•		0.1 (seal	ed), else	enter 0				0	(12)
lf no draught lobby, er	nter 0.05, else e	enter 0							0	(13)
Percentage of window	s and doors dr	aught stripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value	•		•	•	•	etre of e	nvelope	area	4	(17)
If based on air permeab									0.29	(18)
Air permeability value appli Number of sides shelter		on test has been o	lone or a de	gree air pei	rmeability i	is being us	sed		0	(19)
Shelter factor	5u			(20) = 1 -	[0.075 x (1	9)] =			3 0.78	(19)
Infiltration rate incorpora	ting shelter fac	tor		(21) = (18)) x (20) =				0.22	(21)
Infiltration rate modified	•								0.22	
Jan Feb	Mar Apr	May Jur	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s	·		I						I	
(22)m= 5.1 5	4.9 4.4	4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
		I					1		I	
Wind Factor (22a)m = (2		1.00 0.07	0.05	0.00		1.00	4.40	1.40		
(22a)m= 1.27 1.25	1.23 1.1	1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		



Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	-	-	-		
	0.28	0.28	0.27	0.24	0.24	0.21	0.21	0.21	0.22	0.24	0.25	0.26		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se							(23a)
				endix N, (2	3b) = (23a	a) x Fmv (e	equation (N5)) . other	wise (23b) = (23a)			0	(23a) (23b)
			0 11	iency in %	, (, (• •	<i>,,</i> .	,	, (,			0	(23b) (23c)
			-	-	_					2h)m ± (23h) v [*	1 – (23c)		(230)
(24a)m=					0			0	0			1 - (230)	÷ 100]	(24a)
			_	entilation		-	-	-	m = (2)		23h)	Ů		
(24b)m=				0	0			0	0		0	0		(24b)
	_			ntilation c	_				-	, , , , , , , , , , , , , , , , , , ,	Ů	ů		
,				hen (240	•	•				.5 × (23b))			
(24c)m=	, <i>,</i>	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	/e input v	ventilatio	on from l	oft	1				
,				m = (22b		•				0.5]				
(24d)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)					
(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53		(25)
3. He	at losse	s and he	eat loss	paramete	er:									
	IENT	Gros		Openin		Net Ar	ea	U-valı	Je	ΑXU		k-value	9	A X k
		area	(m²)	m	2	A ,n	n²	W/m2	К	(W/	K)	kJ/m²∙l	<	kJ/K
Windo	ws Type	e 1				7.39	x1.	/[1/(1.2)+	0.04] =	8.46				(27)
Windo	ws Type	e 2				3.5	x1.	/[1/(1.2)+	0.04] =	4.01				(27)
Windo	ws Type	93				8.26	x1,	/[1/(1.2)+	0.04] =	9.46				(27)
Windo	ws Type	94				8.26	x1.	/[1/(1.2)+	0.04] =	9.46				(27)
Windo	ws Type	e 5				5.28	x1.	/[1/(1.2)+	0.04] =	6.05				(27)
Walls		108.	14	32.69	Э	75.45	5 X	0.16	=	12.07				(29)
Total a	area of e	elements	, m²			108.1	4							(31)
Party	wall					19.25	5 X	0	=	0				(32)
Party	wall					15.26	x	0	= =	0			\dashv	(32)
		roof wind	ows, use e	effective wi	ndow U-va				L /[(1/U-valu		as given in	paragraph		、 、
** incluc	le the area	as on both	sides of ir	nternal wal	ls and part	titions								
		ss, W/K :	•	U)				(26)(30)	+ (32) =				49.5	(33)
		Cm = S(. ,						((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TM	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
	0	sments wh ad of a de		tails of the ulation.	constructi	ion are not	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						6.79	(36)
			are not kr	own (36) =	= 0.15 x (3	1)								
	abric he									(36) =			56.29	(37)
Ventila		1	1	monthly							(25)m x (5)	r	I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00)
(38)m=	41.29	41.17	41.05	40.51	40.41	39.93	39.93	39.84	40.11	40.41	40.61	40.83		(38)
Heat t		coefficier	r	,	I					= (37) + (r.		I	
(39)m=	97.58	97.47	97.35	96.8	96.7	96.22	96.22	96.13	96.41	96.7	96.91	97.12		<u> </u>
Stroma	FSAP 201	2 Version:	1.0.3.15	(SAP 9.92)	- http://ww	ww.stroma	.com			Average =	Sum(39)1	12 /12=	96. 8	2 of 38)



Heat lo	Heat loss parameter (HLP), W/m ² K $(40)m = (39)m \div (4)$													
(40)m=	1.01	1.01	1.01	1	1	1	1	1	1	1	1	1.01		
Numbe	er of day	vs in mo	nth (Tabl	le 1a)					/	Average =	Sum(40) _{1.}	12 /12=	1	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
I														
4. Wa	iter heat	ting ene	rgy requi	rement:								kWh/ye	ear:	
if TF			N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.(0013 x (1	ΓFA -13.	2. .9)	71		(42)
Reduce	the annua	al average	ater usag hot water person per	usage by a	5% if the c	welling is	designed t			se target o		.45		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea		,				000	•••		200		
(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		
. ,										Fotal = Su	m(44) ₁₁₂ =		1181.35	(44)
Energy o	content of	hot water	used - cale	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mon	oth (see Ta	ables 1b, 1	c, 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		
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	(45)	
(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)
	storage													
-		. ,	includin				-		ame vess	sel		0		(47)
	•	•	ind no ta		•			• •		(0) : . (47)			
	/ise if no storage		hot wate	er (this in	iciudes i	nstantar	ieous co	inod idmo	ers) ente	er '0' in (47)			
	0		eclared le	oss facto	or is kno	wn (kWł	n/dav):					0		(48)
,			m Table				, , , .					0		(49)
-			storage		ear			(48) x (49)) =			0		(50)
			eclared c			or is not		(-/ (-/				0		(00)
		-	factor fr		e 2 (kW	h/litre/da	y)					0		(51)
	•	-	ee sectio	on 4.3										()
		from Ta	bie ∠a m Table	2h								0		(52) (53)
					or			(47) x (51)	v (52) v (l	52) -		0		
		(54) in (5	storage	, KVVII/ye	al			(47) X (31)	(JZ) X (55) =		0 0		(54) (55)
	. , .	. , .	culated f	or each	month			((56)m = (55) x (41)r	m		0		(00)
	0	0	0	0	0	0	0	0	0	0	0	0		(56)
(56)m= If cylinde	_	-	d solar sto		-	-			-	÷		-	ix H	(00)
-														(57)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
	•	•	nual) fro			>						0		(58)
	•		culated f					• •		r tharma	etet)			
(moc (59)m=			rom Tabl				o o o o o	ng and a				0		(59)
(33)11=	v	U	Ŭ	Ū	U		U		Ū	Ū	, U	0		(00)



Combi	loss ca	lculated	for each	n month ((61)m =	(60) ÷ 36	65 × (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		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(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		(62)
Solar DH	HW input o	calculated	using App	endix G or	Appendix	H (negativ	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or V	WWHRS	applies	, see Ap	pendix (G)			_		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	37.65	27.8	22.17	12.1	9.24	7.72	7.39	8.33	8.37	15.4	28.37	38.68		(63) (G2)
WWHR	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
Output	from w	ater hea	ter											
(64)m=	120.32	111.5	125.42	121.89	121.97	109.75	108.3	118.38	119.19	126.75	118.17	115.96		
				-				Outp	out from wa	ater heate	r (annual)₁	12	1417.59	(64)
Heat g	ains froi	m water	heating,	, kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	۲ ((46)m	+ (57)m	+ (59)m]	
(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	de (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the c	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal da	ains (see	Table 5	5 and 5a):	•		-				-	-	
		s (Table												
MELAD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26		(66)
				ı opendix				l Iso see '						
(67)m=	22.34	19.84	16.14	12.22	9.13	7.71	8.33	10.83	14.54	18.46	21.54	22.96		(67)
				Append										
7001101 (68)m=	250.61	253.21	246.66	232.71	215.09	198.54	187.49	184.89	191.44	205.39	223	239.55		(68)
											220	200.00		(00)
	36.53	(Calcula 36.53	36.53	ppendix 36.53	L, equal 36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53		(69)
(69)m=					30.33	30.33	30.33	30.03	30.03	30.55	30.03	30.55	,	(00)
		ns gains	r`	, 			0							(70)
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	I	(70)
		· · · · · · · · · · · · · · · · · · ·	<u> </u>	tive valu	, ,	,						i	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	I	(71)
Water		gains (T	able 5)										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	I	(72)
Total i	nternal	gains =				(66)	m + (67)m	n + (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	428.42	426.25	411.27	386.37	360.84	336.32	320.89	327.86	341.06	366.18	394.38	415.72		(73)
	lar gains													
				r flux from	Table 6a			tions to co	onvert to th	e applicat		ion.		
Orienta		Access F Table 6d		Area m²		Flu Tat	x ble 6a	Т	g_ able 6b	Т	FF able 6c		Gains (W)	
Northea	ast 0.9x	0.77	x	7.3	9	x 1	1.28	x	0.76	x	0.7	=	30.74	(75)

х

x

8.26

7.39

11.28

22.97

х

x

0.76

0.76

х

x

0.7

0.7

=

=

х

x

0.77

0.77

Northeast 0.9x

Northeast 0.9x

34.36

62.57

(75)

(75)

be	compliance testing consulting
build energy	

Northeast 0.9x	0.77	x	8.26	×	22.97	×	0.76	x	0.7] =	69.94	(75)
Northeast 0.9x	0.77	x	7.39	×	41.38	x	0.76	x	0.7	1 =	112.74	(75)
Northeast 0.9x	0.77	x	8.26	×	41.38	x	0.76	x	0.7	=	126.01	(75)
Northeast 0.9x	0.77	X	7.39	×	67.96	x	0.76	x	0.7	i =	185.15	(75)
Northeast 0.9x	0.77] ×	8.26	×	67.96	x	0.76	x	0.7	i =	206.94	(75)
Northeast 0.9x	0.77	x	7.39	×	91.35	x	0.76	x	0.7	i -	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	×	7.39	×	97.38	×	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	×	72.63	x	0.76	x	0.7] =	197.87	(75)
Northeast 0.9x	0.77	x	8.26	×	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	×	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	×	14.2	x	0.76	x	0.7	=	38.68	(75)
Northeast 0.9x	0.77	x	8.26	×	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	×	62.67	x	0.76	x	0.7	=	80.87	(77)
Southeast 0.9x	0.77	x	5.28	×	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	×	85.75	X	0.76	x	0.7	=	166.93	(77)
Southeast 0.9x	0.77	x	3.5	×	106.25	X	0.76	x	0.7	=	137.1	(77)
Southeast 0.9x	0.77	×	5.28	×	106.25	X	0.76	x	0.7	=	206.83	(77)
Southeast 0.9x	0.77	×	3.5	×	119.01	X	0.76	x	0.7] =	153.57	(77)
Southeast 0.9x	0.77	X	5.28	×	119.01	X	0.76	x	0.7] =	231.67	(77)
Southeast 0.9x	0.77	×	3.5	×	118.15	X	0.76	x	0.7] =	152.46	(77)
Southeast 0.9x	0.77	×	5.28	×	118.15	X	0.76	x	0.7	=	229.99	(77)
Southeast 0.9x	0.77	×	3.5	X	113.91	X	0.76	X	0.7	=	146.98	(77)
Southeast 0.9x	0.77	×	5.28	X	113.91	X	0.76	X	0.7	=	221.74	(77)
Southeast 0.9x	0.77	×	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	×	92.85	×	0.76	x	0.7] =	119.81	(77)
Southeast 0.9x	0.77	X	5.28	×	92.85	X	0.76	x	0.7] = 1	180.75	(77)
Southeast 0.9x	0.77	_ ×	3.5	×	69.27	×	0.76	x	0.7] =	89.38	(77)
Southeast 0.9x	0.77	x	5.28	×	69.27	X	0.76	X	0.7	=	134.84	(77)



		_											
Southeast 0.9x	0.77	x	3.5	x	4	4.07	x	0.76	x	0.7	=	56.87	(77)
Southeast 0.9x	0.77	x	5.28	x	4	4.07	x	0.76	x	0.7	=	85.79	(77)
Southeast 0.9x	0.77	x	3.5	x	3	1.49	x	0.76	x	0.7	=	40.63	(77)
Southeast 0.9x	0.77	x	5.28	x	3	1.49	x	0.76	x	0.7	=	61.29	(77)
Southwest0.9x	0.77	x	8.26	×	3	6.79		0.76	×	0.7	=	112.05	(79)
Southwest0.9x	0.77	x	8.26	x	6	2.67		0.76	x	0.7		190.86	(79)
Southwest0.9x	0.77	×	8.26	×	8	5.75		0.76	×	0.7	= =	261.14	(79)
Southwest0.9x	0.77	×	8.26	×	1	06.25		0.76	x	0.7	=	323.56	(79)
Southwest0.9x	0.77	×	8.26	×	1	19.01		0.76	×	0.7	_ =	362.42	(79)
Southwest0.9x	0.77	×	8.26	×	1	18.15		0.76	×	0.7	=	359.8	(79)
Southwest0.9x	0.77	×	8.26	×	1	13.91		0.76	×	0.7	=	346.88	(79)
Southwest0.9x	0.77	×	8.26	×	10	04.39		0.76	×	0.7	=	317.9	(79)
Southwest0.9x	0.77	×	8.26	×	9	2.85		0.76	×	0.7	=	282.76	(79)
Southwest0.9x	0.77	x	8.26	x	6	9.27		0.76	x	0.7	=	210.94	(79)
Southwest0.9x	0.77	×	8.26	x	4	4.07		0.76	×	0.7	=	134.21	(79)
Southwest0.9x	0.77	×	8.26	x	3	1.49		0.76	×	0.7	=	95.89	(79)
Solar gains ir	watts, calcu	lated	for each mo	onth			(83)m =	Sum(74)m	.(82)m			_	
(83)m= 296.25			1059.59 127		304.13		1074.8	5 874.23	597.1	358.77	250.98		(83)
Total gains –			· / ·	<u>, </u>	,							-	
(84)m= 724.67	952.49 11	88.73	1445.96 163	5.54 1	640.45	1562.13	1402.7	1215.29	963.28	3 753.15	666.7		(84)
7. Mean inte	ernal tempera	ature (heating sea	son)									
	ernal temperate e during heat		Ŭ		area	from Tab	ole 9, T	'n1 (°C)				21	(85)
Temperatur		ting pe	eriods in the	living			ole 9, T	'n1 (°C)				21	(85)
Temperatur	e during heat	ting pe	eriods in the ving area, h	living			ole 9, T Aug	1 - 1	Oct	Nov	Dec	ـــــــــــــــــــــــــــــــــــــ	(85)
Temperatur Utilisation fa	e during heat ctor for gains Feb	ting pe s for li	eriods in the ving area, h	living 1,m (s lay	see Ta	ble 9a)			Oct 0.87	Nov 0.98	Dec 1	ـــــــــــــــــــــــــــــــــــــ	(85)
Temperature Utilisation fa Jan (86)m= 0.99	e during heat ctor for gains Feb	ting pe s for li Mar	eriods in the ving area, h Apr N 0.75 0.3	living 1,m (s lay	see Ta Jun 0.37	ble 9a) Jul 0.27	Aug 0.31	Sep 0.54		-		ـــــــــــــــــــــــــــــــــــــ]
Temperature Utilisation fa Jan (86)m= 0.99	e during heat ctor for gains Feb I 0.97 0 al temperatu	ting pe s for li Mar	eriods in the ving area, h Apr N 0.75 0.3	living 1,m (s lay 54 1 (follo	see Ta Jun 0.37	ble 9a) Jul 0.27	Aug 0.31	Sep 0.54		0.98		ـــــــــــــــــــــــــــــــــــــ]
Temperature Utilisation fa (86)m= 0.99 Mean intern (87)m= 20.09	e during heat actor for gains Feb I 0.97 0 al temperatu 20.36 20	ting pe s for li Mar .91 re in li 0.67	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20.	living 1,m (s lay 54 1 (follo 99	see Ta Jun 0.37 ow ste 21	ble 9a) Jul 0.27 ps 3 to 7 21	Aug 0.31 7 in Tat 21	Sep 0.54 ble 9c) 20.99	0.87	0.98	1	ـــــــــــــــــــــــــــــــــــــ	(86)
Temperature Utilisation fa (86)m= 0.99 Mean intern (87)m= 20.09	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat	ting pe s for li Mar .91 re in li 0.67	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20.	living 1,m (s lay 54 1 (follo 99 t of dv	see Ta Jun 0.37 ow ste 21	ble 9a) Jul 0.27 ps 3 to 7 21	Aug 0.31 7 in Tat 21	Sep 0.54 ble 9c) 20.99	0.87	0.98	1	ـــــــــــــــــــــــــــــــــــــ	(86)
Temperature Utilisation fa (86)m= 0.99 Mean intern (87)m= 20.09 Temperature (88)m= 20.07	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20	ting person of the second seco	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20. eriods in res 20.08 20.	living 1,m (s lay 54 1 (follo 99 t of dv 08	see Ta Jun 0.37 ow ste 21 velling 20.09	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09	Aug 0.31 7 in Tat 21 ble 9, 7 20.09	Sep 0.54 0le 9c) 20.99 Th2 (°C)	0.87	0.98	1 20.03	ـــــــــــــــــــــــــــــــــــــ	(86) (87)
Temperature Utilisation fa (86)m= 0.99 Mean intern (87)m= 20.09 Temperature (88)m= 20.07 Utilisation fa	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20	ting personal sing personal si	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 ng, h2	see Ta Jun 0.37 ow ste 21 velling 20.09	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ee Table	Aug 0.31 7 in Tat 21 ble 9, 7 20.09 9a)	Sep 0.54 ble 9c) 20.99 Th2 (°C) 20.08	0.87	0.98 20.39 20.08	1 20.03 20.08	ـــــــــــــــــــــــــــــــــــــ	(86) (87) (88)
Temperature Utilisation fa (86)m= 0.99 Mean intern (87)m= 20.09 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.99	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ctor for gains 0.97 0	ting personal strain st	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 ng, h2 19	see Ta Jun 0.37 20w ste 21 velling 20.09 2,m (se 0.32	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ee Table 0.21	Aug 0.31 7 in Tak 21 ble 9, 7 20.09 9a) 0.25	Sep 0.54 ble 9c) 20.99 Th2 (°C) 20.08	0.87 20.83 20.08 0.83	0.98	1 20.03	ـــــــــــــــــــــــــــــــــــــ	(86) (87)
Temperature Utilisation fa (86)m= \boxed{Jan} (86)m= $\boxed{0.99}$ Mean intern (87)m= $\boxed{20.09}$ Temperature (88)m= $\boxed{20.07}$ Utilisation fa (89)m= $\boxed{0.99}$ Mean intern	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ctor for gains 0.97 0 al temperatu	ting personal time personal ti	eriods in the ving area, h Apr N 0.75 0.6 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4 he rest of dw	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 1 (follo 99 t of dv 08 1 1 1 (follo 99 t of dv 08 1 1 1 1 1 1 1 1 1 1 1 1 1	see Ta Jun 0.37 ow ste 21 velling 20.09 2,m (se 0.32 g T2 (fe	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ee Table 0.21	Aug 0.31 7 in Tal 21 ble 9, 20.09 9a) 0.25 ps 3 to	Sep 0.54 ole 9c) 20.99 Th2 (°C) 20.08 0.47 0 7 in Table	0.87 20.83 20.08 0.83 e 9c)	0.98 20.39 20.08 0.98	1 20.03 20.08 0.99	ـــــــــــــــــــــــــــــــــــــ	(86) (87) (88) (89)
Temperature Utilisation fa (86)m= 0.99 Mean intern (87)m= 20.09 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.99	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ctor for gains 0.97 0 al temperatu	ting personal strain st	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 1 (follo 99 t of dv 08 1 1 1 (follo 99 t of dv 08 1 1 1 1 1 1 1 1 1 1 1 1 1	see Ta Jun 0.37 20w ste 21 velling 20.09 2,m (se 0.32	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ee Table 0.21	Aug 0.31 7 in Tak 21 ble 9, 7 20.09 9a) 0.25	Sep 0.54 ole 9c) 20.99 Th2 (°C) 20.08 0.47 0 7 in Table 20.08	0.87 20.83 20.08 0.83 0.83 9 9 c) 19.91	0.98 20.39 20.08 0.98 19.32	1 20.03 20.08 0.99 18.79		(86) (87) (88) (89) (90)
Temperature Utilisation fa (86)m= \boxed{Jan} (86)m= $\boxed{0.99}$ Mean intern (87)m= $\boxed{20.09}$ Temperature (88)m= $\boxed{20.07}$ Utilisation fa (89)m= $\boxed{0.99}$ Mean intern	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ctor for gains 0.97 0 al temperatu	ting personal time personal ti	eriods in the ving area, h Apr N 0.75 0.6 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4 he rest of dw	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 1 (follo 99 t of dv 08 1 1 1 (follo 99 t of dv 08 1 1 1 1 1 1 1 1 1 1 1 1 1	see Ta Jun 0.37 ow ste 21 velling 20.09 2,m (se 0.32 g T2 (fe	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ee Table 0.21	Aug 0.31 7 in Tal 21 ble 9, 20.09 9a) 0.25 ps 3 to	Sep 0.54 ole 9c) 20.99 Th2 (°C) 20.08 0.47 0 7 in Table 20.08	0.87 20.83 20.08 0.83 0.83 9 9 c) 19.91	0.98 20.39 20.08 0.98	1 20.03 20.08 0.99 18.79	ـــــــــــــــــــــــــــــــــــــ	(86) (87) (88) (89)
Temperature Utilisation fa (86)m= \boxed{Jan} (86)m= $\boxed{0.99}$ Mean intern (87)m= $\boxed{20.09}$ Temperature (88)m= $\boxed{20.07}$ Utilisation fa (89)m= $\boxed{0.99}$ Mean intern (90)m= $\boxed{18.87}$ Mean intern	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ctor for gains 0.97 0 al temperatu	ting personal sing personal si	eriods in the ving area, h Apr N 0.75 0.9 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4 he rest of dw 19.99 20.	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 ng, h2 19 welling 07	see Ta Jun 0.37 ow ste 21 velling 20.09 2,m (se 0.32 0.32 0.32 0.32 0.32	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ee Table 0.21 ollow ste 20.09	Aug 0.31 7 in Tak 21 ble 9, 20.09 9a) 0.25 ps 3 to 20.09	Sep 0.54 0.54 0.54 0.99 Th2 (°C) 20.08 0.47 0.	0.87 20.83 20.08 0.83 0.83 9 9 c) 19.91	0.98 20.39 20.08 0.98 19.32	1 20.03 20.08 0.99 18.79		(86) (87) (88) (89) (90)
Temperature Utilisation fa (86)m= $\boxed{0.99}$ Mean intern (87)m= $\boxed{20.09}$ Temperature (88)m= $\boxed{20.07}$ Utilisation fa (89)m= $\boxed{0.99}$ Mean intern (90)m= $\boxed{18.87}$ Mean intern (92)m= $\boxed{19.5}$	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ctor for gains 0.97 0 al temperatu 19.26 19 al temperatu	ting pe s for li Mar .91 re in li 0.67 ting pe 0.08 s for re .89 re in t 9.69 re (for 0.2	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4 19.99 20. • the whole of 20.46 20.46 20.	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 mg, h2 19 welling 07 54 1 1 1 1 1 1 1 1 1 1 1 1 1	see Ta Jun 0.37 20w ste 21 velling 20.09 2,m (se 0.32 0 T2 (fr 20.09 mg) = fl 20.56	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ee Table 0.21 ollow ste 20.09 _A × T1 20.56	Aug 0.31 7 in Tat 21 ble 9, 7 20.09 9a) 0.25 ps 3 tc 20.09 + (1 – 7 20.56	Sep 0.54 0.54 0le 9c) 20.99 Th2 (°C) 20.08 0.47 0.47 0.47 0.47 1.00 1.00 0.47 0.47 0.47 0.47 0.47 0.47 0.47 0.47 0.54	0.87 20.83 20.08 0.83 9 9 c) 19.91 .A = Liv 20.38	0.98 20.39 20.08 0.98 19.32	1 20.03 20.08 0.99 18.79		(86) (87) (88) (89) (90)
Temperature Utilisation fa (86)m= \boxed{Jan} (86)m= $\boxed{0.99}$ Mean intern (87)m= $\boxed{20.09}$ Temperature (88)m= $\boxed{20.07}$ Utilisation fa (89)m= $\boxed{0.99}$ Mean intern (90)m= $\boxed{18.87}$ Mean intern (92)m= $\boxed{19.5}$ Apply adjust	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ctor for gains 0.97 0 al temperatu 19.26 19 al temperatu 19.83 2 cment to the p	ting personal sing personal si	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4 he rest of dw 19.99 20. the whole of 20.46 20. internal terr	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 1 (follo 99 t of dv 08 1 1 1 (follo 99 t of dv 08 1 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 1 1 1 1 1 1 1 1 1 1	see Ta Jun 0.37 ow ste 21 velling 20.09 c,m (se 0.32 g T2 (fo 20.09 g T2 (fo 20.09 g T2 (fo 20.09	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ee Table 0.21 ollow ste 20.09 _A × T1 20.56 m Table	Aug 0.31 7 in Tak 21 ble 9, 20.09 9a) 0.25 ps 3 to 20.09 + (1 – 20.56 4e, wh	Sep 0.54 ole 9c) 20.99 Th2 (°C) 20.08 0.47 0 7 in Table 20.08 fLA) × T2 20.55 pere appro	0.87 20.83 20.08 0.83 e 9c) 19.91 .A = Liv 20.38 priate	0.98 20.39 20.08 0.98 19.32 ring area ÷ (4 19.87	1 20.03 20.08 0.99 18.79 +) = 19.43		(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fa (86)m= 0.99 Mean intern (87)m= 20.09 Temperature (88)m= 20.07 Utilisation fa (89)m= 0.99 Mean intern (90)m= 18.87 Mean intern (92)m= 19.5 Apply adjust (93)m= 19.35	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ctor for gains 0.97 0 al temperatu 19.26 19 al temperatu 19.83 2 cment to the r 19.68 20	ting pe s for li Mar .91 re in li 0.67 ting pe 0.08 s for re .89 re in t 9.69 re (for 0.2 mean 0.05	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4 19.99 20. • the whole of 20.46 20.46 20.	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 1 (follo 99 t of dv 08 1 1 1 (follo 99 t of dv 08 1 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 (follo 99 1 1 1 1 1 1 1 1 1 1 1 1 1	see Ta Jun 0.37 20w ste 21 velling 20.09 2,m (se 0.32 0 T2 (fr 20.09 mg) = fl 20.56	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ee Table 0.21 ollow ste 20.09 _A × T1 20.56	Aug 0.31 7 in Tat 21 ble 9, 7 20.09 9a) 0.25 ps 3 tc 20.09 + (1 – 7 20.56	Sep 0.54 0.54 0le 9c) 20.99 Th2 (°C) 20.08 0.47 0.47 0.47 0.47 1.00 1.00 0.47 0.47 0.47 0.47 0.47 0.47 0.47 0.47 0.54	0.87 20.83 20.08 0.83 9 9 c) 19.91 .A = Liv 20.38	0.98 20.39 20.08 0.98 19.32 ring area ÷ (4 19.87	1 20.03 20.08 0.99 18.79		(86) (87) (88) (89) (90) (91)
Temperature Utilisation fa (86)m= \boxed{Jan} (86)m= $\boxed{0.99}$ Mean intern (87)m= $\boxed{20.09}$ Temperature (88)m= $\boxed{20.07}$ Utilisation fa (89)m= $\boxed{0.99}$ Mean intern (90)m= $\boxed{18.87}$ Mean intern (92)m= $\boxed{19.5}$ Apply adjust (93)m= $\boxed{19.35}$ 8. Space he	e during heat ictor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ictor for gains 0.97 0 al temperatu 19.26 19 al temperatu 19.83 2 iment to the r 19.68 20 ating require	ting personal strain st	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4 he rest of dwelli 0.71 0.4 he rest of dwelli 0.71 0.4 internal terr 20.31 20.	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 ng, h2 19 welling 07 54 1 1 1 1 1 1 1 1 1 1 1 1 1	see Ta Jun 0.37 ow ste 21 velling 20.09 2,m (se 0.32 g T2 (fo 20.09 mg) = fl 20.56 ure fro 20.41	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ce Table 0.21 ollow ste 20.09 _A × T1 20.56 m Table 20.41	Aug 0.31 7 in Tak 21 ble 9, 20.09 9a) 0.25 ps 3 to 20.09 + (1 – 20.56 4e, wł 20.41	Sep 0.54 0le 9c) 20.99 Th2 (°C) 20.08 0.47 0 7 in Table 20.08 fLA) × T2 20.55 pere appro 20.4	0.87 20.83 20.08 0.83 20.08 9C) 19.91 A = Liv 20.38 priate 20.23	0.98 20.39 20.08 0.98 19.32 ting area ÷ (4 19.87 19.72	1 20.03 20.08 0.99 18.79 +) = 19.43 19.28		(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fa (86)m= \boxed{Jan} (86)m= $\boxed{0.99}$ Mean intern (87)m= $\boxed{20.09}$ Temperature (88)m= $\boxed{20.07}$ Utilisation fa (89)m= $\boxed{0.99}$ Mean intern (90)m= $\boxed{18.87}$ Mean intern (92)m= $\boxed{19.5}$ Apply adjust (93)m= $\boxed{19.35}$ 8. Space he Set Ti to the	e during heat ictor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ictor for gains 0.97 0 al temperatu 19.26 19 al temperatu 19.83 2 iment to the r 19.68 20 ating require mean intern	ting personal sing personal si	eriods in the ving area, h Apr N 0.75 0.4 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4 he rest of dw 19.99 20. the whole of 20.46 20. internal terr 20.31 20.	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 ng, h2 19 welling 07 54 sperato 39 tained	see Ta Jun 0.37 ow ste 21 velling 20.09 2,m (se 0.32 g T2 (fo 20.09 mg) = fl 20.56 ure fro 20.41	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ce Table 0.21 ollow ste 20.09 _A × T1 20.56 m Table 20.41	Aug 0.31 7 in Tak 21 ble 9, 20.09 9a) 0.25 ps 3 to 20.09 + (1 – 20.56 4e, wł 20.41	Sep 0.54 0le 9c) 20.99 Th2 (°C) 20.08 0.47 0 7 in Table 20.08 fLA) × T2 20.55 pere appro 20.4	0.87 20.83 20.08 0.83 20.08 9C) 19.91 A = Liv 20.38 priate 20.23	0.98 20.39 20.08 0.98 19.32 ting area ÷ (4 19.87 19.72	1 20.03 20.08 0.99 18.79 +) = 19.43 19.28		(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fa (86)m= \boxed{Jan} (86)m= $\boxed{0.99}$ Mean intern (87)m= $\boxed{20.09}$ Temperature (88)m= $\boxed{20.07}$ Utilisation fa (89)m= $\boxed{0.99}$ Mean intern (90)m= $\boxed{18.87}$ Mean intern (92)m= $\boxed{19.5}$ Apply adjust (93)m= $\boxed{19.35}$ 8. Space he Set Ti to the	e during heat ctor for gains Feb I 0.97 0 al temperatu 20.36 20 e during heat 20.08 20 ctor for gains 0.97 0 al temperatu 19.26 19 al temperatu 19.83 2 ment to the r 19.68 20 ating require mean intern n factor for g	ting personal sing personal si	eriods in the ving area, h Apr N 0.75 0.9 iving area T 20.91 20. eriods in res 20.08 20. est of dwelli 0.71 0.4 he rest of dwelli 0.71 0.4 he rest of dwelli 20.46 20. internal ter 20.31 20.	living 1,m (s lay 54 1 (follo 99 t of dv 08 1 ng, h2 19 welling 07 54 sperato 39 tained	see Ta Jun 0.37 ow ste 21 velling 20.09 2,m (se 0.32 g T2 (fo 20.09 mg) = fl 20.56 ure fro 20.41	ble 9a) Jul 0.27 ps 3 to 7 21 from Ta 20.09 ce Table 0.21 ollow ste 20.09 _A × T1 20.56 m Table 20.41	Aug 0.31 7 in Tak 21 ble 9, 20.09 9a) 0.25 ps 3 to 20.09 + (1 – 20.56 4e, wł 20.41	Sep 0.54 0le 9c) 20.99 Th2 (°C) 20.08 0.47 0 7 in Table 20.08 fLA) × T2 20.55 nere appro 20.4	0.87 20.83 20.08 0.83 20.08 9C) 19.91 A = Liv 20.38 priate 20.23	0.98 20.39 20.08 0.98 19.32 ing area ÷ (4 19.87 19.72 (76)m and	1 20.03 20.08 0.99 18.79 +) = 19.43 19.28		(86) (87) (88) (89) (90) (91) (92)



Utilisa	ation fac	ctor for g	ains, hm	n:										
(94)m=	0.99	0.96	0.89	0.72	0.51	0.34	0.23	0.27	0.49	0.83	0.97	0.99		(94)
Usefu	ul gains,	, hmGm	, W = (94	4)m x (84	4)m	-		•			•			
(95)m=	717.48	918.22	1056.34	1035.73	830.77	557.87	366.3	385.1	601.06	803.73	733.31	662.26		(95)
Mont	hly aver	age exte	ernal tem	perature	e from T	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 rat	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]	_			
(97)m=	1468.95	1440.35	1318.73	1104.9	840.58	558.72	366.38	385.29	607.2	931.46	1223.14	1464.88		(97)
Spac	e heatir	ng 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=	559.09	350.87	195.22	49.8	7.29	0	0	0	0	95.03	352.68	597.15		_
								Tota	al per year	(kWh/yeai	r) = Sum(9	8)15,912 =	2207.14	(98)
Spac	e heatir	ng require	ement in	kWh/m²	²/year]	22.86	(99)
9a, En	erav re	quiremer	nts – Ind	ividual h	eating s	vstems i	ncluding	ı micro-C	CHP)			L		-
	e heati	•			o a an ig o)					
•		pace hea	at from s	econdar	y/supple	mentary	system]	0	(201)
Fract	ion of s	bace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =			Ī	1	(202)
		otal heati			~ /			(204) = (2	02) × [1 –	(203)] =		L I	1	(204)
		main spa	0							(/]		l		4
	•	•		0,			0/					ļ	90.4	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heatin	g system	ז, % י	i	i				0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Spac	e heatir	ng require	ement (c	alculate	d above)					1			
	559.09	350.87	195.22	49.8	7.29	0	0	0	0	95.03	352.68	597.15		
(211)n	n = {[(98	3)m x (20	04)] } x 1	00 ÷ (20)6)									(211)
	618.47	388.13	215.95	55.09	8.07	0	0	0	0	105.12	390.13	660.56		_
								Tota	al (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2441.53	(211)
Spac	e heatir	ng fuel (s	econdar	y), kWh/	month							_		-
= {[(98)m x (2	01)]}x1	00 ÷ (20	8)				ī	ī					
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	al (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
Water	heating	g												
Output		ater hea												
	120.32	111.5	125.42	121.89	121.97	109.75	108.3	118.38	119.19	126.75	118.17	115.96		п
		ater hea	i	1									80.3	(216)
(217)m=	88.43	87.74	86.16	82.99	80.81	80.3	80.3	80.3	80.3	84.34	87.63	88.59		(217)
		heating,												
. ,	1 = (64)	<u>)m x 100</u> 127.08	$\frac{1}{2} \div (217)$	146.88	150.93	136.67	134.87	147.42	148.43	150.29	134.84	130.89		
<u>,</u>		1		I	I	1	1		l = Sum(2)				1689.93	(219)
Δnnur	al totals										Wh/year	. l	kWh/year	
) g fuel use	ed, main	system	1					ĸ	••••yedi	[2441.53	1
	-			.,								L r		L T
vvater	neating	fuel use	u										1689.93	

Electricity for pumps, fans and electric keep-hot



central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)(230g) =	75 (231)
Electricity for lighting			394.57 (232)
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 =	527.37 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	365.03 (264)
Space and water heating	(261) + (262) + (263) + (264) =	892.4 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	204.78 (268)
Energy saving/generation technologies Total CO2, kg/year		sum of (265)(271) =	1136.1 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	11.77 (273)
El rating (section 14)			89 (274)



			User [Details:						
Assessor Name:	Peter Mitch	nell		Strom	a Num	ber:		STRO	007945	
Software Name:	Stroma FS			Softwa					n: 1.0.3.15	
			Property	Address	: Unit 6 (GFEND) CLEAN	J		
Address :	New Dwellir	ng at:, Gordon	House, 6	Lissende	en Garde	ens, LOI	NDON, N	W5 1LX		
1. Overall dwelling dim	ensions:									
			Are	a(m²)		Av. He	ight(m)		Volume(m ³)	1
Ground floor				96.54	(1a) x	2	2.4	(2a) =	231.7	(3a)
Total floor area TFA = (1	la)+(1b)+(1c)+	(1d)+(1e)+	(1n)	96.54	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	231.7	(5)
2. Ventilation rate:				- 41						
	main heating	secono heatin		other		total			m ³ per hour	,
Number of chimneys	0	+ 0	+	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0	+ 0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ans				- Ē	3	x ′	0 =	30	(7a)
Number of passive vents	S					0	x ′	0 =	0	(7b)
Number of flueless gas f	fires					0	x 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimne	evs. flues and fa	ans = (6a)+(6b)	+(7a)+(7b)+	(7c) =	Г	30	<u> </u>	÷ (5) =	0.13	(8)
If a pressurisation test has					continue fre			. (0)	0.15	
Number of storeys in t	the dwelling (na	S)							0	(9)
Additional infiltration							[(9)-	1]x0.1 =	0	(10)
Structural infiltration: (•	uction			0	(11)
if both types of wall are µ deducting areas of open			g to the grea	ter wall are	a (after					
If suspended wooden			0.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, er	nter 0.05, else e	enter 0	·						0	(13)
Percentage of window	s and doors dr	aught stripped	t					·	0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00		·	0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value	, q50, expresse	ed in cubic me	tres per h	our per s	quare m	etre of e	nvelope	area	5	(17)
If based on air permeab									0.38	(18)
Air permeability value appli		on test has been	done or a de	gree air pe	rmeability	is being us	sed			٦
Number of sides shelter Shelter factor	ed			(20) = 1 -	[0.075 x (1	9)] =			3	(19) (20)
Infiltration rate incorpora	iting shelter fac	tor		(21) = (18)		-/1			0.78	
Infiltration rate modified	-			(21) - (10)) x (20) -				0.29	(21)
Jan Feb	Mar Apr	May Ju	n Jul	Aug	Sep	Oct	Nov	Dec		
				Aug		001		Dee		
Monthly average wind sp (22)m= 5.1 5	4.9 4.4	e / 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
(<u></u>	-1.0 4.4	J J.O	5.0	5.1		4.5	4.5	-7.1		
Wind Factor (22a)m = (2	22)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1	1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		



Adjust	ed infiltra	ation rat	e (allowi	ng for sh	elter an	d wind s	peed) =	(21a) x	(22a)m					
	0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35		
	ate effec echanica		•	rate for t	he appli	cable ca	se							(23a)
				endix N, (2	3b) = (23a	a) x Fmv (e	equation (N	(5)) othe	rwise (23h) = (23a)			0	(23a) (23b)
		• •	0	iency in %	, (, ,	•	,, .	`) (200)			0	(230) (23c)
			-	-	-					2h)m ⊥ ('	23h) v [·	1 – (23c)	-	(230)
(24a)m=					0			0				1 - (230)		(24a)
		-	anical ve	entilation	-	heat rec		1 /\/) (24H	1 - (22)	$\frac{1}{2}$	23h)	-	1	· · ·
(24b)m=				0	0					0	0	0	1	(24b)
				tilation of	-								l	· · ·
,				hen (24d	•	•				5 × (23b))			
(24c)m=		0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilati	on or wh	ole hous	e positiv	ve input v	ventilatio	on from I	oft				1	
,	if (22b)n	n = 1, th	en (24d)	m = (22b)m othe	erwise (2	4d)m = (0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in box	k (25)					
(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
3. He	at losse	s and he	eat loss i	paramete	er:									
ELEN		Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	()	k-value kJ/m²·l		A X k kJ/K
Windo	ws Type					5.46		/[1/(1.4)+		7.24				(27)
Windo	ws Type	2				2.58		/[1/(1.4)+	0.04] =	3.42				(27)
	ws Type					6.1		/[1/(1.4)+	L	8.09				(27)
	ws Type					6.1		/[1/(1.4)+	L	8.09				(27)
	ws Type					3.9		/[1/(1.4)+	L		\exists			(27)
Walls	wo rype		44	011						5.17				
	area of e	108.		24.14	+	84	×	0.18	= [15.12				(29)
		lements	, 111-			108.1	=		r		—			(31)
Party v						19.25		0		0			\dashv	(32)
Party v				f f a a b a a b b b b b b b b b b		15.26		0	=	0				(32)
** incluc	le the area	as on both	sides of ir	nternal wal			-			ie)+0.04j a	is given in	paragraph	1 3.2	
			= S (A x	U)				(26)(30)) + (32) =				47.12	(33)
	apacity		· ,						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
		•	· ·	P = Cm ÷	,					tive Value			250	(35)
	•		ere the de tailed calc	tails of the	construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
				culated u	usina Ar	pendix ł	<						3.52	(36)
	-	•		own (36) =	• •	•							0.02	(00)
	abric he								(33) +	(36) =			50.65	(37)
Ventila	ation hea	at loss c	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	43.61	43.4	43.19	42.23	42.05	41.21	41.21	41.06	41.54	42.05	42.41	42.8		(38)
Heat ti	ransfer c	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	94.25	94.04	93.84	92.88	92.7	91.86	91.86	91.7	92.18	92.7	93.06	93.44		

Average = Sum(39)_{1...12} /12= 92.8 $\beta_{age 2} \oint 39$



Heat lo	oss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	(4)			
(40)m=	0.98	0.97	0.97	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.96	0.97		_
Numbe	er of day	rs in mor	nth (Tabl	le 1a)					/	Average =	Sum(40)1	.12 /12=	0.96	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ing ener	gy requi	rement:								kWh/ye	ear:	
if TF	ed occu A > 13.9 A £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	⁻ A -13.9)2)] + 0.(0013 x (1	ΓFA -13.	2. ⁻ 9)	71		(42)
Reduce	the annua	l average		usage by	5% if the a	welling is	designed	(25 x N) to achieve		se target o		.45		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea		,				000	•••		200		
(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		
									-	Total = Su	m(44) ₁₁₂ =	:	1181.35	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mon	oth (see Ta	bles 1b, 1	c, 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		_
lf instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46		Fotal = Su	m(45) ₁₁₂ =	:	1548.94	(45)
(46)m= Water	24.09 storage	21.07 loss:	21.74	18.95	18.19	15.69	14.54	16.69	16.89	19.68	21.48	23.33		(46)
	•		includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel	()		(47)
Otherw	•	stored	nd no ta hot wate		-			(47) ombi boil	ers) ente	er '0' in (47)			
a) If m	anufact	urer's de	eclared lo	oss facto	or is kno	wn (kWł	n/day):				(0		(48)
•			m Table								(0		(49)
•••			storage	-		or is not		(48) x (49)) =		(0		(50)
		-	factor fr ee sectio		e 2 (kW	h/litre/da	ıy)				(0		(51)
	e factor	•									(0		(52)
Tempe	erature fa	actor fro	m Table	2b							(C		(53)
			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	(0		(54)
	(50) or (,								(0		(55)
Water	storage	loss cal	culated f	or each	month			((56)m = (55) × (41)r	n				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)i	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)
		•	inual) fro culated f			59)m = ((58) ÷ 36	65 × (41)	m		(0		(58)
	•					,	. ,	ng and a		r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)



Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m						
(61)m=	50.96	46.03	50.96	47.58	47.16	43.69	45.15	47.16	47.58	50.96	49.32	50.96		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(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		(62)
Solar DH	HW input of	calculated	using App	endix G or	Appendix	H (negativ	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G1
Output	from w	ater hea	ter											
(64)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		
			•					Outp	out from w	ater heate	r (annual)₁	12	2126.43	(64)
Heat g	ains fro	m water	heating	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(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	de (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	vater is fr	om com	munity h	eating	
5. Int	ernal ga	ains (see	e Table 5	5 and 5a):	-							-	
			e 5), Wat											
metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26	135.26		(66)
Liahtin	u dains	ı (calcula	ι ted in Aι	pendix	L. equat	ion L9 oi	r L9a), a	lso see	r Table 5			Į	1	
(67)m=	22.34	19.84	16.14	12.22	9.13	7.71	8.33	10.83	14.54	18.46	21.54	22.96		(67)
Applia	nces da	ins (calc	ulated in	Append	lixlea	uation L	13 or I 1	i 3a), alsc) see Ta	l ble 5			1	
(68)m=	250.61	253.21	246.66	232.71	215.09	198.54	187.49	184.89	191.44	205.39	223	239.55		(68)
), also se	L Pe Table				1	
(69)m=	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53		(69)
			(Table (1	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	1	(70)
				L tive valu			Ů		Ĵ		<u> </u>		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	1	(71)
				100.2	100.2	100.2	100.2	100.2	100.2	100.2	100.2	100.2	I	()
(72)m=	88.89	gains (T 86.62	81.9	74.87	70.03	63.49	58.5	65.57	68.51	75.76	83.26	86.63		(72)
				74.07	70.05			n + (68)m +]	()
		gains =	r	200.07	200.04		1	· · ·	· · ·	r	· · ·		l	(73)
(73)m=	428.42	426.25	411.27	386.37	360.84	336.32	320.89	327.86	341.06	366.18	394.38	415.72		(13)
	ar gains			r flux from	Table 6a	and associ	iated equa	ations to co	nvert to th	e applicat	ole orientat	ion		
-	ation: A	Access F Fable 6d	actor	Area m²		Flu			g_ able 6b		FF able 6c	.011.	Gains (W)	
Northea	ast <mark>0.9x</mark>	0.77	×	5.4	6	x 1	1.28) x [0.63	ר × ר	0.7		18.83	(75)

x

x

6.1

5.46

x

x

11.28

22.97

x

x

0.63

0.63

х

x

0.7

0.7

=

=

Northeast 0.9x

Northeast 0.9x

0.77

0.77

(75)

(75)

21.03

38.32

be	compliance testing consulting
build energy	

		1		1		1		1		1		
Northeast 0.9x	0.77	X	6.1	X	22.97	X	0.63	X	0.7	=	42.82	(75)
Northeast 0.9x	0.77	X	5.46	X	41.38	X	0.63	X	0.7	=	69.05	(75)
Northeast 0.9x	0.77	X	6.1	X	41.38	X	0.63	X	0.7	=	77.14	(75)
Northeast 0.9x	0.77	×	5.46	×	67.96	X	0.63	X	0.7	=	113.39	(75)
Northeast 0.9x	0.77	x	6.1	X	67.96	X	0.63	X	0.7	=	126.69	(75)
Northeast 0.9x	0.77	x	5.46	×	91.35	x	0.63	x	0.7	=	152.42	(75)
Northeast 0.9x	0.77	x	6.1	×	91.35	×	0.63	x	0.7	=	170.29	(75)
Northeast 0.9x	0.77	x	5.46	x	97.38	X	0.63	X	0.7	=	162.5	(75)
Northeast 0.9x	0.77	x	6.1	×	97.38	X	0.63	X	0.7	=	181.55	(75)
Northeast 0.9x	0.77	x	5.46	×	91.1	×	0.63	x	0.7	=	152.02	(75)
Northeast 0.9x	0.77	x	6.1	x	91.1	x	0.63	x	0.7	=	169.83	(75)
Northeast 0.9x	0.77	x	5.46	×	72.63	×	0.63	x	0.7	=	121.19	(75)
Northeast 0.9x	0.77	x	6.1	×	72.63	x	0.63	x	0.7	=	135.39	(75)
Northeast 0.9x	0.77	x	5.46	x	50.42	x	0.63	x	0.7	=	84.13	(75)
Northeast 0.9x	0.77	x	6.1	x	50.42	X	0.63	x	0.7	=	94	(75)
Northeast 0.9x	0.77	x	5.46	x	28.07	×	0.63	x	0.7	=	46.83	(75)
Northeast 0.9x	0.77	x	6.1	x	28.07	×	0.63	x	0.7	=	52.32	(75)
Northeast 0.9x	0.77	x	5.46	x	14.2	×	0.63	x	0.7	=	23.69	(75)
Northeast 0.9x	0.77	x	6.1	x	14.2	×	0.63	x	0.7	=	26.47	(75)
Northeast 0.9x	0.77	x	5.46	x	9.21	x	0.63	x	0.7	=	15.38	(75)
Northeast 0.9x	0.77	x	6.1	x	9.21	×	0.63	x	0.7	=	17.18	(75)
Southeast 0.9x	0.77	x	2.58	x	36.79	x	0.63	x	0.7	=	29.01	(77)
Southeast 0.9x	0.77	x	3.9	x	36.79	x	0.63	x	0.7	=	43.85	(77)
Southeast 0.9x	0.77	x	2.58	x	62.67	×	0.63	x	0.7	=	49.42	(77)
Southeast 0.9x	0.77	x	3.9	x	62.67	×	0.63	x	0.7	=	74.7	(77)
Southeast 0.9x	0.77	x	2.58	x	85.75	x	0.63	x	0.7	=	67.61	(77)
Southeast 0.9x	0.77	x	3.9	x	85.75	×	0.63	x	0.7	=	102.21	(77)
Southeast 0.9x	0.77	x	2.58	x	106.25	x	0.63	x	0.7	=	83.78	(77)
Southeast 0.9x	0.77	x	3.9	x	106.25	×	0.63	x	0.7	=	126.64	(77)
Southeast 0.9x	0.77	x	2.58	×	119.01	×	0.63	x	0.7] =	93.84	(77)
Southeast 0.9x	0.77	x	3.9	x	119.01	×	0.63	x	0.7	=	141.85	(77)
Southeast 0.9x	0.77	x	2.58	×	118.15	×	0.63	x	0.7] =	93.16	(77)
Southeast 0.9x	0.77	x	3.9	×	118.15	×	0.63	x	0.7	=	140.82	(77)
Southeast 0.9x	0.77	x	2.58	x	113.91	×	0.63	x	0.7	=	89.82	(77)
Southeast 0.9x	0.77	x	3.9	x	113.91	×	0.63	x	0.7	=	135.77	(77)
Southeast 0.9x	0.77	x	2.58	×	104.39	×	0.63	x	0.7	=	82.31	(77)
Southeast 0.9x	0.77	x	3.9	×	104.39	×	0.63	x	0.7] =	124.42	(77)
Southeast 0.9x	0.77	x	2.58	×	92.85	×	0.63	x	0.7	=	73.21	(77)
Southeast 0.9x	0.77	x	3.9	×	92.85	×	0.63	x	0.7	=	110.67	(77)
Southeast 0.9x	0.77	x	2.58	x	69.27	×	0.63	x	0.7	=	54.62	(77)
Southeast 0.9x	0.77	×	3.9	×	69.27	×	0.63	×	0.7	=	82.56	(77)



Southeast 0.9x	0.77	x	2.58	x	4	4.07	x	0.63	x	0.7	=	34.75	(77)
Southeast 0.9x	0.77	x	3.9	x	4	4.07	x	0.63	x	0.7	=	52.53	(77)
Southeast 0.9x	0.77	x	2.58	x	3	31.49	x	0.63	x	0.7	=	24.83	(77)
Southeast 0.9x	0.77	x	3.9	x	3	31.49	x	0.63	x	0.7	=	37.53	(77)
Southwest0.9x	0.77	x	6.1	x	3	6.79	İΓ	0.63	x	0.7	=	68.59	(79)
Southwest0.9x	0.77	x	6.1	x	6	2.67	Í	0.63	×	0.7	=	116.84	(79)
Southwest0.9x	0.77	x	6.1	x	8	5.75	Í	0.63	×	0.7	=	159.86	(79)
Southwest0.9x	0.77	x	6.1	×	1	06.25	İΓ	0.63	×	0.7	=	198.08	(79)
Southwest0.9x	0.77	x	6.1	x	1	19.01	Í	0.63	×	0.7	=	221.86	(79)
Southwest0.9x	0.77	x	6.1	x	1	18.15		0.63	×	0.7	=	220.26	(79)
Southwest0.9x	0.77	x	6.1	x	1	13.91		0.63	x	0.7	=	212.35	(79)
Southwest0.9x	0.77	x	6.1	x	1	04.39		0.63	×	0.7	=	194.61	(79)
Southwest0.9x	0.77	x	6.1	x	g	2.85		0.63	×	0.7	=	173.1	(79)
Southwest0.9x	0.77	x	6.1	×	6	9.27		0.63	×	0.7	=	129.13	(79)
Southwest0.9x	0.77	x	6.1	x	4	4.07		0.63	×	0.7	=	82.16	(79)
Southwest0.9x	0.77	x	6.1	×	3	31.49		0.63	×	0.7	=	58.7	(79)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m													
(83)m= 181.32		475.87	648.58 780		98.29	759.79	657.9	92 535.11	365.47	219.59	153.61		(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m= 609.74	748.34	887.14	1034.95 114	1.1 1	134.61	1080.68	985.7	78 876.17	731.65	613.97	569.33		(84)
7. Mean internal temperature (heating season)													
7. Mean inte	rnal tempe	erature (heating sea	son)						•			
7. Mean inte Temperature			Ŭ		area	from Tab	ole 9, ⁻	Th1 (°C)				21	(85)
	e during he	eating pe	eriods in the	living			ole 9, ⁻	Th1 (°C)				21	(85)
Temperature	e during he	eating pe	eriods in the ving area, h	living			ble 9, ⁻ Au		Oct	Nov	Dec	21	(85)
Temperature Utilisation fa	e during he	eating pe ins for liv	eriods in the ving area, h	living 1,m (s ay	see Ta	ble 9a)		g Sep	Oct 0.94	Nov 0.99	Dec 1	21	(85)
Temperature Utilisation fa Jan (86)m= 1	e during he ctor for ga Feb 0.99	eating pe ins for lin Mar 0.97	eriods in the ving area, h Apr M 0.89 0.7	living 1,m (s ay	see Ta Jun ^{0.51}	ble 9a) Jul 0.37	Au 0.43	g Sep 3 0.69				21	
Temperature Utilisation fa	e during he ctor for ga Feb 0.99	eating pe ins for lin Mar 0.97	eriods in the ving area, h Apr M 0.89 0.7	living 1,m (s ay ′1 1 (follo	see Ta Jun ^{0.51}	ble 9a) Jul 0.37	Au 0.43	g Sep 3 0.69		0.99		21	
Temperature Utilisation fa (86)m= 1 Mean intern (87)m= 20.03	e during he ctor for ga Feb 0.99 al tempera 20.22	eating period ins for lin Mar 0.97 ture in li 20.5	Apr M 0.89 0.7 20.79 20.	living 1,m (s ay 1 1 (follo 95	see Ta Jun 0.51 ow ste 20.99	ble 9a) Jul 0.37 ps 3 to 7 21	Au 0.43 7 in Ta 21	g Sep 3 0.69 able 9c) 20.97	0.94	0.99	1	21	(86)
Temperature Utilisation fa (86)m= 1 Mean interna (87)m= 20.03 Temperature	e during he ctor for ga Feb 0.99 al tempera 20.22	eating period ins for lin Mar 0.97 ture in li 20.5	Apr M 0.89 0.7 20.79 20.	living 1,m (s ay 1 1 (follo 95 2 t of dv	see Ta Jun 0.51 ow ste 20.99	ble 9a) Jul 0.37 ps 3 to 7 21 from Ta	Au 0.43 7 in Ta 21	g Sep 3 0.69 able 9c) 20.97 , Th2 (°C)	0.94	0.99	1	21	(86)
Temperature Utilisation fa (86)m= 1 Mean interna (87)m= 20.03 Temperature (88)m= 20.1	e during he ctor for ga Feb 0.99 al tempera 20.22 e during he 20.1	eating period	AprM0.890.70.890.70.7920.7920.7920.20.1220.	living 1,m (s ay 1 1 (follo 95 2 t of dw 12 2	see Ta Jun 0.51 ow ste 20.99 velling 20.12	ble 9a) Jul 0.37 ps 3 to 7 21 from Ta 20.12	Au 0.43 7 in Ta 21 ble 9, 20.13	g Sep 3 0.69 able 9c) 20.97 , Th2 (°C)	0.94	0.99	1	 	(86) (87)
Temperature Utilisation fa (86)m= 1 Mean intern (87)m= 20.03 Temperature (88)m= 20.1 Utilisation fa	e during he ctor for ga Feb 0.99 al tempera 20.22 e during he 20.1 ctor for ga	eating period ins for lin Mar 0.97 ture in li 20.5 eating period 20.11 ins for re	eriods in the ving area, h Apr M 0.89 0.7 ving area T 20.79 20. eriods in res 20.12 20.12 20.	living 1,m (s ay 1 1 (follo 95 2 t of dv 12 2 ng, h2	see Ta Jun 0.51 20.99 velling 20.12	ble 9a) Jul 0.37 ps 3 to 7 21 from Ta 20.12 ee Table	Au 0.43 7 in Ta 21 ble 9, 20.13 9a)	g Sep 3 0.69 able 9c) 20.97 , Th2 (°C) 3 20.12	0.94 20.72 20.12	0.99 20.31 20.11	1 19.99 20.11	21	(86) (87) (88)
Temperature Utilisation fa (86)m= 1 Mean intern (87)m= 20.03 Temperature (88)m= 20.1 Utilisation fa (89)m= 1	e during he ctor for ga Feb 0.99 al tempera 20.22 e during he 20.1 ctor for ga 0.99	eating period ins for lin Mar 0.97 ture in li 20.5 eating period 20.11 ins for re 0.96	AprM0.890.70.890.70.7920.720.7920.20.1220.20.120.60.860.6	living 1,m (s ay 1 1 (follo 95 2 1 1 (follo 95 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1	see Ta Jun 0.51 20.99 velling 20.12 2,m (se 0.45	ble 9a) Jul 0.37 ps 3 to 7 21 from Ta 20.12 ee Table 0.3	Au; 0.43 7 in Ta 21 ble 9, 20.13 9a) 0.35	g Sep a 0.69 able 9c) 20.97 , Th2 (°C) 3 20.12 5 0.62	0.94 20.72 20.12 0.92	0.99	1		(86) (87)
Temperature Utilisation fa (86)m= $\boxed{1}$ Mean intern (87)m= $\boxed{20.03}$ Temperature (88)m= $\boxed{20.1}$ Utilisation fa (89)m= $\boxed{1}$ Mean intern	e during he ctor for ga Feb 0.99 al tempera 20.22 e during he 20.1 ctor for ga 0.99 al tempera	eating period	eriods in the ving area, h Apr M 0.89 0.7 ving area T 20.79 20. eriods in res 20.12 20. est of dwellin 0.86 0.6 he rest of dw	living 1,m (s ay 1 1 (follo 95 2 t of dw 12 2 3 1 1 2 3 4 5 2 2 3 4 5 2 4 5 2 4 5 5 2 4 5 5 2 4 5 5 5 5 5 5 5 5 5 5 5 5 5	see Ta Jun 0.51 20.99 velling 20.12 2,m (se 0.45 g T2 (fe	ble 9a) Jul 0.37 ps 3 to 7 21 from Ta 20.12 ee Table 0.3 ollow ste	Au 0.43 7 in Ta 21 ble 9, 20.13 9a) 0.35	g Sep 3 0.69 able 9c) 20.97 , Th2 (°C) 3 20.12 5 0.62 to 7 in Table	0.94 20.72 20.12 0.92 e 9c)	0.99 20.31 20.11 0.99	1 19.99 20.11 1	21	(86) (87) (88) (89)
Temperature Utilisation fa (86)m= 1 Mean intern (87)m= 20.03 Temperature (88)m= 20.1 Utilisation fa (89)m= 1	e during he ctor for ga Feb 0.99 al tempera 20.22 e during he 20.1 ctor for ga 0.99	eating period ins for lin Mar 0.97 ture in li 20.5 eating period 20.11 ins for re 0.96	AprM0.890.70.890.70.7920.720.7920.20.1220.20.120.60.860.6	living 1,m (s ay 1 1 (follo 95 2 t of dw 12 2 3 1 1 2 3 4 5 2 2 3 4 5 2 4 5 2 4 5 5 2 4 5 5 2 4 5 5 5 5 5 5 5 5 5 5 5 5 5	see Ta Jun 0.51 20.99 velling 20.12 2,m (se 0.45	ble 9a) Jul 0.37 ps 3 to 7 21 from Ta 20.12 ee Table 0.3	Au; 0.43 7 in Ta 21 ble 9, 20.13 9a) 0.35	g Sep a 0.69 able 9c) 20.97 , Th2 (°C) 3 20.12 5 0.62 to 7 in Table 2 20.1	0.94 20.72 20.12 0.92 e 9c) 19.81	0.99 20.31 20.11 0.99 19.22	1 19.99 20.11 1 18.76		(86) (87) (88) (89) (90)
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Utilisa	ation fac	tor for g	ains, hm	n:										
(94)m=	1	0.99	0.96	0.86	0.68	0.48	0.34	0.39	0.65	0.93	0.99	1		(94)
Usefu	l gains,	hmGm	, W = (9	4)m x (84	4)m	-		•			•			
(95)m=	607.08	738.37	849.69	894.86	780.96	544.49	364.77	382.01	573.17	676.88	607.26	567.6		(95)
Montl	nly aver	age exte	ernal terr	perature	e 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 rat	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1426.7	1389.43	1267.19	1063.71	818.19	548.5	365.19	382.91	594.43	897.38	1180.49	1419.75		(97)
Space	e heatin	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=	609.8	437.51	310.61	121.58	27.7	0	0	0	0	164.05	412.73	634		_
								Tota	l per year	(kWh/yeai	r) = Sum(9	8)15,912 =	2717.99	(98)
Space	e heatin	g require	ement in	kWh/m²	/year]	28.15	(99)
9a, En	erav rea	nuiremer	nts – Ind	ividual h	eating s	ystems i	ncludina	micro-C	CHP)			L		
	e heati				outing o)					
•		-	at from s	econdar	y/supple	mentary	system]	0	(201)
Fracti	ion of si	bace hea	at from n	nain syst	em(s)			(202) = 1	- (201) =			Ĭ	1	(202)
	-			-				(204) = (2)	02) x [1 –	(203)] =		l I	1	(204)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$								l		4				
Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, %							93.4	(206)						
Efficie	ency of	seconda	ry/suppl	ementar	y heatin	g system	ו, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	r	g require	ement (c	alculate	d above)		1			1			
	609.8	437.51	310.61	121.58	27.7	0	0	0	0	164.05	412.73	634		
(211)n	ו = {[(98)m x (20	04)] } x 1	00 ÷ (20)6)									(211)
	652.89	468.43	332.56	130.17	29.66	0	0	0	0	175.64	441.9	678.8		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2910.05	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month							-		
		01)]}x1	00 ÷ (20	8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	9										_		
Output				ulated a										
	211.55	186.48	195.9	173.94	168.4	148.32	142.1	158.41	160.16	182.16	192.53	206.48		-
		ater hea	ater								1		80.3	(216)
(217)m=	87.56	87.13	86.21	84.17	81.59	80.3	80.3	80.3	80.3	84.79	86.92	87.69		(217)
		heating,												
(219)m (219)m=		m x 100) ÷ (217) 227.24	m 206.65	206.41	184.71	176.96	197.27	199.45	214.84	221.5	235.47		
(213)11=	271.0	214.04	221.24	200.00	200.41	104.71	170.30				221.0	200.47	0506.4.4	
Total = Sum(219a) ₁₁₂ = kWh/year								2526.14	(219)					
			ed, main	system	1					K	Wh/year	Γ	kWh/year 2910.05	٦
	-			5,50011	•							l		
Water heating fuel used							2526.14	1						

Electricity for pumps, fans and electric keep-hot



central heating pump:			30		(230c)					
boiler with a fan-assisted flue			45		(230e)					
Total electricity for the above, kWh/year	sum of (230a)	[75	(231)						
Electricity for lighting				394.57	(232)					
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	= [628.57	(261)					
Space heating (secondary)	(215) x	0.519	= [0	(263)					
Water heating	(219) x	0.216	= [545.65	(264)					
Space and water heating	(261) + (262) + (263) + (264) =		[1174.22	(265)					
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= [38.93	(267)					
Electricity for lighting	(232) x	0.519	= [204.78	(268)					
Total CO2, kg/year	sum	of (265)(271) =	[1417.92	(272)					

TER =

14.69 (273)