

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Unit 10			Issued on Date	16/02/2026
Assessment Reference	Unit 10	Prop Type Ref	TF Flat		
Property	Flat 10, 36 Southampton Street, READING, RG1 2QL				
SAP Rating	80 C	DER	20.48	TER	30.42
Environmental	82 B	% DER<TER	32.67		
CO ₂ Emissions (t/year)	1.16	DFEE	54.64	TFEE	53.36
General Requirements Compliance	Fail	% DFEE<TFEE	-2.39		
Assessor Details	Ms. Ceris Fussell, Ceris Fussell, Tel: 03300553405, ceris@buildenergy.co.uk			Assessor ID	AU31-0001
Client					

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Top-floor flat, total floor area 49 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 30.42 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 20.48 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.6 kWh/m²/yrFail
Excess energy =1.2 kWh/m²/yr (2.2%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor (no floor)			
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.47 (max. 2.00)	1.47 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.73 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Heat pump with radiators or underfloor - Electric
NIBE Fighter 470	

Secondary heating system:	None
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5 Cylinder insulation

Hot water storage	No cylinder
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6 Controls

Space heating controls:	Programmer and at least two room thermostats	OK
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Hot water controls:	No cylinder
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7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%	
Minimum	75%
	OK

8 Mechanical ventilation

Continuous extract system	
Specific fan power:	0.65
Maximum	0.7
	OK

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
Based on:		
Overshading:	Average	
Windows facing North East:	8.71 m ² , No overhang	
Windows facing South East:	5.59 m ² , No overhang	
Windows facing West:	4.40 m ² , No overhang	
Air change rate:	6.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m ² K
Party wall U-value	0.00 W/m ² K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.7000 (1b)	x 2.3000 (2b)	= 112.0100 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.0100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.7300
Infiltration rate					0.2865 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2435 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3105	0.3044	0.2983	0.2679	0.2618	0.2313	0.2313	0.2253	0.2435	0.2618	0.2740	0.2861 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5605	0.5544	0.5483	0.5179	0.5118	0.5000	0.5000	0.5000	0.5000	0.5118	0.5240	0.5361 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.47)			18.7000	1.3884	25.9624		(27)
External Wall	47.0400	18.7000	28.3400	0.1900	5.3846	18.0000	510.1200 (29a)
Flat Roof	48.7000		48.7000	0.1500	7.3050	9.0000	438.3000 (30)
Total net area of external elements Aum(A, m ²)			95.7400	(26)...(30) + (32) =		38.6520	(31)
Fabric heat loss, W/K = Sum (A x U)							(33)
Corridor Wall			22.3100	0.0000	0.0000	20.0000	446.2000 (32)
Party Wall			4.6000	0.0000	0.0000	20.0000	92.0000 (32)
Party Floor 1			48.7000			64.0000	3116.8000 (32d)
Internal Wall 1			57.2700			9.0000	515.4300 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	5118.8500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		105.1099 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.4949 (36)
Total fabric heat loss	(33) + (36) =	49.1469 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	20.7177	20.4927	20.2676	19.1425	18.9174	18.4817	18.4817	18.4817	18.4817	18.9174	19.3675	19.8176 (38)
Heat transfer coeff	69.8646	69.6396	69.4146	68.2894	68.0643	67.6286	67.6286	67.6286	67.6286	68.0643	68.5144	68.9645 (39)
Average = Sum(39)m / 12 =												68.4442 (39)
HLP	1.4346	1.4300	1.4254	1.4022	1.3976	1.3887	1.3887	1.3887	1.3887	1.3976	1.4069	1.4161 (40)
HLP (average)												1.4054 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6519 (42)
Average daily hot water use (litres/day)												73.4327 (43)
Daily hot water use	80.7759	77.8386	74.9013	71.9640	69.0267	66.0894	66.0894	69.0267	71.9640	74.9013	77.8386	80.7759 (44)
Energy conte	119.7884	104.7677	108.1108	94.2537	90.4386	78.0417	72.3171	82.9849	83.9760	97.8659	106.8283	116.0086 (45)
Energy content (annual)	Total = Sum(45)m =											1155.3817 (45)

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Distribution loss (46)m = 0.15 x (45)m	17.9683	15.7151	16.2166	14.1380	13.5658	11.7062	10.8476	12.4477	12.5964	14.6799	16.0242	17.4013 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8424 (55)
Total storage loss												
26.1144 23.5872 26.1144 25.2720 26.1144 25.2720 26.1144 26.1144 25.2720 26.1144 25.2720 26.1144 (56)												
If cylinder contains dedicated solar storage												
26.1144 23.5872 26.1144 25.2720 26.1144 25.2720 26.1144 26.1144 25.2720 26.1144 25.2720 26.1144 (57)												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
145.9028 128.3549 134.2252 119.5257 116.5530 103.3137 98.4315 109.0993 109.2480 123.9803 132.1003 142.1230 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	145.9028	128.3549	134.2252	119.5257	116.5530	103.3137	98.4315	109.0993	109.2480	123.9803	132.1003	142.1230 (64)
Total per year (kWh/year) = Sum(64)m =												1462.8577 (64)
Heat gains from water heating, kWh/month												
39.8296 34.8352 35.9469 31.3393 30.0708 25.9489 24.0454 27.5925 27.9220 32.5404 35.5204 38.5729 (65)												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.8251	11.3911	9.2639	7.0133	5.2426	4.4260	4.7824	6.2164	8.3436	10.5941	12.3649	13.1815 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	143.8581	145.3509	141.5891	133.5807	123.4715	113.9703	107.6229	106.1301	109.8919	117.9003	128.0095	137.5107 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761 (71)
Water heating gains (Table 5)	53.5344	51.8382	48.3157	43.5269	40.4178	36.0401	32.3191	37.0867	38.7806	43.7371	49.3339	51.8453 (72)
Total internal gains	257.9961	256.3587	246.9472	231.8994	216.9104	202.2148	192.5029	197.2116	204.7946	220.0101	237.4868	250.3160 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					8.7100	11.2829	0.6300	0.8000	0.7700		34.3245 (75)	
Southeast					5.5900	36.7938	0.6300	0.8000	0.7700		71.8374 (77)	
West					4.4000	19.6403	0.6300	0.8000	0.7700		30.1831 (80)	
Solar gains	136.3450	251.2787	390.5448	555.9972	684.0497	704.8548	668.9274	570.2554	447.7665	290.6863	166.8685	114.3301 (83)
Total gains	394.3411	507.6374	637.4920	787.8966	900.9601	907.0696	861.4303	767.4670	652.5611	510.6964	404.3554	364.6461 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.3523	20.4180	20.4842	20.8217	20.8906	21.0252	21.0252	21.0252	21.0252	20.8906	20.7533	20.6179
alpha	2.3568	2.3612	2.3656	2.3881	2.3927	2.4017	2.4017	2.4017	2.4017	2.3927	2.3836	2.3745
util living area	0.9473	0.9094	0.8415	0.7214	0.5740	0.4313	0.3273	0.3765	0.5813	0.8096	0.9210	0.9551 (86)
Tweekday	17.1106	17.5909	18.2645	19.0000	19.4631	19.6867	19.7503	19.7388	19.5735	18.9043	17.8854	17.0405
Tweekend	19.3343	19.6130	20.0100	20.4530	20.7538	20.9113	20.9668	20.9528	20.8140	20.3746	19.7717	19.2886
24 / 16	9	8	9	8	9	9	9	8	9	9	8	9
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	19.7369	19.7404	19.7440	19.7616	19.7652	19.7720	19.7720	19.7720	19.7720	19.7652	19.7581	19.7510 (88)
util rest of house	0.9387	0.8955	0.8180	0.6833	0.5199	0.3606	0.2423	0.2856	0.5069	0.7720	0.9063	0.9477 (89)
Tweekday	17.1106	17.5909	18.2645	19.0000	19.4631	19.6867	19.7503	19.7388	19.5735	18.9043	17.8854	17.0405
Tweekend	18.2494	18.5230	18.9060	19.3303	19.5941	19.7237	19.7597	19.7532	19.6596	19.2776	18.6974	18.2159
MIT 2	19.7369	19.7404	19.7440	19.7616	19.7652	19.7720	19.7720	19.7720	19.7720	19.7652	19.7581	19.7510 (90)
Living area fraction									fLA = Living area / (4) =			0.5955 (91)
MIT	20.4891	20.4905	20.4919	20.4991	20.5005	20.5033	20.5033	20.5033	20.5033	20.5005	20.4976	20.4948 (92)
Temperature adjustment												0.0000
adjusted MIT	20.4891	20.4905	20.4919	20.4991	20.5005	20.5033	20.5033	20.5033	20.5033	20.5005	20.4976	20.4948 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9440	0.9041	0.8325	0.7067	0.5529	0.4036	0.2938	0.3409	0.5528	0.7954	0.9154	0.9523 (94)
Ext temp.	372.2603	458.9565	530.6880	556.8222	498.1587	366.0560	253.0869	261.6061	360.7060	406.2112	370.1660	347.2409 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)

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Month	1131.0427	1085.7149	971.2420	792.0919	598.9991	399.2292	263.9720	277.4978	433.0434	673.8698	917.9299	1123.7597 (97)
fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	564.5340	421.1816	327.7722	169.3941	75.0252	0.0000	0.0000	0.0000	0.0000	199.1380	394.3900	577.7299 (98)
Space heating requirement												2729.1651 (98)
Space heating per m2											(98) / (4) =	56.0404 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												307.0400 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												888.8632 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	564.5340	421.1816	327.7722	169.3941	75.0252	0.0000	0.0000	0.0000	0.0000	199.1380	394.3900	577.7299 (98)
Space heating efficiency (main heating system 1)	307.0400	307.0400	307.0400	307.0400	307.0400	0.0000	0.0000	0.0000	0.0000	307.0400	307.0400	307.0400 (210)
Space heating fuel (main heating system)	183.8634	137.1748	106.7523	55.1701	24.4350	0.0000	0.0000	0.0000	0.0000	64.8574	128.4491	188.1612 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	145.9028	128.3549	134.2252	119.5257	116.5530	103.3137	98.4315	109.0993	109.2480	123.9803	132.1003	142.1230 (64)
Efficiency of water heater	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850 (216)
(217)m	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850 (217)
Fuel for water heating, kWh/month	66.1136	58.1620	60.8221	54.1612	52.8142	46.8150	44.6027	49.4367	49.5040	56.1798	59.8592	64.4009 (219)
Water heating fuel used												662.8714 (219)
Annual totals kWh/year												
Space heating fuel - main system												888.8632 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)												143.2373 (230a)
Total electricity for the above, kWh/year												143.2373 (231)
Electricity for lighting (calculated in Appendix L)												226.4945 (232)
Total delivered energy for all uses												1921.4663 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	888.8632	0.5190	461.3200 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	662.8714	0.5190	344.0302 (264)
Space and water heating			805.3502 (265)
Pumps and fans	143.2373	0.5190	74.3401 (267)
Energy for lighting	226.4945	0.5190	117.5506 (268)
Total CO2, kg/year			997.2410 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.4800 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		20.4800 ZC1
Total Floor Area	TFA	48.7000
Assumed number of occupants	N	1.6519
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.5046 ZC2
CO2 emissions from cooking, equation (L16)		3.2576 ZC3
Total CO2 emissions		41.2422 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		41.2422 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.7000 (1b)	x 2.3000 (2b)	= 112.0100 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.0100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1786 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4286 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3643 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4644	0.4553	0.4462	0.4007	0.3916	0.3461	0.3461	0.3370	0.3643	0.3916	0.4098	0.4280 (22b)
Effective ac	0.6079	0.6037	0.5996	0.5803	0.5767	0.5599	0.5599	0.5568	0.5663	0.5767	0.5840	0.5916 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.40)			12.1700	1.3258	16.1345		(27)
External Wall	47.0400	12.1700	34.8700	0.1800	6.2766		(29a)
Flat Roof	48.7000		48.7000	0.1300	6.3310		(30)
Total net area of external elements Aum(A, m ²)			95.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.7421		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.6955 (36)
Total fabric heat loss	(33) + (36) = 37.4376 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	22.4683	22.3135	22.1618	21.4491	21.3157	20.6949	20.6949	20.5800	20.9341	21.3157	21.5855	21.8675 (38)
Heat transfer coeff	59.9059	59.7511	59.5994	58.8866	58.7533	58.1325	58.1325	58.0176	58.3716	58.7533	59.0230	59.3051 (39)
Average = Sum(39)m / 12 =												58.8860 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2301	1.2269	1.2238	1.2092	1.2064	1.1937	1.1937	1.1913	1.1986	1.2064	1.2120	1.2178 (40)
HLP (average)												1.2092 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6519 (42)
Average daily hot water use (litres/day)	73.4327 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	80.7759	77.8386	74.9013	71.9640	69.0267	66.0894	66.0894	69.0267	71.9640	74.9013	77.8386	80.7759 (44)
Energy conte	119.7884	104.7677	108.1108	94.2537	90.4386	78.0417	72.3171	82.9849	83.9760	97.8659	106.8283	116.0086 (45)
Energy content (annual)										Total = Sum(45)m =		1155.3817 (45)
Distribution loss (46)m = 0.15 x (45)m	17.9683	15.7151	16.2166	14.1380	13.5658	11.7062	10.8476	12.4477	12.5964	14.6799	16.0242	17.4013 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage												
Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Solar input	166.3833	146.8534	154.7058	139.3455	137.0335	123.1335	118.9120	129.5798	129.0678	144.4608	151.9202	162.6035 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	Solar input (sum of months) = Sum (63)m =											
	166.3833	146.8534	154.7058	139.3455	137.0335	123.1335	118.9120	129.5798	129.0678	144.4608	151.9202	162.6035 (64)
	77.1056	68.5038	73.2228	67.4128	67.3468	62.0223	61.3213	64.8684	63.9955	69.8163	71.5939	75.8488 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	12.8251	11.3911	9.2639	7.0133	5.2426	4.4260	4.7824	6.2164	8.3436	10.5941	12.3649	13.1815 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	143.8581	145.3509	141.5891	133.5807	123.4715	113.9703	107.6229	106.1301	109.8919	117.9003	128.0095	137.5107 (68)
Pumps, fans	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761 (71)
Total internal gains	103.6365	101.9402	98.4177	93.6289	90.5198	86.1421	82.4212	87.1887	88.8826	93.8392	99.4360	101.9473 (72)
	311.0982	309.4607	300.0492	285.0014	270.0124	255.3169	245.6050	250.3137	257.8966	273.1121	290.5889	303.4180 (73)

6. Solar gains

[Jan]				Area	Solar flux	g	FF			Access	Gains	
				m2	Table 6a	Specific data	Specific data			factor	W	
					W/m2	or Table 6b	or Table 6c			Table 6d		
Northeast				5.6700	11.2829	0.6300	0.7000			0.7700	19.5514 (75)	
Southeast				3.6400	36.7938	0.6300	0.7000			0.7700	40.9306 (77)	
West				2.8600	19.6403	0.6300	0.7000			0.7700	17.1666 (80)	
Solar gains	77.6486	143.0989	222.4002	316.6110	389.5270	401.3738	380.9154	324.7288	254.9826	165.5384	95.0309	65.1117 (83)
Total gains	388.7468	452.5597	522.4494	601.6125	659.5394	656.6907	626.5204	575.0425	512.8793	438.6505	385.6198	368.5297 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	56.4543	56.6005	56.7446	57.4314	57.5618	58.1765	58.1765	58.2917	57.9382	57.5618	57.2987	57.0262
util living area	4.7636	4.7734	4.7830	4.8288	4.8375	4.8784	4.8784	4.8861	4.8625	4.8375	4.8199	4.8017
	0.9932	0.9853	0.9623	0.8903	0.7427	0.5506	0.4052	0.4582	0.7166	0.9336	0.9859	0.9947 (86)
MIT	19.8323	20.0185	20.3123	20.6625	20.8920	20.9800	20.9963	20.9935	20.9326	20.6154	20.1605	19.8003 (87)
Th 2	19.8960	19.8985	19.9010	19.9127	19.9149	19.9251	19.9251	19.9269	19.9211	19.9149	19.9104	19.9058 (88)
util rest of house	0.9910	0.9806	0.9503	0.8580	0.6801	0.4650	0.3078	0.3544	0.6293	0.9061	0.9805	0.9929 (89)
MIT 2	18.3675	18.6384	19.0588	19.5429	19.8195	19.9132	19.9238	19.9246	19.8735	19.4961	18.8547	18.3280 (90)
Living area fraction	19.2398	19.4603	19.8052	20.2096	20.4582	20.5485	20.5625	20.5611	20.5042	20.1626	19.6323	19.2048 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (91)
adjusted MIT	19.2398	19.4603	19.8052	20.2096	20.4582	20.5485	20.5625	20.5611	20.5042	20.1626	19.6323	19.2048 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9893	0.9783	0.9491	0.8677	0.7127	0.5154	0.3659	0.4163	0.6785	0.9134	0.9788	0.9914 (94)
Ext temp.	384.5719	442.7428	495.8437	521.9956	470.0813	338.4646	229.2410	239.3879	348.0040	400.6422	377.4427	365.3781 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	894.9812	869.9915	792.9810	665.9843	514.5716	345.7992	230.3492	241.4167	373.8231	561.8341	739.6928	889.8578 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	379.7445	287.1111	221.0701	103.6719	33.1008	0.0000	0.0000	0.0000	0.0000	119.9268	260.8201	390.2129 (98)
												1795.6582 (98)
												36.8718 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1920.4900 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	379.7445	287.1111	221.0701	103.6719	33.1008	0.0000	0.0000	0.0000	0.0000	119.9268	260.8201	390.2129	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	406.1438	307.0707	236.4387	110.8790	35.4019	0.0000	0.0000	0.0000	0.0000	128.2639	278.9520	417.3400	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	166.3833	146.8534	154.7058	139.3455	137.0335	123.1335	118.9120	129.5798	129.0678	144.4608	151.9202	162.6035	(64)
Efficiency of water heater (217)m	86.9481	86.5719	85.7655	84.0388	81.6788	79.8000	79.8000	79.8000	79.8000	84.3222	86.2436	87.0662	(216)
Fuel for water heating, kWh/month	191.3592	169.6318	180.3822	165.8110	167.7711	154.3026	149.0125	162.3807	161.7391	171.3200	176.1525	186.7586	(219)
Water heating fuel used												2036.6213	(219)
Annual totals kWh/year													
Space heating fuel - main system												1920.4900	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												226.4945	(232)
Total delivered energy for all uses												4258.6058	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1920.4900	0.2160	414.8258 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2036.6213	0.2160	439.9102 (264)
Space and water heating			854.7361 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	226.4945	0.5190	117.5506 (268)
Total CO2, kg/m2/year			1011.2117 (272)
Emissions per m2 for space and water heating			17.5510 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.4138 (272b)
Emissions per m2 for pumps and fans			0.7993 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.5510 * 1.55) + 2.4138 + 0.7993, rounded to 2 d.p.			30.4200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.7000 (1b)	x 2.3000 (2b)	= 112.0100 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.0100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1786 (8)
Pressure test					Yes
Measured/design AP50					5.7300
Infiltration rate					0.4651 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3953 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5040	0.4941	0.4842	0.4348	0.4249	0.3755	0.3755	0.3656	0.3953	0.4249	0.4447	0.4645 (22b)
Effective ac	0.6270	0.6221	0.6172	0.5945	0.5903	0.5705	0.5705	0.5668	0.5781	0.5903	0.5989	0.6079 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.47)			18.7000	1.3884	25.9624		(27)
External Wall	47.0400	18.7000	28.3400	0.1900	5.3846	18.0000	510.1200 (29a)
Flat Roof	48.7000		48.7000	0.1500	7.3050	9.0000	438.3000 (30)
Total net area of external elements Aum(A, m ²)			95.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6520		(33)
Corridor Wall			22.3100	0.0000	0.0000	20.0000	446.2000 (32)
Party Wall			4.6000	0.0000	0.0000	20.0000	92.0000 (32)
Party Floor 1			48.7000			64.0000	3116.8000 (32d)
Internal Wall 1			57.2700			9.0000	515.4300 (32c)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 5118.8500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							105.1099 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4949 (36)
Total fabric heat loss							(33) + (36) = 49.1469 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	23.1764	22.9941	22.8154	21.9761	21.8190	21.0880	21.0880	20.9526	21.3696	21.8190	22.1367	22.4688 (38)
Heat transfer coeff	72.3233	72.1410	71.9623	71.1230	70.9659	70.2349	70.2349	70.0996	70.5165	70.9659	71.2836	71.6157 (39)
Average = Sum(39)m / 12 =												71.1222 (39)
HLP	1.4851	1.4813	1.4777	1.4604	1.4572	1.4422	1.4422	1.4394	1.4480	1.4572	1.4637	1.4705 (40)
HLP (average)												1.4604 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												1.6519 (42)
												73.4327 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	80.7759	77.8386	74.9013	71.9640	69.0267	66.0894	66.0894	69.0267	71.9640	74.9013	77.8386	80.7759 (44)
Energy conte	119.7884	104.7677	108.1108	94.2537	90.4386	78.0417	72.3171	82.9849	83.9760	97.8659	106.8283	116.0086 (45)
Energy content (annual)												1155.3817 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	25.4550	22.2631	22.9736	20.0289	19.2182	16.5839	15.3674	17.6343	17.8449	20.7965	22.7010	24.6518 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.8251	11.3911	9.2639	7.0133	5.2426	4.4260	4.7824	6.2164	8.3436	10.5941	12.3649	13.1815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	143.8581	145.3509	141.5891	133.5807	123.4715	113.9703	107.6229	106.1301	109.8919	117.9003	128.0095	137.5107	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	(71)
Water heating gains (Table 5)	34.2137	33.1297	30.8784	27.8179	25.8309	23.0331	20.6551	23.7020	24.7846	27.9523	31.5292	33.1342	(72)
Total internal gains	238.6754	237.6502	229.5099	216.1905	202.3235	189.2079	180.8389	183.8270	190.7986	204.2252	219.6821	231.6049	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					8.7100	11.2829	0.6300	0.8000			0.7700			34.3245 (75)
Southeast					5.5900	36.7938	0.6300	0.8000			0.7700			71.8374 (77)
West					4.4000	19.6403	0.6300	0.8000			0.7700			30.1831 (80)
Solar gains	136.3450	251.2787	390.5448	555.9972	684.0497	704.8548	668.9274	570.2554	447.7665	290.6863	166.8685	114.3301	(83)	
Total gains	375.0204	488.9289	620.0548	772.1877	886.3732	894.0626	849.7663	754.0823	638.5651	494.9116	386.5507	345.9350	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.6604	19.7101	19.7590	19.9922	20.0364	20.2450	20.2450	20.2840	20.1641	20.0364	19.9471	19.8546	
alpha	2.3107	2.3140	2.3173	2.3328	2.3358	2.3497	2.3497	2.3523	2.3443	2.3358	2.3298	2.3236	
util living area	0.9528	0.9171	0.8522	0.7369	0.5921	0.4476	0.3414	0.3924	0.6014	0.8241	0.9289	0.9600	(86)
MIT	18.2795	18.7164	19.3489	20.0603	20.5639	20.8401	20.9388	20.9138	20.6682	19.9348	18.9659	18.2014	(87)
Th 2	19.6987	19.7015	19.7043	19.7173	19.7197	19.7311	19.7311	19.7332	19.7267	19.7197	19.7148	19.7097	(88)
util rest of house	0.9449	0.9038	0.8294	0.6987	0.5363	0.3732	0.2507	0.2960	0.5245	0.7874	0.9152	0.9532	(89)
MIT 2	17.2697	17.6972	18.3066	18.9765	19.4173	19.6446	19.7088	19.6993	19.5267	18.8890	17.9586	17.2004	(90)
Living area fraction									fLA = Living area / (4) =			0.5955	(91)
MIT	17.8710	18.3041	18.9273	19.6219	20.1001	20.3565	20.4412	20.4226	20.2065	19.5117	18.5584	17.7965	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8710	18.3041	18.9273	19.6219	20.1001	20.3565	20.4412	20.4226	20.2065	19.5117	18.5584	17.7965	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9302	0.8861	0.8134	0.6956	0.5537	0.4109	0.3025	0.3499	0.5553	0.7805	0.8995	0.9399	(94)
Ext temp.	348.8482	433.2338	504.3354	537.1000	490.7916	367.4035	257.0899	263.8534	354.5702	386.2641	347.7016	325.1288	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	981.4994	966.9854	894.2945	762.5737	596.1177	404.3043	269.7886	281.9796	430.6073	632.4305	816.7977	973.7235	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	470.6925	358.6810	290.1296	162.3411	78.3626	0.0000	0.0000	0.0000	0.0000	183.1478	337.7492	482.5544	(98)
												2363.6582	(98)
												48.5351	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	660.2083	519.7385	532.7566	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8545	0.8939	0.8670	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	564.1721	464.6046	461.8905	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1107.6605	1054.7068	943.7796	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	391.3116	439.0361	358.5255	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												1188.8732 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	97.8279	109.7590	89.6314	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												297.2183 (107)
Energy for space heating												6.1030 (108)
Energy for space cooling												48.5351 (99)
Total												6.1030 (108)
Dwelling Fabric Energy Efficiency (DFEE)												54.6381 (109)
												54.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.7000 (1b)	x 2.3000 (2b)	= 112.0100 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.0100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1786 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4286 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3643 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4644	0.4553	0.4462	0.4007	0.3916	0.3461	0.3461	0.3370	0.3643	0.3916	0.4098	0.4280 (22b)
Effective ac	0.6079	0.6037	0.5996	0.5803	0.5767	0.5599	0.5599	0.5568	0.5663	0.5767	0.5840	0.5916 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			12.1700	1.3258	16.1345		(27)					
External Wall	47.0400	12.1700	34.8700	0.1800	6.2766		(29a)					
Flat Roof	48.7000		48.7000	0.1300	6.3310		(30)					
Total net area of external elements Aum(A, m2)			95.7400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		28.7421		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6955 (36)					
Total fabric heat loss						(33) + (36) =	37.4376 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 22.4683	Feb 22.3135	Mar 22.1618	Apr 21.4491	May 21.3157	Jun 20.6949	Jul 20.6949	Aug 20.5800	Sep 20.9341	Oct 21.3157	Nov 21.5855	Dec 21.8675 (38)
Heat transfer coeff	59.9059	59.7511	59.5994	58.8866	58.7533	58.1325	58.1325	58.0176	58.3716	58.7533	59.0230	59.3051 (39)
Average = Sum(39)m / 12 =												58.8860 (39)
HLP	Jan 1.2301	Feb 1.2269	Mar 1.2238	Apr 1.2092	May 1.2064	Jun 1.1937	Jul 1.1937	Aug 1.1913	Sep 1.1986	Oct 1.2064	Nov 1.2120	Dec 1.2178 (40)
HLP (average)												1.2092 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6519 (42)
Average daily hot water use (litres/day)												73.4327 (43)
Daily hot water use	80.7759	77.8386	74.9013	71.9640	69.0267	66.0894	66.0894	69.0267	71.9640	74.9013	77.8386	80.7759 (44)
Energy conte	119.7884	104.7677	108.1108	94.2537	90.4386	78.0417	72.3171	82.9849	83.9760	97.8659	106.8283	116.0086 (45)
Energy content (annual)												1155.3817 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month												

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

25.4550 22.2631 22.9736 20.0289 19.2182 16.5839 15.3674 17.6343 17.8449 20.7965 22.7010 24.6518 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	82.5951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.8251	11.3911	9.2639	7.0133	5.2426	4.4260	4.7824	6.2164	8.3436	10.5941	12.3649	13.1815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	143.8581	145.3509	141.5891	133.5807	123.4715	113.9703	107.6229	106.1301	109.8919	117.9003	128.0095	137.5107	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	31.2595	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	(71)
Water heating gains (Table 5)	34.2137	33.1297	30.8784	27.8179	25.8309	23.0331	20.6551	23.7020	24.7846	27.9523	31.5292	33.1342	(72)
Total internal gains	238.6754	237.6502	229.5099	216.1905	202.3235	189.2079	180.8389	183.8270	190.7986	204.2252	219.6821	231.6049	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W			
Northeast				5.6700	11.2829	0.6300	0.7000	0.7700	19.5514	(75)			
Southeast				3.6400	36.7938	0.6300	0.7000	0.7700	40.9306	(77)			
West				2.8600	19.6403	0.6300	0.7000	0.7700	17.1666	(80)			
Solar gains	77.6486	143.0989	222.4002	316.6110	389.5270	401.3738	380.9154	324.7288	254.9826	165.5384	95.0309	65.1117	(83)
Total gains	316.3240	380.7491	451.9101	532.8015	591.8505	590.5817	561.7543	508.5557	445.7812	369.7636	314.7130	296.7166	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil_lm (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4543	56.6005	56.7446	57.4314	57.5618	58.1765	58.1765	58.2917	57.9382	57.5618	57.2987	57.0262	21.0000 (85)
alpha	4.7636	4.7734	4.7830	4.8288	4.8375	4.8784	4.8784	4.8861	4.8625	4.8375	4.8199	4.8017	
util living area	0.9972	0.9927	0.9780	0.9241	0.7940	0.6038	0.4499	0.5139	0.7848	0.9633	0.9939	0.9979	(86)
MIT	19.6980	19.8893	20.1966	20.5799	20.8540	20.9704	20.9942	20.9894	20.8988	20.5135	20.0320	19.6661	(87)
Th 2	19.8960	19.8985	19.9010	19.9127	19.9149	19.9251	19.9251	19.9269	19.9211	19.9149	19.9104	19.9058	(88)
util rest of house	0.9962	0.9903	0.9704	0.8987	0.7349	0.5132	0.3428	0.3995	0.7015	0.9458	0.9914	0.9972	(89)
MIT 2	18.7191	18.9112	19.2157	19.5890	19.8238	19.9127	19.9237	19.9242	19.8693	19.5378	19.0636	18.6951	(90)
Living area fraction	19.3020	19.4937	19.7998	20.1791	20.4373	20.5425	20.5612	20.5585	20.4824	20.1188	19.6402	19.2733	(92)
MIT	19.3020	19.4937	19.7998	20.1791	20.4373	20.5425	20.5612	20.5585	20.4824	20.1188	19.6402	19.2733	(93)
Temperature adjustment													0.0000
adjusted MIT	19.3020	19.4937	19.7998	20.1791	20.4373	20.5425	20.5612	20.5585	20.4824	20.1188	19.6402	19.2733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9891	0.9696	0.9057	0.7649	0.5664	0.4068	0.4678	0.7476	0.9497	0.9906	0.9966	(94)
Useful gains	314.9032	376.6065	438.1579	482.5341	452.7190	334.5069	228.5109	237.9060	333.2544	351.1722	311.7600	295.7211	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	898.7097	871.9873	792.6584	664.1857	513.3433	345.4553	230.2730	241.2651	372.5504	559.2621	740.1632	893.9245	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	434.3521	332.8959	263.7484	130.7891	45.1045	0.0000	0.0000	0.0000	0.0000	154.8189	308.4503	445.0633	(98)
Space heating												2115.2224	(98)
Space heating per m ²												43.4337	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	546.4457	430.1806	440.9335	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9323	0.9654	0.9481	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	509.4530	415.2838	418.0635	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	752.9425	718.0694	656.8005	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	175.3124	225.2725	177.6204	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												578.2052	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	43.8281	56.3181	44.4051	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													144.5513 (107)
Space cooling per m2													2.9682 (108)
Energy for space heating													43.4337 (99)
Energy for space cooling													2.9682 (108)
Total													46.4019 (109)
Target Fabric Energy Efficiency (TFEE)													53.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.7000 (1b)	x 2.3000 (2b)	= 112.0100 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.0100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.7300
Infiltration rate					0.2865 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2435 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2618	0.2496	0.2496	0.2313	0.2374	0.2070	0.2070	0.2009	0.2070	0.2313	0.2253	0.2435 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.47)			18.7000	1.3884	25.9624		(27)
External Wall	47.0400	18.7000	28.3400	0.1900	5.3846	18.0000	510.1200 (29a)
Flat Roof	48.7000		48.7000	0.1500	7.3050	9.0000	438.3000 (30)
Total net area of external elements Aum(A, m ²)			95.7400	(26)...(30) + (32) =		38.6520	(31)
Fabric heat loss, W/K = Sum (A x U)							(33)
Corridor Wall			22.3100	0.0000	0.0000	20.0000	446.2000 (32)
Party Wall			4.6000	0.0000	0.0000	20.0000	92.0000 (32)
Party Floor 1			48.7000			64.0000	3116.8000 (32d)
Internal Wall 1			57.2700			9.0000	515.4300 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												5118.8500 (34)
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.9174	18.4817	18.4817	18.4817	18.4817	18.4817	18.4817	18.4817	18.4817	18.4817	18.4817	18.4817 (38)
Average = Sum(39)m / 12 =	68.0643	67.6286	67.6286	67.6286	67.6286	67.6286	67.6286	67.6286	67.6286	67.6286	67.6286	67.6286 (39)
HLP	1.3976	1.3887	1.3887	1.3887	1.3887	1.3887	1.3887	1.3887	1.3887	1.3887	1.3887	1.3887 (40)
HLP (average)												1.3894 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6519 (42)
Average daily hot water use (litres/day)												73.4327 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	80.7759	77.8386	74.9013	71.9640	69.0267	66.0894	66.0894	69.0267	71.9640	74.9013	77.8386	80.7759 (44)
Energy content (annual)	119.7884	104.7677	108.1108	94.2537	90.4386	78.0417	72.3171	82.9849	83.9760	97.8659	106.8283	116.0086 (45)
Total = Sum(45)m =												1155.3817 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	17.9683	15.7151	16.2166	14.1380	13.5658	11.7062	10.8476	12.4477	12.5964	14.6799	16.0242	17.4013 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8424 (55)
Total storage loss												
26.1144 23.5872 26.1144 25.2720 26.1144 25.2720 26.1144 26.1144 25.2720 26.1144 25.2720 26.1144 (56)												
If cylinder contains dedicated solar storage												
26.1144 23.5872 26.1144 25.2720 26.1144 25.2720 26.1144 26.1144 25.2720 26.1144 25.2720 26.1144 (57)												
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)												
Total heat required for water heating calculated for each month												
145.9028 128.3549 134.2252 119.5257 116.5530 103.3137 98.4315 109.0993 109.2480 123.9803 132.1003 142.1230 (62)												
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)												
Output from w/h												
145.9028 128.3549 134.2252 119.5257 116.5530 103.3137 98.4315 109.0993 109.2480 123.9803 132.1003 142.1230 (64)												
RHI water heating demand												
Heat gains from water heating, kWh/month												
39.8296 34.8352 35.9469 31.3393 30.0708 25.9489 24.0454 27.5925 27.9220 32.5404 35.5204 38.5729 (65)												

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
32.0626 28.4778 23.1597 17.5334 13.1064 11.0650 11.9561 15.5410 20.8591 26.4854 30.9123 32.9538 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
214.7136 216.9416 211.3270 199.3741 184.2858 170.1049 160.6311 158.4031 164.0177 175.9706 191.0589 205.2399 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
46.5633 46.5633 46.5633 46.5633 46.5633 46.5633 46.5633 46.5633 46.5633 46.5633 46.5633 46.5633 (69)												
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)												
Losses e.g. evaporation (negative values) (Table 5)												
-66.0761 -66.0761 -66.0761 -66.0761 -66.0761 -66.0761 -66.0761 -66.0761 -66.0761 -66.0761 -66.0761 -66.0761 (71)												
Water heating gains (Table 5)												
53.5344 51.8382 48.3157 43.5269 40.4178 36.0401 32.3191 37.0867 38.7806 43.7371 49.3339 51.8453 (72)												
Total internal gains												
379.9120 376.8589 362.4037 340.0357 317.4113 296.8112 284.5077 290.6320 303.2587 325.7944 350.9065 369.6402 (73)												

6. Solar gains

[Jan]												
	Area	Solar flux										
	m2	Table 6a	g									
		W/m2	or Table 6b									
Northeast	8.7100	13.7804	0.6300									
Southeast	5.5900	43.0593	0.6300									
West	4.4000	23.8018	0.6300									

Solar gains	162.5709	262.5710	406.8606	590.2153	708.5692	772.5194	725.8539	633.8653	498.0889	326.5356	196.1608	137.0052 (83)
Total gains	542.4830	639.4300	769.2643	930.2510	1025.9805	1069.3306	1010.3616	924.4973	801.3476	652.3300	547.0673	506.6454 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	20.8906	21.0252	21.0252	21.0252	21.0252	21.0252	21.0252	21.0252	21.0252	21.0252	21.0252	21.0252
alpha	2.3927	2.4017	2.4017	2.4017	2.4017	2.4017	2.4017	2.4017	2.4017	2.4017	2.4017	2.4017
util living area	0.8943	0.8507	0.7661	0.6273	0.4714	0.3132	0.2163	0.2420	0.4523	0.7006	0.8491	0.9060 (86)
Tweekday	17.8091	18.1883	18.7520	19.2996	19.6190	19.7444	19.7681	19.7664	19.6866	19.2631	18.4728	17.7392
Tweekend	19.7318	19.9547	20.2962	20.6439	20.8634	20.9644	20.9901	20.9869	20.9076	20.6050	20.1167	19.6873
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	19.7652	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720 (88)
util rest of house												
0.8785 0.8297 0.7351 0.5827 0.4133 0.2443 0.1377 0.1573 0.3744 0.6501 0.8238 0.8916 (89)												
Tweekday	17.8091	18.1883	18.7520	19.2996	19.6190	19.7444	19.7681	19.7664	19.6866	19.2631	18.4728	17.7392
Tweekend	18.6573	18.8750	19.1943	19.5045	19.6853	19.7564	19.7698	19.7688	19.7236	19.4838	19.0362	18.6207
MIT 2	19.7652	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720	19.7720 (90)
Living area fraction												
MIT	20.5005	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033 (92)
Temperature adjustment												
adjusted MIT	20.5005	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033	20.5033 (93)

8. Space heating requirement

Utilisation	0.8883	0.8427	0.7541	0.6099	0.4486	0.2859	0.1849	0.2083	0.4219	0.6813	0.8394	0.9005 (94)
Useful gains	481.8734	538.8207	580.1214	567.3640	460.2359	305.7267	186.8025	192.5807	338.0709	444.4487	459.2304	456.2192 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	1048.2237	1001.1233	886.1548	717.0834	514.1977	318.0749	189.5806	196.3435	372.1777	608.8777	845.5777	1041.7005 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	421.3646	310.6674	227.6888	107.7980	40.1476	0.0000	0.0000	0.0000	0.0000	122.3352	278.1700	435.5980 (98)
Space heating												1943.7695 (98)
RHI space heating demand												1944 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.7000 (1b)	x 2.3000 (2b)	= 112.0100 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.0100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.7300
Infiltration rate					0.2865 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2435 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3105	0.3044	0.2983	0.2679	0.2618	0.2313	0.2313	0.2253	0.2435	0.2618	0.2740	0.2861 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												1.2783 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	1.2783	1.2783	1.2783	1.2783	1.2783	1.2783	1.2783	1.2783	1.2783	1.2783	1.2783	1.2783 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.47)			18.7000	1.3884	25.9624		(27)
External Wall	47.0400	18.7000	28.3400	0.1900	5.3846	18.0000	510.1200 (29a)
Flat Roof	48.7000		48.7000	0.1500	7.3050	9.0000	438.3000 (30)
Total net area of external elements Aum(A, m ²)			95.7400	(26)...(30) + (32) =		38.6520	(31)
Fabric heat loss, W/K = Sum (A x U)							(33)
Corridor Wall			22.3100	0.0000	0.0000	20.0000	446.2000 (32)
Party Wall			4.6000	0.0000	0.0000	20.0000	92.0000 (32)
Party Floor 1			48.7000			64.0000	3116.8000 (32d)
Internal Wall 1			57.2700			9.0000	515.4300 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												5118.8500 (34)
(38)m	Jan 47.2509	Feb 47.2509	Mar 47.2509	Apr 47.2509	May 47.2509	Jun 47.2509	Jul 47.2509	Aug 47.2509	Sep 47.2509	Oct 47.2509	Nov 47.2509	Dec 47.2509 (38)
Heat transfer coeff	96.3978	96.3978	96.3978	96.3978	96.3978	96.3978	96.3978	96.3978	96.3978	96.3978	96.3978	96.3978 (39)
Average = Sum(39)m / 12 =												96.3978 (39)
HLP	Jan 1.9794	Feb 1.9794	Mar 1.9794	Apr 1.9794	May 1.9794	Jun 1.9794	Jul 1.9794	Aug 1.9794	Sep 1.9794	Oct 1.9794	Nov 1.9794	Dec 1.9794 (40)
HLP (average)												1.9794 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6519 (42)
Average daily hot water use (litres/day)												73.4327 (43)
Daily hot water use	Jan 80.7759	Feb 77.8386	Mar 74.9013	Apr 71.9640	May 69.0267	Jun 66.0894	Jul 66.0894	Aug 69.0267	Sep 71.9640	Oct 74.9013	Nov 77.8386	Dec 80.7759 (44)
Energy conte	119.7884	104.7677	108.1108	94.2537	90.4386	78.0417	72.3171	82.9849	83.9760	97.8659	106.8283	116.0086 (45)
Energy content (annual)												Total = Sum(45)m = 1155.3817 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	17.9683	15.7151	16.2166	14.1380	13.5658	11.7062	10.8476	12.4477	12.5964	14.6799	16.0242	17.4013 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8424 (55)
Total storage loss												
26.1144 23.5872 26.1144 25.2720 26.1144 25.2720 26.1144 26.1144 25.2720 26.1144 25.2720 26.1144 (56)												
If cylinder contains dedicated solar storage												
26.1144 23.5872 26.1144 25.2720 26.1144 25.2720 26.1144 26.1144 25.2720 26.1144 25.2720 26.1144 (57)												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
145.9028 128.3549 134.2252 119.5257 116.5530 103.3137 98.4315 109.0993 109.2480 123.9803 132.1003 142.1230 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	145.9028	128.3549	134.2252	119.5257	116.5530	103.3137	98.4315	109.0993	109.2480	123.9803	132.1003	142.1230 (64)
Heat gains from water heating, kWh/month	39.8296	34.8352	35.9469	31.3393	30.0708	25.9489	24.0454	27.5925	27.9220	32.5404	35.5204	38.5729 (65)
Total per year (kWh/year) = Sum(64)m =												1462.8577 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.0626	28.4778	23.1597	17.5334	13.1064	11.0650	11.9561	15.5410	20.8591	26.4854	30.9123	32.9538 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.7136	216.9416	211.3270	199.3741	184.2858	170.1049	160.6311	158.4031	164.0177	175.9706	191.0589	205.2399 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761 (71)
Water heating gains (Table 5)	53.5344	51.8382	48.3157	43.5269	40.4178	36.0401	32.3191	37.0867	38.7806	43.7371	49.3339	51.8453 (72)
Total internal gains	379.9120	376.8589	362.4037	340.0357	317.4113	296.8112	284.5077	290.6320	303.2587	325.7944	350.9065	369.6402 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast					8.7100	11.2829	0.6300	0.8000			0.7700			34.3245 (75)		
Southeast					5.5900	36.7938	0.6300	0.8000			0.7700			71.8374 (77)		
West					4.4000	19.6403	0.6300	0.8000			0.7700			30.1831 (80)		
Solar gains					136.3450	251.2787	390.5448	555.9972	684.0497	704.8548	668.9274	570.2554	447.7665	290.6863	166.8685	114.3301 (83)
Total gains					516.2570	628.1376	752.9485	896.0329	1001.4610	1001.6660	953.4351	860.8874	751.0252	616.4807	517.7750	483.9703 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	14.7504	14.7504	14.7504	14.7504	14.7504	14.7504	14.7504	14.7504	14.7504	14.7504	14.7504	14.7504	
alpha	1.9834	1.9834	1.9834	1.9834	1.9834	1.9834	1.9834	1.9834	1.9834	1.9834	1.9834	1.9834	
util living area	0.9263	0.8939	0.8394	0.7477	0.6274	0.4976	0.3905	0.4373	0.6237	0.8083	0.9011	0.9343 (86)	
Tweekday	16.2392	16.6717	17.3547	18.1494	18.7858	19.1624	19.2982	19.2775	19.0015	18.1619	17.0466	16.1294	
Tweekend	18.9671	19.2205	19.6243	20.1082	20.5182	20.7870	20.9068	20.8798	20.6466	20.0941	19.4311	18.9030	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)	
Th 2	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471 (88)	
util rest of house	0.9130	0.8752	0.8111	0.7028	0.5595	0.3988	0.2616	0.3045	0.5285	0.7620	0.8803	0.9223 (89)	
Tweekday	16.2392	16.6717	17.3547	18.1494	18.7858	19.1624	19.2982	19.2775	19.0015	18.1619	17.0466	16.1294	
Tweekend	17.5881	17.8328	18.2194	18.6692	19.0294	19.2426	19.3194	19.3077	19.1515	18.6763	18.0450	17.5259	
MIT 2	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471	19.3471 (90)	
Living area fraction									fLA = Living area / (4) =			0.5955 (91)	
MIT	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314 (92)	
Temperature adjustment												0.0000	
adjusted MIT	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314	20.3314 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	475.6416	557.0671	623.9815	654.8046	602.5741	460.8332	325.4232	333.3532	441.9652	487.7829	462.5721	450.0039 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fraction	1545.3886	1487.5499	1333.3134	1101.9587	832.0449	552.4913	359.6957	378.9752	600.6902	938.0825	1275.4748	1555.0284 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	795.8917	625.2844	527.7430	321.9510	170.7263	0.0000	0.0000	0.0000	0.0000	335.0229	585.2899	822.1382 (98)
Space heating requirement												4184.0474 (98)
Space heating requirement per m2												85.9147 (99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												307.0400 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1362.7045 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	795.8917	625.2844	527.7430	321.9510	170.7263	0.0000	0.0000	0.0000	0.0000	335.0229	585.2899	822.1382 (98)
Space heating efficiency (main heating system 1)	307.0400	307.0400	307.0400	307.0400	307.0400	0.0000	0.0000	0.0000	0.0000	307.0400	307.0400	307.0400 (210)
Space heating fuel (main heating system)	259.2144	203.6492	171.8809	104.8564	55.6039	0.0000	0.0000	0.0000	0.0000	109.1138	190.6234	267.7626 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	145.9028	128.3549	134.2252	119.5257	116.5530	103.3137	98.4315	109.0993	109.2480	123.9803	132.1003	142.1230 (64)
Efficiency of water heater	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850 (216)
(217)m	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850 (217)
Fuel for water heating, kWh/month	66.1136	58.1620	60.8221	54.1612	52.8142	46.8150	44.6027	49.4367	49.5040	56.1798	59.8592	64.4009 (219)
Water heating fuel used												662.8714 (219)
Annual totals kWh/year												
Space heating fuel - main system												1362.7045 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)												143.2373 (230a)
Total electricity for the above, kWh/year												143.2373 (231)
Electricity for lighting (calculated in Appendix L)												226.4945 (232)
Total delivered energy for all uses												2395.3076 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	1362.7045	13.1900	179.7407 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	662.8714	13.1900	87.4327 (247)
Mechanical ventilation fans	143.2373	13.1900	18.8930 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	226.4945	13.1900	29.8746 (250)
Additional standing charges			0.0000 (251)
Total energy cost			315.9411 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4162 (257)
SAP value		80.2444
SAP rating (Section 12)		80 (258)
SAP band		C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	1362.7045	0.5190	707.2437 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	662.8714	0.5190	344.0302 (264)
Space and water heating			1051.2739 (265)
Pumps and fans	143.2373	0.5190	74.3401 (267)
Energy for lighting	226.4945	0.5190	117.5506 (268)
Total kg/year			1243.1647 (272)
CO2 emissions per m2			25.5300 (273)
EI value			82.2216
EI rating			82 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW	

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 3.0704 = 4.296$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 3.0704 = 0.1690$, stars = 5
Water heating energy efficiency	$13.19 / 2.2069 = 5.977$, stars = 3
Water heating environmental impact	$0.519 / 2.2069 = 0.2352$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.7000 (1b)	x 2.3000 (2b)	= 112.0100 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.0100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.7300
Infiltration rate					0.2865 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2435 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2618	0.2496	0.2496	0.2313	0.2374	0.2070	0.2070	0.2009	0.2070	0.2313	0.2253	0.2435 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												1.2765 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	1.2765	1.2765	1.2765	1.2765	1.2765	1.2765	1.2765	1.2765	1.2765	1.2765	1.2765	1.2765 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.47)			18.7000	1.3884	25.9624		(27)
External Wall	47.0400	18.7000	28.3400	0.1900	5.3846	18.0000	510.1200 (29a)
Flat Roof	48.7000		48.7000	0.1500	7.3050	9.0000	438.3000 (30)
Total net area of external elements Aum(A, m ²)			95.7400	(26)...(30) + (32) =		38.6520	(31)
Fabric heat loss, W/K = Sum (A x U)							(33)
Corridor Wall			22.3100	0.0000	0.0000	20.0000	446.2000 (32)
Party Wall			4.6000	0.0000	0.0000	20.0000	92.0000 (32)
Party Floor 1			48.7000			64.0000	3116.8000 (32d)
Internal Wall 1			57.2700			9.0000	515.4300 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	5118.8500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		105.1099 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.4949 (36)
Total fabric heat loss	(33) + (36) =	49.1469 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.1845	47.1845	47.1845	47.1845	47.1845	47.1845	47.1845	47.1845	47.1845	47.1845	47.1845	47.1845 (38)
Heat transfer coeff	96.3314	96.3314	96.3314	96.3314	96.3314	96.3314	96.3314	96.3314	96.3314	96.3314	96.3314	96.3314 (39)
Average = Sum(39)m / 12 =												96.3314 (39)
HLP	1.9781	1.9781	1.9781	1.9781	1.9781	1.9781	1.9781	1.9781	1.9781	1.9781	1.9781	1.9781 (40)
HLP (average)												1.9781 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6519 (42)
Average daily hot water use (litres/day)												73.4327 (43)
Daily hot water use	80.7759	77.8386	74.9013	71.9640	69.0267	66.0894	66.0894	69.0267	71.9640	74.9013	77.8386	80.7759 (44)
Energy conte	119.7884	104.7677	108.1108	94.2537	90.4386	78.0417	72.3171	82.9849	83.9760	97.8659	106.8283	116.0086 (45)
Energy content (annual)												Total = Sum(45)m = 1155.3817 (45)

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Distribution loss (46)m = 0.15 x (45)m	17.9683	15.7151	16.2166	14.1380	13.5658	11.7062	10.8476	12.4477	12.5964	14.6799	16.0242	17.4013 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8424 (55)
Total storage loss												
26.1144 23.5872 26.1144 25.2720 26.1144 25.2720 26.1144 26.1144 25.2720 26.1144 25.2720 26.1144 (56)												
If cylinder contains dedicated solar storage												
26.1144 23.5872 26.1144 25.2720 26.1144 25.2720 26.1144 26.1144 25.2720 26.1144 25.2720 26.1144 (57)												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
145.9028 128.3549 134.2252 119.5257 116.5530 103.3137 98.4315 109.0993 109.2480 123.9803 132.1003 142.1230 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	145.9028	128.3549	134.2252	119.5257	116.5530	103.3137	98.4315	109.0993	109.2480	123.9803	132.1003	142.1230 (64)
Heat gains from water heating, kWh/month	39.8296	34.8352	35.9469	31.3393	30.0708	25.9489	24.0454	27.5925	27.9220	32.5404	35.5204	38.5729 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141	99.1141 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.0626	28.4778	23.1597	17.5334	13.1064	11.0650	11.9561	15.5410	20.8591	26.4854	30.9123	32.9538 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.7136	216.9416	211.3270	199.3741	184.2858	170.1049	160.6311	158.4031	164.0177	175.9706	191.0589	205.2399 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633	46.5633 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761	-66.0761 (71)
Water heating gains (Table 5)	53.5344	51.8382	48.3157	43.5269	40.4178	36.0401	32.3191	37.0867	38.7806	43.7371	49.3339	51.8453 (72)
Total internal gains	379.9120	376.8589	362.4037	340.0357	317.4113	296.8112	284.5077	290.6320	303.2587	325.7944	350.9065	369.6402 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
Northeast				8.7100	13.7804	0.6300		0.8000		0.7700	41.9222 (75)	
Southeast				5.5900	43.0593	0.6300		0.8000		0.7700	84.0702 (77)	
West				4.4000	23.8018	0.6300		0.8000		0.7700	36.5785 (80)	
Solar gains	162.5709	262.5710	406.8606	590.2153	708.5692	772.5194	725.8539	633.8653	498.0889	326.5356	196.1608	137.0052 (83)
Total gains	542.4830	639.4300	769.2643	930.2510	1025.9805	1069.3306	1010.3616	924.4973	801.3476	652.3300	547.0673	506.6454 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	14.7605	14.7605	14.7605	14.7605	14.7605	14.7605	14.7605	14.7605	14.7605	14.7605	14.7605	14.7605	
alpha	1.9840	1.9840	1.9840	1.9840	1.9840	1.9840	1.9840	1.9840	1.9840	1.9840	1.9840	1.9840	
util living area	0.9137	0.8823	0.8196	0.7100	0.5710	0.4067	0.2922	0.3237	0.5525	0.7693	0.8811	0.9226 (86)	
Tweekday	16.5363	16.9214	17.6154	18.4005	18.9776	19.2685	19.3372	19.3330	19.1432	18.4235	17.3624	16.4506	
Tweekend	19.1382	19.3651	19.7787	20.2653	20.6505	20.8814	20.9592	20.9492	20.7569	20.2572	19.6156	19.0874	
24 / 16		8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)	
Th 2	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480 (88)	
util rest of house	0.8977	0.8609	0.7868	0.6576	0.4917	0.2962	0.1537	0.1770	0.4422	0.7126	0.8551	0.9080 (89)	
Tweekday	16.5363	16.9214	17.6154	18.4005	18.9776	19.2685	19.3372	19.3330	19.1432	18.4235	17.3624	16.4506	
Tweekend	17.7566	17.9745	18.3673	18.8117	19.1384	19.3030	19.3419	19.3395	19.2321	18.8247	18.2242	17.7081	
MIT 2	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480	19.3480 (90)	
Living area fraction									fLA = Living area / (4) =			0.5955 (91)	
MIT	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317 (92)	
Temperature adjustment												0.0000	
adjusted MIT	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317	20.3317 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	492.4276	559.0159	621.0215	642.0553	554.9588	389.6363	241.0949	247.2159	409.7802	488.1933	476.7426	464.6623 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W												

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Month fraction	1467.2944	1409.4956	1245.7322	1004.9038	715.9096	436.5486	253.5190	263.1521	513.6137	850.7735	1187.9334	1467.2944 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	725.3009	571.5223	464.7848	261.2509	119.7474	0.0000	0.0000	0.0000	0.0000	269.7597	512.0574	745.9583 (98)
Space heating requirement												3670.3817 (98)
Space heating per m2											(98) / (4) =	75.3672 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												306.6302 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1197.0061 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	725.3009	571.5223	464.7848	261.2509	119.7474	0.0000	0.0000	0.0000	0.0000	269.7597	512.0574	745.9583 (98)
Space heating efficiency (main heating system 1)	306.6302	306.6302	306.6302	306.6302	306.6302	0.0000	0.0000	0.0000	0.0000	306.6302	306.6302	306.6302 (210)
Space heating fuel (main heating system)	236.5393	186.3882	151.5783	85.2007	39.0527	0.0000	0.0000	0.0000	0.0000	87.9756	166.9951	243.2762 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	145.9028	128.3549	134.2252	119.5257	116.5530	103.3137	98.4315	109.0993	109.2480	123.9803	132.1003	142.1230 (64)
Efficiency of water heater	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850 (216)
(217)m	66.1136	58.1620	60.8221	54.1612	52.8142	46.8150	44.6027	49.4367	49.5040	56.1798	59.8592	64.4009 (219)
Fuel for water heating, kWh/month												662.8714 (219)
Water heating fuel used												
Annual totals kWh/year												
Space heating fuel - main system												1197.0061 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)												143.7432 (230a)
Total electricity for the above, kWh/year												143.7432 (231)
Electricity for lighting (calculated in Appendix L)												226.4945 (232)
Total delivered energy for all uses												2230.1152 (238)

10a. Fuel costs - using BEDF prices (570)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	1197.0061	24.1800	289.4361 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	662.8714	24.1800	160.2823 (247)
Mechanical ventilation fans	143.7432	24.1800	34.7571 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	226.4945	24.1800	54.7664 (250)
Additional standing charges			0.0000 (251)
Total energy cost			539.2419 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	1197.0061	0.5190	621.2462 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	662.8714	0.5190	344.0302 (264)
Space and water heating			965.2764 (265)
Pumps and fans	143.7432	0.5190	74.6027 (267)
Energy for lighting	226.4945	0.5190	117.5506 (268)
Total kg/year			1157.4298 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	1197.0061	3.0700	3674.8088 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	662.8714	3.0700	2035.0151 (264)
Space and water heating			5709.8238 (265)
Pumps and fans	143.7432	3.0700	441.2917 (267)
Energy for lighting	226.4945	3.0700	695.3381 (268)
Primary energy kWh/year			6846.4536 (272)
Primary energy kWh/m2/year			140.5843 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 80
Current environmental impact rating: B 82

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: (none) SAP change Cost change CO2 change

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 80
Potential environmental impact rating: B 82

Fuel prices for cost data on this page from database revision number 570 TEST (02 May 2025)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current £539	Potential £539	Saving £0
Electricity			
Space heating	£324	£324	£0
Water heating	£160	£160	£0
Lighting	£55	£55	£0
Total cost of fuels	£539	£539	£0
Total cost of uses	£539	£539	£0
Delivered energy	46 kWh/m²	46 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	24 kg/m²	24 kg/m²	0 kg/m²
Primary energy	141 kWh/m²	141 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type SemiDetached Flat
Number of storeys 1
Cross ventilation possible Yes
SAP Region Thames Valley
Front of dwelling faces North East
Overshading Average or unknown
Thermal mass parameter 105.1 (calculated from construction elements)
Night ventilation No
Ventilation rate during hot weather (ach) 6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient 221.78 (P1)
Transmission heat loss coefficient 49.15 (37)
Summer heat loss coefficient 270.93 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	8.7100	98.8453	0.6300	0.8000	0.9000	351.4711
South East	5.5900	119.9223	0.6300	0.8000	0.9000	273.6702
West	4.4000	117.5071	0.6300	0.8000	0.9000	211.0728
total:						836.2140

	Jun	Jul	Aug	
Solar gains	891	836	729	(P3)
Internal gains	297	285	291	
Total summer gains	1188	1121	1019	(P5)
Summer gain/loss ratio	4.38	4.14	3.76	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 105.1)	1.26	1.26	1.26	
Threshold temperature	21.65	23.30	22.83	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			