

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-194			Issued on Date	31/03/2023
Assessment Reference	As Built	Prop Type Ref	2F Flat Det		
Property	20, Keepers Drive, Fair Oak, EASTLEIGH, SO50 7QR				
SAP Rating	83 B	DER	15.29	TER	19.56
Environmental	90 B	% DER<TER	21.84		
CO ₂ Emissions (t/year)	0.70	DFEE	43.24	TFEE	49.69
General Requirements Compliance	Pass	% DFEE<TFEE	12.99		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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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 55 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:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.56 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.29 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.42 (max. 2.00)	1.80 (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: 5.21 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

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: 0.28
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Medium OK
Based on:
Overshading: Average
Windows facing North: 3.37 m², Overhang twice as wide as window, ratio 0.15
Windows facing West: 1.29 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 0.63 W/m²K
Photovoltaic array 312.80 kWh/Year

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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	54.8900 (1b)	x 2.2200 (2b)	= 121.8558 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	54.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 121.8558 (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					5.2100
Infiltration rate					0.2605 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2410 (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	0.3072	0.3012	0.2952	0.2651	0.2590	0.2289	0.2289	0.2229	0.2410	0.2590	0.2711	0.2831 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5572	0.5512	0.5452	0.5151	0.5090	0.5000	0.5000	0.5000	0.5000	0.5090	0.5211	0.5331 (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		
Window (Uw = 1.40)			2.5400	1.3258	3.3674			(27)	
French Door (Uw = 1.40)			2.1200	1.3258	2.8106			(27)	
DTC			2.1200	0.6300	1.3356			(26)	
Roof Window (Uw = 1.80)			4.7200	1.6791	7.9254			(27a)	
140mm Timber Frame	18.0600	1.2900	16.7700	0.1900	3.1863	9.0000	150.9300	(29a)	
WTS	17.1600	2.1200	15.0400	0.1500	2.2560	18.0000	270.7200	(29a)	
WTV/S	11.2200		11.2200	0.1500	1.6830	9.0000	100.9800	(29a)	
Timber Stud Wall	11.9900	3.3700	8.6200	0.2300	1.9826	9.0000	77.5800	(29a)	
400mm Mineral Wool	42.0400		42.0400	0.1100	4.6244	9.0000	378.3600	(30)	
Sloping	13.3500	4.7200	8.6300	0.2000	1.7260	9.0000	77.6700	(30)	
Total net area of external elements Aum(A, m2)			113.8200						(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8973			(33)	
Party Floor			54.8900			30.0000	1646.7000	(32d)	
Timber			71.7100			9.0000	645.3900	(32c)	
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	3348.3300 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								61.0007 (35)	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.7337 (36)	
Total fabric heat loss							(33) + (36) =	40.6310 (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	22.4075	22.1652	21.9230	20.7118	20.4695	20.1062	20.1062	20.1062	20.1062	20.4695	20.9540	21.4385 (38)
Heat transfer coeff	63.0384	62.7962	62.5539	61.3427	61.1005	60.7372	60.7372	60.7372	60.7372	61.1005	61.5850	62.0694 (39)
Average = Sum(39)m / 12 =												61.5446 (39)
HLP	1.1484	1.1440	1.1396	1.1176	1.1131	1.1065	1.1065	1.1065	1.1065	1.1131	1.1220	1.1308 (40)
HLP (average)												1.1212 (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												1.8341 (42)
Average daily hot water use (litres/day)												77.7607 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Daily hot water use	85.5368	82.4264	79.3159	76.2055	73.0951	69.9846	69.9846	73.0951	76.2055	79.3159	82.4264	85.5368 (44)
Energy conte	126.8486	110.9426	114.4828	99.8089	95.7690	82.6414	76.5794	87.8760	88.9255	103.6341	113.1247	122.8461 (45)
Energy content (annual)										Total = Sum (45)m =		1223.4789 (45)
Distribution loss (46)m = 0.15 x (45)m	19.0273	16.6414	17.1724	14.9713	14.3654	12.3962	11.4869	13.1814	13.3388	15.5451	16.9687	18.4269 (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 (57)
Combi loss	14.0170	12.6448	13.9745	13.4953	13.9246	13.4516	13.8852	13.9107	13.4754	13.9538	13.5366	14.0087 (61)
Total heat required for water heating calculated for each month	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548 (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	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548 (64)
Heat gains from water heating, kWh/month	45.6814	40.0496	41.5592	36.5603	35.3243	30.8412	28.9339	32.6964	32.9366	37.9468	40.9981	44.3485 (65)
Total per year (kWh/year) = Sum (64)m =												1387.7572 (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	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.4599	12.8431	10.4447	7.9073	5.9108	4.9902	5.3920	7.0088	9.4072	11.9446	13.9411	14.8617 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	159.9021	161.5614	157.3800	148.4785	137.2418	126.6810	119.6257	117.9664	122.1477	131.0493	142.2859	152.8468 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707 (69)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654 (71)
Water heating gains (Table 5)	61.3997	59.5976	55.8591	50.7782	47.4789	42.8349	38.8897	43.9468	45.7453	51.0037	56.9418	59.6082 (72)
Total internal gains	289.2737	287.5142	277.1959	260.6760	244.1436	228.0181	217.4194	222.4340	230.8122	247.5096	266.6809	280.8288 (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	
North					1.2500	10.6334	0.6300	0.7000	0.7700		4.0621 (74)	
West					1.2900	19.6403	0.6300	0.7000	0.7700		7.7430 (80)	
North					2.1200	10.6334	0.6300	0.7000	0.7700		6.8894 (74)	
North					1.5700	15.2954	0.6300	0.7000	1.0000		9.5311 (82)	
South					3.1500	47.0123	0.6300	0.7000	1.0000		58.7764 (82)	
Solar gains	87.0020	158.7149	245.2480	351.1963	436.7388	452.7044	428.4934	361.7201	281.4557	182.9724	106.1202	73.2204 (83)
Total gains	376.2757	446.2290	522.4439	611.8723	680.8824	680.7225	645.9128	584.1541	512.2679	430.4821	372.8011	354.0492 (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	14.7544	14.8113	14.8686	15.1622	15.2223	15.3134	15.3134	15.3134	15.3134	15.2223	15.1026	14.9847
alpha	1.9836	1.9874	1.9912	2.0108	2.0148	2.0209	2.0209	2.0209	2.0209	2.0148	2.0068	1.9990
util living area	0.9124	0.8796	0.8251	0.7299	0.6064	0.4743	0.3699	0.4153	0.6000	0.7870	0.8840	0.9207 (86)
MIT	17.9841	18.3650	18.9680	19.7246	20.3284	20.7144	20.8773	20.8404	20.5155	19.7175	18.7336	17.9271 (87)
Th 2	19.9615	19.9650	19.9686	19.9865	19.9901	19.9955	19.9955	19.9955	19.9955	19.9901	19.9829	19.9758 (88)
util rest of house	0.9032	0.8673	0.8071	0.7025	0.5660	0.4174	0.2969	0.3401	0.5446	0.7584	0.8702	0.9123 (89)
MIT 2	17.2092	17.5835	18.1720	18.9069	19.4665	19.8065	19.9329	19.9099	19.6526	18.9213	17.9639	17.1627 (90)
Living area fraction									fLA = Living area / (4) =			0.4463 (91)
MIT	17.5551	17.9323	18.5273	19.2719	19.8512	20.2118	20.3544	20.3253	20.0378	19.2767	18.3075	17.5039 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4051	17.7823	18.3773	19.1219	19.7012	20.0618	20.2044	20.1753	19.8878	19.1267	18.1575	17.3539 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8735	0.8346	0.7739	0.6760	0.5536	0.4214	0.3128	0.3542	0.5381	0.7296	0.8385	0.8839 (94)
Useful gains	328.6614	372.4085	404.3380	413.6291	376.9125	286.8248	202.0262	206.9246	275.6767	314.0971	312.6108	312.9567 (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	826.1225	808.9619	742.9720	627.0385	488.8772	331.7315	218.9232	229.2985	351.5316	520.9834	680.9747	816.4550 (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	370.1110	293.3639	251.9437	153.6548	83.3017	0.0000	0.0000	0.0000	0.0000	153.9235	265.2220	374.6027 (98)
Space heating												1946.1233 (98)

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Space heating per m2 (98) / (4) = 35.4550 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2150.4125 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	370.1110	293.3639	251.9437	153.6548	83.3017	0.0000	0.0000	0.0000	0.0000	153.9235	265.2220	374.6027	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	408.9625	324.1590	278.3908	169.7843	92.0461	0.0000	0.0000	0.0000	0.0000	170.0812	293.0630	413.9256	(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	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548	(64)
Efficiency of water heater (217)m	89.5946	89.5273	89.3935	89.1136	88.6530	87.3000	87.3000	87.3000	87.3000	89.0858	89.4404	87.3000	(216)
Fuel for water heating, kWh/month	157.2254	138.0443	143.6987	127.1458	123.7336	110.0721	103.6249	116.5941	117.2977	131.9940	141.6153	89.6210	(217)
Water heating fuel used												152.7040	(219)
Annual totals kWh/year												1563.7502	(219)
Space heating fuel - main system												2150.4125	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.3640)													
mechanical ventilation fans (SFP = 0.3640)													54.1137 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													129.1137 (231)
Electricity for lighting (calculated in Appendix L)													255.3657 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4098.6421 (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	2150.4125	0.2160	464.4891	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1563.7502	0.2160	337.7700	(264)
Space and water heating			802.2591	(265)
Pumps and fans	129.1137	0.5190	67.0100	(267)
Energy for lighting	255.3657	0.5190	132.5348	(268)
Energy saving/generation technologies				
PV Unit	-312.8000	0.5190	-162.3432	(269)
Total CO2, kg/year			839.4607	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2900	(273)

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

DER			15.2900	ZC1
Total Floor Area		TFA	54.8900	
Assumed number of occupants		N	1.8341	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.2626	ZC2
CO2 emissions from cooking, equation (L16)			2.9699	ZC3
Total CO2 emissions			35.5226	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			35.5226	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	54.8900 (1b)	x 2.2200 (2b)	= 121.8558 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	54.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 121.8558 (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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1641 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4141 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3831 (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												
	0.4884	0.4788	0.4693	0.4214	0.4118	0.3639	0.3639	0.3543	0.3831	0.4118	0.4310	0.4501 (22b)
Effective ac	0.6193	0.6146	0.6101	0.5888	0.5848	0.5662	0.5662	0.5628	0.5734	0.5848	0.5929	0.6013 (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 Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			4.6600	1.3258	6.1780		(27)
TER Room Window (Uw = 1.70)			4.7200	1.5918	7.5131		(27a)
140mm Timber Frame	18.0600	1.2900	16.7700	0.1800	3.0186		(29a)
WTS	17.1600	2.1200	15.0400	0.1800	2.7072		(29a)
WTV/S	11.2200		11.2200	0.1800	2.0196		(29a)
Timber Stud Wall	11.9900	3.3700	8.6200	0.1800	1.5516		(29a)
400mm Mineral Wool	42.0400		42.0400	0.1300	5.4652		(30)
Sloping	13.3500	4.7200	8.6300	0.1300	1.1219		(30)
Total net area of external elements Aum(A, m ²)			113.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.6952		(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)	8.4749 (36)
Total fabric heat loss	(33) + (36) = 40.1701 (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	24.9025	24.7162	24.5337	23.6762	23.5158	22.7690	22.7690	22.6307	23.0566	23.5158	23.8403	24.1796 (38)
Heat transfer coeff	65.0726	64.8864	64.7038	63.8464	63.6859	62.9391	62.9391	62.8008	63.2268	63.6859	64.0105	64.3498 (39)
Average = Sum(39)m / 12 =												63.8456 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1855	1.1821	1.1788	1.1632	1.1602	1.1466	1.1466	1.1441	1.1519	1.1602	1.1662	1.1723 (40)
HLP (average)												1.1632 (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	1.8341 (42)
Average daily hot water use (litres/day)	77.7607 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	85.5368	82.4264	79.3159	76.2055	73.0951	69.9846	69.9846	73.0951	76.2055	79.3159	82.4264	85.5368 (44)
Energy conte	126.8486	110.9426	114.4828	99.8089	95.7690	82.6414	76.5794	87.8760	88.9255	103.6341	113.1247	122.8461 (45)
Energy content (annual)										Total = Sum(45)m =		1223.4789 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.0273	16.6414	17.1724	14.9713	14.3654	12.3962	11.4869	13.1814	13.3388	15.5451	16.9687	18.4269 (46)
Water storage loss:												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	(57)
Combi loss	43.5886	37.9387	40.4185	37.5808	37.2485	34.5130	35.6634	37.2485	37.5808	40.4185	40.6486	43.5886	(61)
Total heat required for water heating calculated for each month	170.4372	148.8813	154.9013	137.3897	133.0175	117.1544	112.2428	125.1244	126.5063	144.0526	153.7733	166.4347	(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	170.4372	148.8813	154.9013	137.3897	133.0175	117.1544	112.2428	125.1244	126.5063	144.0526	153.7733	166.4347	(64)
Heat gains from water heating, kWh/month	53.0743	46.3731	48.1702	42.5817	41.1553	36.1065	34.3785	38.5309	38.9629	44.5630	47.7761	51.7435	(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)
(66)m	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.4599	12.8431	10.4447	7.9073	5.9108	4.9902	5.3920	7.0088	9.4072	11.9446	13.9411	14.8617	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	159.9021	161.5614	157.3800	148.4785	137.2418	126.6810	119.6257	117.9664	122.1477	131.0493	142.2859	152.8468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	(69)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	(71)
Water heating gains (Table 5)	71.3364	69.0076	64.7449	59.1412	55.3163	50.1479	46.2077	51.7888	54.1152	59.8965	66.3557	69.5477	(72)
Total internal gains	299.2104	296.9241	286.0817	269.0390	251.9809	235.3311	224.7374	230.2760	239.1821	256.4024	276.0948	290.7683	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W			
North				3.3700	10.6334	0.6300	0.7000	0.7700	10.9515 (74)			
West				1.2900	19.6403	0.6300	0.7000	0.7700	7.7430 (80)			
North				1.5700	15.2954	0.6300	0.7000	1.0000	9.5311 (82)			
South				3.1500	47.0123	0.6300	0.7000	1.0000	58.7764 (82)			
Solar gains	87.0020	158.7149	245.2480	351.1963	436.7388	452.7044	428.4934	361.7201	281.4557	182.9724	106.1202	73.2204 (83)
Total gains	386.2124	455.6390	531.3297	620.2354	688.7197	688.0355	653.2308	591.9961	520.6378	439.3748	382.2150	363.9887 (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	58.5777	58.7459	58.9116	59.7028	59.8532	60.5634	60.5634	60.6968	60.2878	59.8532	59.5497	59.2357		
alpha	4.9052	4.9164	4.9274	4.9802	4.9902	5.0376	5.0376	5.0465	5.0192	4.9902	4.9700	4.9490		
util living area	0.9960	0.9904	0.9727	0.9097	0.7646	0.5684	0.4207	0.4812	0.7526	0.9525	0.9914	0.9970	(86)	
MIT	19.8065	19.9906	20.2828	20.6444	20.8879	20.9799	20.9964	20.9931	20.9240	20.5836	20.1286	19.7762	(87)	
Th 2	19.9316	19.9343	19.9370	19.9496	19.9519	19.9629	19.9629	19.9650	19.9587	19.9519	19.9472	19.9422	(88)	
util rest of house	0.9946	0.9872	0.9637	0.8815	0.7046	0.4836	0.3233	0.3764	0.6688	0.9314	0.9880	0.9959	(89)	
MIT 2	18.3554	18.6246	19.0461	19.5528	19.8512	19.9508	19.9617	19.9624	19.9030	19.4858	18.8360	18.3187	(90)	
Living area fraction									fLA = Living area / (4) =			0.4463	(91)	
MIT	19.0031	19.2343	19.5981	20.0400	20.3139	20.4102	20.4235	20.4224	20.3587	19.9758	19.4129	18.9692	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0031	19.2343	19.5981	20.0400	20.3139	20.4102	20.4235	20.4224	20.3587	19.9758	19.4129	18.9692	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	383.5096	448.5746	510.1381	548.4489	500.3763	358.4313	239.6527	250.6321	366.0760	409.5046	376.7463	362.0389	(94)	
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	956.7680	930.1009	847.4959	711.2487	548.5851	365.6869	240.6485	252.6130	395.7191	597.1081	788.1549	950.3957	(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	426.5042	323.5857	250.9942	117.2158	35.8673	0.0000	0.0000	0.0000	0.0000	139.5770	296.2142	437.7374	(98)	
Space heating												2027.6959	(98)	
Space heating per m2												36.9411	(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 %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2170.9807 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	426.5042	323.5857	250.9942	117.2158	35.8673	0.0000	0.0000	0.0000	0.0000	139.5770	296.2142	437.7374 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	456.6427	346.4515	268.7304	125.4987	38.4019	0.0000	0.0000	0.0000	0.0000	149.4401	317.1458	468.6696 (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	170.4372	148.8813	154.9013	137.3897	133.0175	117.1544	112.2428	125.1244	126.5063	144.0526	153.7733	166.4347 (64)
Efficiency of water heater (217)m	87.2661	86.9536	86.2595	84.6543	82.2517	80.3000	80.3000	80.3000	80.3000	84.9719	86.6746	80.3000 (216)
Fuel for water heating, kWh/month	195.3074	171.2192	179.5760	162.2950	161.7201	145.8958	139.7793	155.8212	157.5421	169.5298	177.4146	87.3726 (217)
Water heating fuel used												190.4884 (219)
Annual totals kWh/year												2006.5888 (219)
Space heating fuel - main system												2170.9807 (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)												255.3657 (232)
Total delivered energy for all uses												4507.9351 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	2170.9807	0.2160	468.9318 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.5888	0.2160	433.4232 (264)
Space and water heating			902.3550 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	255.3657	0.5190	132.5348 (268)
Total CO ₂ , kg/m ² /year			1073.8148 (272)
Emissions per m ² for space and water heating			16.4393 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m ² for lighting			2.4146 (272b)
Emissions per m ² for pumps and fans			0.7091 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4393 * 1.00) + 2.4146 + 0.7091, rounded to 2 d.p.			19.5600 (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	54.8900 (1b)	x 2.2200 (2b)	= 121.8558 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	54.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 121.8558 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	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) =	0.1641 (8)
Pressure test					Yes
Measured/design AP50					5.2100
Infiltration rate					0.4246 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3928 (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												
Effective ac	0.5008	0.4910	0.4812	0.4321	0.4222	0.3731	0.3731	0.3633	0.3928	0.4222	0.4419	0.4615 (22b)
	0.6254	0.6205	0.6158	0.5933	0.5891	0.5696	0.5696	0.5660	0.5771	0.5891	0.5976	0.6065 (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
Window (Uw = 1.40)			2.5400	1.3258	3.3674		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
Roof Window (Uw = 1.80)			4.7200	1.6791	7.9254		(27a)
140mm Timber Frame	18.0600	1.2900	16.7700	0.1900	3.1863	9.0000	150.9300 (29a)
WTS	17.1600	2.1200	15.0400	0.1500	2.2560	18.0000	270.7200 (29a)
WTV/S	11.2200		11.2200	0.1500	1.6830	9.0000	100.9800 (29a)
Timber Stud Wall	11.9900	3.3700	8.6200	0.2300	1.9826	9.0000	77.5800 (29a)
400mm Mineral Wool	42.0400		42.0400	0.1100	4.6244	9.0000	378.3600 (30)
Sloping	13.3500	4.7200	8.6300	0.2000	1.7260	9.0000	77.6700 (30)
Total net area of external elements Aum(A, m ²)			113.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.8973		(33)
Party Floor			54.8900			30.0000	1646.7000 (32d)
Timber			71.7100			9.0000	645.3900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3348.3300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							61.0007 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7337 (36)
Total fabric heat loss						(33) + (36) =	40.6310 (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	25.1488	24.9530	24.7610	23.8595	23.6909	22.9057	22.9057	22.7603	23.2081	23.6909	24.0321	24.3888 (38)
Heat transfer coeff	65.7797	65.5839	65.3920	64.4905	64.3218	63.5367	63.5367	63.3913	63.8391	64.3218	64.6630	65.0198 (39)
Average = Sum(39)m / 12 =												64.4897 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1984	1.1948	1.1913	1.1749	1.1718	1.1575	1.1575	1.1549	1.1630	1.1718	1.1780	1.1845 (40)
HLP (average)												1.1749 (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												1.8341 (42)
Average daily hot water use (litres/day)												77.7607 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	85.5368	82.4264	79.3159	76.2055	73.0951	69.9846	69.9846	73.0951	76.2055	79.3159	82.4264	85.5368 (44)
Energy conte	126.8486	110.9426	114.4828	99.8089	95.7690	82.6414	76.5794	87.8760	88.9255	103.6341	113.1247	122.8461 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1223.4789 (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	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 (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	26.9553	23.5753	24.3276	21.2094	20.3509	17.5613	16.2731	18.6736	18.8967	22.0222	24.0390	26.1048 (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	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.4599	12.8431	10.4447	7.9073	5.9108	4.9902	5.3920	7.0088	9.4072	11.9446	13.9411	14.8617	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	159.9021	161.5614	157.3800	148.4785	137.2418	126.6810	119.6257	117.9664	122.1477	131.0493	142.2859	152.8468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	(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)	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	(71)
Water heating gains (Table 5)	36.2303	35.0823	32.6984	29.4575	27.3534	24.3907	21.8725	25.0990	26.2454	29.5998	33.3875	35.0871	(72)
Total internal gains	261.1043	259.9988	251.0352	236.3553	221.0181	206.5738	197.4022	200.5862	208.3123	223.1057	240.1266	253.3077	(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				
North					1.2500	10.6334	0.6300	0.7000	0.7700	4.0621 (74)				
West					1.2900	19.6403	0.6300	0.7000	0.7700	7.7430 (80)				
North					2.1200	10.6334	0.6300	0.7000	0.7700	6.8894 (74)				
North					1.5700	15.2954	0.6300	0.7000	1.0000	9.5311 (82)				
South					3.1500	47.0123	0.6300	0.7000	1.0000	58.7764 (82)				
Solar gains	87.0020	158.7149	245.2480	351.1963	436.7388	452.7044	428.4934	361.7201	281.4557	182.9724	106.1202	73.2204	(83)	
Total gains	348.1063	418.7137	496.2832	587.5516	657.7568	659.2782	625.8956	562.3062	489.7680	406.0781	346.2468	326.5281	(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	14.1395	14.1817	14.2233	14.4221	14.4600	14.6387	14.6387	14.6722	14.5693	14.4600	14.3837	14.3048
alpha	1.9426	1.9454	1.9482	1.9615	1.9640	1.9759	1.9759	1.9781	1.9713	1.9640	1.9589	1.9537
util living area	0.9242	0.8932	0.8415	0.7509	0.6307	0.4975	0.3914	0.4392	0.6277	0.8091	0.8991	0.9318 (86)
MIT	17.7745	18.1638	18.7896	19.5761	20.2292	20.6671	20.8535	20.8109	20.4383	19.5688	18.5371	17.7064 (87)
Th 2	19.9213	19.9241	19.9269	19.9401	19.9426	19.9541	19.9541	19.9563	19.9497	19.9426	19.9376	19.9324 (88)
util rest of house	0.9158	0.8817	0.8242	0.7236	0.5893	0.4375	0.3126	0.3588	0.5707	0.7814	0.8863	0.9243 (89)
MIT 2	16.9783	17.3614	17.9733	18.7360	19.3431	19.7350	19.8804	19.8558	19.5531	18.7502	17.7441	16.9186 (90)
Living area fraction	fLA = Living area / (4) = 0.4463 (91)											
MIT	17.3337	17.7196	18.3376	19.1110	19.7386	20.1510	20.3147	20.2821	19.9482	19.1156	18.0981	17.2702 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.3337	17.7196	18.3376	19.1110	19.7386	20.1510	20.3147	20.2821	19.9482	19.1156	18.0981	17.2702 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8891	0.8516	0.7933	0.6993	0.5806	0.4494	0.3409	0.3852	0.5706	0.7557	0.8578	0.8990	(94)
Useful gains	309.4886	356.5910	393.7113	410.8872	381.8842	296.2723	213.3742	216.5842	279.4574	306.8615	297.0151	293.5425	(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	857.3528	840.7571	774.0873	658.5100	517.0593	352.6940	236.0202	246.0926	373.3427	547.7363	711.1685	849.8223	(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	407.6110	325.3597	282.9997	178.2885	100.5703	0.0000	0.0000	0.0000	0.0000	179.2109	298.1905	413.8722	(98)
Space heating	2186.1027 (98)												
Space heating per m2	(98) / (4) = 39.8270 (99)												

8c. Space cooling requirement

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

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	597.2446	470.1713	481.7736	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7496	0.8016	0.7709	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	447.6806	376.8740	371.3836	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	784.7819	747.2345	681.5354	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	242.7130	275.5482	230.7530	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												749.0141	(104)
Cooled fraction									FC = cooled area / (4) =			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)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	60.6782	68.8870	57.6882	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												187.2535	(107)
Space cooling per m2												3.4114	(108)
Energy for space heating												39.8270	(99)
Energy for space cooling												3.4114	(108)
Total												43.2384	(109)
Dwelling Fabric Energy Efficiency (DFEE)												43.2	(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	54.8900 (1b)	x 2.2200 (2b)	= 121.8558 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	54.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 121.8558 (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) = 0.1641 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4141 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3831 (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												
	0.4884	0.4788	0.4693	0.4214	0.4118	0.3639	0.3639	0.3543	0.3831	0.4118	0.4310	0.4501 (22b)
Effective ac	0.6193	0.6146	0.6101	0.5888	0.5848	0.5662	0.5662	0.5628	0.5734	0.5848	0.5929	0.6013 (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 Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			4.6600	1.3258	6.1780		(27)
TER Room Window (Uw = 1.70)			4.7200	1.5918	7.5131		(27a)
140mm Timber Frame	18.0600	1.2900	16.7700	0.1800	3.0186		(29a)
WTS	17.1600	2.1200	15.0400	0.1800	2.7072		(29a)
WTV/S	11.2200		11.2200	0.1800	2.0196		(29a)
Timber Stud Wall	11.9900	3.3700	8.6200	0.1800	1.5516		(29a)
400mm Mineral Wool	42.0400		42.0400	0.1300	5.4652		(30)
Sloping	13.3500	4.7200	8.6300	0.1300	1.1219		(30)
Total net area of external elements Aum(A, m ²)			113.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.6952		(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)	8.4749 (36)
Total fabric heat loss	(33) + (36) = 40.1701 (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	24.9025	24.7162	24.5337	23.6762	23.5158	22.7690	22.7690	22.6307	23.0566	23.5158	23.8403	24.1796 (38)
Heat transfer coeff	65.0726	64.8864	64.7038	63.8464	63.6859	62.9391	62.9391	62.8008	63.2268	63.6859	64.0105	64.3498 (39)
Average = Sum(39)m / 12 =												63.8456 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1855	1.1821	1.1788	1.1632	1.1602	1.1466	1.1466	1.1441	1.1519	1.1602	1.1662	1.1723 (40)
HLP (average)												1.1632 (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	1.8341 (42)
Average daily hot water use (litres/day)	77.7607 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	85.5368	82.4264	79.3159	76.2055	73.0951	69.9846	69.9846	73.0951	76.2055	79.3159	82.4264	85.5368 (44)
Energy conte	126.8486	110.9426	114.4828	99.8089	95.7690	82.6414	76.5794	87.8760	88.9255	103.6341	113.1247	122.8461 (45)
Energy content (annual)										Total = Sum(45)m =		1223.4789 (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:												

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (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	26.9553	23.5753	24.3276	21.2094	20.3509	17.5613	16.2731	18.6736	18.8967	22.0222	24.0390	26.1048 (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	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	91.7068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.4599	12.8431	10.4447	7.9073	5.9108	4.9902	5.3920	7.0088	9.4072	11.9446	13.9411	14.8617	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	159.9021	161.5614	157.3800	148.4785	137.2418	126.6810	119.6257	117.9664	122.1477	131.0493	142.2859	152.8468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	32.1707	(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)	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	(71)
Water heating gains (Table 5)	36.2303	35.0823	32.6984	29.4575	27.3534	24.3907	21.8725	25.0990	26.2454	29.5998	33.3875	35.0871	(72)
Total internal gains	261.1043	259.9988	251.0352	236.3553	221.0181	206.5738	197.4022	200.5862	208.3123	223.1057	240.1266	253.3077	(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	
North	3.3700	10.6334	0.6300	0.7000	0.7700	10.9515	(74)
West	1.2900	19.6403	0.6300	0.7000	0.7700	7.7430	(80)
North	1.5700	15.2954	0.6300	0.7000	1.0000	9.5311	(82)
South	3.1500	47.0123	0.6300	0.7000	1.0000	58.7764	(82)

Solar gains	87.0020	158.7149	245.2480	351.1963	436.7388	452.7044	428.4934	361.7201	281.4557	182.9724	106.1202	73.2204	(83)
Total gains	348.1063	418.7137	496.2832	587.5516	657.7568	659.2782	625.8956	562.3062	489.7680	406.0781	346.2468	326.5281	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	58.5777	58.7459	58.9116	59.7028	59.8532	60.5634	60.5634	60.6968	60.2878	59.8532	59.5497	59.2357	
alpha	4.9052	4.9164	4.9274	4.9802	4.9902	5.0376	5.0376	5.0465	5.0192	4.9902	4.9700	4.9490	
util living area	0.9974	0.9933	0.9791	0.9239	0.7866	0.5901	0.4384	0.5049	0.7822	0.9644	0.9944	0.9981	(86)
MIT	19.7429	19.9304	20.2302	20.6080	20.8721	20.9764	20.9956	20.9915	20.9091	20.5377	20.0695	19.7132	(87)
Th 2	19.9316	19.9343	19.9370	19.9496	19.9519	19.9629	19.9629	19.9650	19.9587	19.9519	19.9472	19.9422	(88)
util rest of house	0.9966	0.9910	0.9719	0.8989	0.7281	0.5033	0.3372	0.3958	0.7006	0.9477	0.9921	0.9975	(89)
MIT 2	18.7921	18.9808	19.2782	19.6469	19.8723	19.9531	19.9619	19.9627	19.9120	19.5920	19.1303	18.7710	(90)
Living area fraction									fLA = Living area / (4) =			0.4463	(91)
MIT	19.2165	19.4047	19.7031	20.0759	20.3185	20.4098	20.4233	20.4219	20.3570	20.0141	19.5495	19.1915	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2165	19.4047	19.7031	20.0759	20.3185	20.4098	20.4233	20.4219	20.3570	20.0141	19.5495	19.1915	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9958	0.9896	0.9700	0.9023	0.7499	0.5416	0.3825	0.4448	0.7342	0.9489	0.9910	0.9969	(94)
Ext temp.	346.6431	414.3425	481.3734	530.1711	493.2275	357.0591	239.4310	250.1093	359.6054	385.3167	343.1163	325.5124	(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	970.6555	941.1547	854.2897	713.5392	548.8800	365.6649	240.6351	252.5801	395.6119	599.5461	796.8977	964.7021	(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	464.2653	354.0178	277.4498	132.0251	41.4055	0.0000	0.0000	0.0000	0.0000	159.3867	326.7226	475.5571	(98)
												2230.8298	(98)
										(98) / (4) =		40.6418	(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	591.6275	465.7493	477.2861	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9275	0.9631	0.9438	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	548.7586	448.5432	450.4773	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	784.7819	747.2345	681.5354	0.0000	0.0000	0.0000	0.0000	(103)

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Calculation Type: New Build (As Built)



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Month fraction	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	169.9368	222.2263	171.9072	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												564.0703 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
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 (107)
Space cooling per m2												141.0176 (107)
Energy for space heating												2.5691 (108)
Energy for space cooling												40.6418 (99)
Total												2.5691 (108)
Target Fabric Energy Efficiency (TFEE)												43.2109 (109)
												49.7 (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	54.8900 (1b)	x 2.2200 (2b)	= 121.8558 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	54.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 121.8558 (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					5.2100
Infiltration rate					0.2605 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2410 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2651	0.2470	0.2470	0.2349	0.2349	0.2229	0.2229	0.2108	0.2108	0.2289	0.2229	0.2349 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5151	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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K		
Window (Uw = 1.40)			2.5400	1.3258	3.3674			(27)	
French Door (Uw = 1.40)			2.1200	1.3258	2.8106			(27)	
DTC			2.1200	0.6300	1.3356			(26)	
Roof Window (Uw = 1.80)			4.7200	1.6791	7.9254			(27a)	
140mm Timber Frame	18.0600	1.2900	16.7700	0.1900	3.1863	9.0000	150.9300	(29a)	
WTS	17.1600	2.1200	15.0400	0.1500	2.2560	18.0000	270.7200	(29a)	
WTV/S	11.2200		11.2200	0.1500	1.6830	9.0000	100.9800	(29a)	
Timber Stud Wall	11.9900	3.3700	8.6200	0.2300	1.9826	9.0000	77.5800	(29a)	
400mm Mineral Wool	42.0400		42.0400	0.1100	4.6244	9.0000	378.3600	(30)	
Sloping	13.3500	4.7200	8.6300	0.2000	1.7260	9.0000	77.6700	(30)	
Total net area of external elements Aum(A, m2)			113.8200						(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8973			(33)	
Party Floor			54.8900			30.0000	1646.7000	(32d)	
Timber			71.7100			9.0000	645.3900	(32c)	
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				3348.3300	(34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							61.0007	(35)	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7337	(36)	
Total fabric heat loss			(33) + (36) =				40.6310	(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	20.7118	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062 (38)
Heat transfer coeff	61.3427	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372 (39)
Average = Sum(39)m / 12 =												60.7876 (39)
HLP	1.1176	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065 (40)
HLP (average)												1.1074 (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												1.8341 (42)
Average daily hot water use (litres/day)												77.7607 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	85.5368	82.4264	79.3159	76.2055	73.0951	69.9846	69.9846	73.0951	76.2055	79.3159	82.4264	85.5368 (44)
Energy conte	126.8486	110.9426	114.4828	99.8089	95.7690	82.6414	76.5794	87.8760	88.9255	103.6341	113.1247	122.8461 (45)
Energy content (annual)										Total = Sum (45)m =		1223.4789 (45)
Distribution loss (46)m = 0.15 x (45)m	19.0273	16.6414	17.1724	14.9713	14.3654	12.3962	11.4869	13.1814	13.3388	15.5451	16.9687	18.4269 (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 (57)
Combi loss	14.0170	12.6448	13.9745	13.4953	13.9246	13.4516	13.8852	13.9107	13.4754	13.9538	13.5366	14.0087 (61)
Total heat required for water heating calculated for each month	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548 (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	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	45.6814	40.0496	41.5592	36.5603	35.3243	30.8412	28.9339	32.6964	32.9366	37.9468	40.9981	44.3485 (65)
												1388 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.1497	32.1078	26.1118	19.7683	14.7771	12.4754	13.4801	17.5220	23.5180	29.8615	34.8527	37.1544 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	238.6599	241.1364	234.8956	221.6096	204.8385	189.0761	178.5457	176.0692	182.3100	195.5960	212.3671	228.1295 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389 (69)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654 (71)
Water heating gains (Table 5)	61.3997	59.5976	55.8591	50.7782	47.4789	42.8349	38.8897	43.9468	45.7453	51.0037	56.9418	59.6082 (72)
Total internal gains	423.7309	420.3635	404.3882	379.6778	354.6162	331.9081	318.4372	325.0597	339.0949	363.9828	391.6833	412.4138 (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	
North						1.2500	13.4839	0.6300	0.7000	0.7700	5.1511 (74)	
West						1.2900	25.1925	0.6300	0.7000	0.7700	9.9319 (80)	
North						2.1200	13.4839	0.6300	0.7000	0.7700	8.7362 (74)	
North						1.5700	19.1486	0.6300	0.7000	1.0000	11.9321 (82)	
South						3.1500	58.5609	0.6300	0.7000	1.0000	73.2149 (82)	
Solar gains	108.9662	170.0368	266.8354	386.7232	455.6512	517.8510	472.9146	416.2558	321.9289	209.4015	132.6622	86.6968 (83)
Total gains	532.6971	590.4002	671.2236	766.4010	810.2674	849.7590	791.3518	741.3154	661.0238	573.3843	524.3455	499.1105 (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	15.1622	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134
alpha	2.0108	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209
util living area	0.8352	0.8012	0.7309	0.6221	0.4868	0.3329	0.2413	0.2561	0.4451	0.6529	0.7846	0.8472 (86)
MIT	18.7912	19.0740	19.5982	20.1704	20.6296	20.8834	20.9589	20.9540	20.7745	20.2529	19.4655	18.7512 (87)
Th 2	19.9865	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955 (88)
util rest of house	0.8195	0.7829	0.7065	0.5887	0.4407	0.2750	0.1718	0.1828	0.3827	0.6121	0.7614	0.8323 (89)
MIT 2	18.0098	18.2873	18.7872	19.3193	19.7278	19.9302	19.9805	19.9786	19.8559	19.4116	18.6727	17.9789 (90)
Living area fraction	18.3586	18.6385	19.1492	19.6992	20.1303	20.3557	20.4172	20.4140	20.2659	19.7871	19.0265	18.3236 (91)
MIT												
Temperature adjustment												-0.1500
adjusted MIT	18.2086	18.4885	18.9992	19.5492	19.9803	20.2057	20.2672	20.2640	20.1159	19.6371	18.8765	18.1736 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.7863	0.7507	0.6793	0.5726	0.4400	0.2875	0.1911	0.2029	0.3906	0.5961	0.7312	0.7993 (94)
Ext temp.	418.8477	443.2420	455.9514	438.8548	356.4964	244.2951	151.1917	150.4272	258.1912	341.7765	383.3973	398.9348 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	785.7128	764.5872	692.3559	579.9922	417.8916	261.5134	155.9253	155.7293	292.5058	463.8549	636.3143	769.7594 (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)
	272.9476	215.9440	175.8849	101.6189	45.6781	0.0000	0.0000	0.0000	0.0000	90.8263	182.1003	275.8935 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	1360.8936 (98)
RHI space heating demand	1361 (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	54.8900 (1b)	x 2.2200 (2b)	= 121.8558 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	54.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 121.8558 (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					5.2100
Infiltration rate					0.2605 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2410 (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	0.3072	0.3012	0.2952	0.2651	0.2590	0.2289	0.2289	0.2229	0.2410	0.2590	0.2711	0.2831 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5572	0.5512	0.5452	0.5151	0.5090	0.5000	0.5000	0.5000	0.5000	0.5090	0.5211	0.5331 (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		
Window (Uw = 1.40)			2.5400	1.3258	3.3674			(27)	
French Door (Uw = 1.40)			2.1200	1.3258	2.8106			(27)	
DTC			2.1200	0.6300	1.3356			(26)	
Roof Window (Uw = 1.80)			4.7200	1.6791	7.9254			(27a)	
140mm Timber Frame	18.0600	1.2900	16.7700	0.1900	3.1863	9.0000	150.9300	(29a)	
WTS	17.1600	2.1200	15.0400	0.1500	2.2560	18.0000	270.7200	(29a)	
WTV/S	11.2200		11.2200	0.1500	1.6830	9.0000	100.9800	(29a)	
Timber Stud Wall	11.9900	3.3700	8.6200	0.2300	1.9826	9.0000	77.5800	(29a)	
400mm Mineral Wool	42.0400		42.0400	0.1100	4.6244	9.0000	378.3600	(30)	
Sloping	13.3500	4.7200	8.6300	0.2000	1.7260	9.0000	77.6700	(30)	
Total net area of external elements Aum(A, m2)			113.8200						(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8973			(33)	
Party Floor			54.8900			30.0000	1646.7000	(32d)	
Timber			71.7100			9.0000	645.3900	(32c)	
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	3348.3300 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								61.0007 (35)	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.7337 (36)	
Total fabric heat loss							(33) + (36) =	40.6310 (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	22.4075	22.1652	21.9230	20.7118	20.4695	20.1062	20.1062	20.1062	20.1062	20.4695	20.9540	21.4385 (38)
Heat transfer coeff	63.0384	62.7962	62.5539	61.3427	61.1005	60.7372	60.7372	60.7372	60.7372	61.1005	61.5850	62.0694 (39)
Average = Sum(39)m / 12 =												61.5446 (39)
HLP	1.1484	1.1440	1.1396	1.1176	1.1131	1.1065	1.1065	1.1065	1.1065	1.1131	1.1220	1.1308 (40)
HLP (average)												1.1212 (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												1.8341 (42)
Average daily hot water use (litres/day)												77.7607 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	85.5368	82.4264	79.3159	76.2055	73.0951	69.9846	69.9846	73.0951	76.2055	79.3159	82.4264	85.5368 (44)
Energy conte	126.8486	110.9426	114.4828	99.8089	95.7690	82.6414	76.5794	87.8760	88.9255	103.6341	113.1247	122.8461 (45)
Energy content (annual)										Total = Sum (45)m =		1223.4789 (45)
Distribution loss (46)m = 0.15 x (45)m	19.0273	16.6414	17.1724	14.9713	14.3654	12.3962	11.4869	13.1814	13.3388	15.5451	16.9687	18.4269 (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 (57)
Combi loss	14.0170	12.6448	13.9745	13.4953	13.9246	13.4516	13.8852	13.9107	13.4754	13.9538	13.5366	14.0087 (61)
Total heat required for water heating calculated for each month	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548 (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	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548 (64)
Heat gains from water heating, kWh/month	45.6814	40.0496	41.5592	36.5603	35.3243	30.8412	28.9339	32.6964	32.9366	37.9468	40.9981	44.3485 (65)
										Total per year (kWh/year) = Sum (64)m =		1387.7572 (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	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.1497	32.1078	26.1118	19.7683	14.7771	12.4754	13.4801	17.5220	23.5180	29.8615	34.8527	37.1544 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	238.6599	241.1364	234.8956	221.6096	204.8385	189.0761	178.5457	176.0692	182.3100	195.5960	212.3671	228.1295 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389 (69)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654 (71)
Water heating gains (Table 5)	61.3997	59.5976	55.8591	50.7782	47.4789	42.8349	38.8897	43.9468	45.7453	51.0037	56.9418	59.6082 (72)
Total internal gains	423.7309	420.3635	404.3882	379.6778	354.6162	331.9081	318.4372	325.0597	339.0949	363.9828	391.6833	412.4138 (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			
North				1.2500	10.6334	0.6300	0.7000	0.7700	4.0621 (74)			
West				1.2900	19.6403	0.6300	0.7000	0.7700	7.7430 (80)			
North				2.1200	10.6334	0.6300	0.7000	0.7700	6.8894 (74)			
North				1.5700	15.2954	0.6300	0.7000	1.0000	9.5311 (82)			
South				3.1500	47.0123	0.6300	0.7000	1.0000	58.7764 (82)			
Solar gains	87.0020	158.7149	245.2480	351.1963	436.7388	452.7044	428.4934	361.7201	281.4557	182.9724	106.1202	73.2204 (83)
Total gains	510.7329	579.0783	649.6362	730.8742	791.3550	784.6125	746.9306	686.7797	620.5506	546.9552	497.8035	485.6342 (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	14.7544	14.8113	14.8686	15.1622	15.2223	15.3134	15.3134	15.3134	15.3134	15.2223	15.1026	14.9847
alpha	1.9836	1.9874	1.9912	2.0108	2.0148	2.0209	2.0209	2.0209	2.0209	2.0148	2.0068	1.9990
util living area	0.8614	0.8259	0.7688	0.6730	0.5536	0.4267	0.3276	0.3648	0.5325	0.7170	0.8247	0.8710 (86)
MIT	18.3948	18.7304	19.2600	19.9200	20.4374	20.7663	20.9024	20.8750	20.6157	19.9482	19.0821	18.3430 (87)
Th 2	19.9615	19.9650	19.9686	19.9865	19.9901	19.9955	19.9955	19.9955	19.9955	19.9901	19.9829	19.9758 (88)
util rest of house	0.8482	0.8099	0.7476	0.6435	0.5133	0.3728	0.2610	0.2959	0.4779	0.6841	0.8060	0.8587 (89)
MIT 2	17.6059	17.9328	18.4452	19.0818	19.5563	19.8428	19.9465	19.9297	19.7286	19.1275	18.2948	17.5657 (90)
Living area fraction									fLA = Living area / (4) =			0.4463 (91)
MIT	17.9580	18.2888	18.8089	19.4559	19.9496	20.2550	20.3731	20.3516	20.1246	19.4938	18.6462	17.9127 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8080	18.1388	18.6589	19.3059	19.7996	20.1050	20.2231	20.2016	19.9746	19.3438	18.4962	17.7627 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8144	0.7761	0.7166	0.6218	0.5052	0.3789	0.2766	0.3106	0.4766	0.6604	0.7734	0.8256 (94)
Useful gains	415.9617	449.4106	465.5290	454.4310	399.7854	297.3136	206.5889	213.3120	295.7782	361.2218	385.0164	400.9456 (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	851.5240	831.3467	760.5881	638.3253	494.8888	334.3583	220.0585	230.9001	356.8044	534.2525	701.8348	841.8264 (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	324.0584	256.6611	219.5240	132.4039	70.7570	0.0000	0.0000	0.0000	0.0000	128.7349	228.1093	328.0154 (98)
Space heating												1688.2639 (98)

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Space heating per m2 (98) / (4) = 30.7572 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1865.4849 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	324.0584	256.6611	219.5240	132.4039	70.7570	0.0000	0.0000	0.0000	0.0000	128.7349	228.1093	328.0154	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	358.0756	283.6034	242.5679	146.3027	78.1845	0.0000	0.0000	0.0000	0.0000	142.2485	252.0544	362.4479	(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	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548	(64)
Efficiency of water heater (217)m	89.5059	89.4345	89.2918	88.9957	88.5274	87.3000	87.3000	87.3000	87.3000	88.9436	89.3309	87.3000	(216)
Fuel for water heating, kWh/month	157.3812	138.1875	143.8624	127.3143	123.9092	110.0721	103.6249	116.5941	117.2977	132.2050	141.7888	152.8526	(219)
Water heating fuel used												1565.0899	(219)
Annual totals kWh/year													
Space heating fuel - main system												1865.4849	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.3640)													
mechanical ventilation fans (SFP = 0.3640)													54.1137 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													129.1137 (231)
Electricity for lighting (calculated in Appendix L)													255.3657 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3815.0543 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1865.4849	3.4800	64.9189 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1565.0899	3.4800	54.4651 (247)
Mechanical ventilation fans	54.1137	13.1900	7.1376 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	255.3657	13.1900	33.6827 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			290.0968 (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] =	1.2197 (257)
SAP value		82.9845
SAP rating (Section 12)		83 (258)
SAP band		B

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	1865.4849	0.2160	402.9447 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1565.0899	0.2160	338.0594 (264)
Space and water heating			741.0042 (265)
Pumps and fans	129.1137	0.5190	67.0100 (267)
Energy for lighting	255.3657	0.5190	132.5348 (268)
Energy saving/generation technologies			
PV Unit	-312.8000	0.5190	-162.3432 (269)
Total kg/year			778.2058 (272)
CO2 emissions per m2			14.1800 (273)
EI value			89.5606

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EI rating
EI band

90 (274)
B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8856 = 3.929$, stars = 4
Water heating environmental impact	$0.216 / 0.8856 = 0.2439$, stars = 4

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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	54.8900 (1b)	x 2.2200 (2b)	= 121.8558 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	54.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 121.8558 (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					5.2100
Infiltration rate					0.2605 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2410 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2651	0.2470	0.2470	0.2349	0.2349	0.2229	0.2229	0.2108	0.2108	0.2289	0.2229	0.2349 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5151	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
Window (Uw = 1.40)			2.5400	1.3258	3.3674		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
Roof Window (Uw = 1.80)			4.7200	1.6791	7.9254		(27a)
140mm Timber Frame	18.0600	1.2900	16.7700	0.1900	3.1863	9.0000	150.9300 (29a)
WTS	17.1600	2.1200	15.0400	0.1500	2.2560	18.0000	270.7200 (29a)
WTV/S	11.2200		11.2200	0.1500	1.6830	9.0000	100.9800 (29a)
Timber Stud Wall	11.9900	3.3700	8.6200	0.2300	1.9826	9.0000	77.5800 (29a)
400mm Mineral Wool	42.0400		42.0400	0.1100	4.6244	9.0000	378.3600 (30)
Sloping	13.3500	4.7200	8.6300	0.2000	1.7260	9.0000	77.6700 (30)
Total net area of external elements Aum(A, m ²)			113.8200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8973		(32)
Party Floor			54.8900			30.0000	1646.7000 (32d)
Timber			71.7100			9.0000	645.3900 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3348.3300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							61.0007 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7337 (36)
Total fabric heat loss					(33) + (36) =		40.6310 (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	20.7118	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062	20.1062 (38)
Heat transfer coeff	61.3427	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372	60.7372 (39)
Average = Sum(39)m / 12 =												60.7876 (39)
HLP	1.1176	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065	1.1065 (40)
HLP (average)												1.1074 (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												1.8341 (42)
Average daily hot water use (litres/day)												77.7607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	85.5368	82.4264	79.3159	76.2055	73.0951	69.9846	69.9846	73.0951	76.2055	79.3159	82.4264	85.5368 (44)
Energy conte	126.8486	110.9426	114.4828	99.8089	95.7690	82.6414	76.5794	87.8760	88.9255	103.6341	113.1247	122.8461 (45)
Energy content (annual)										Total = Sum (45)m =		1223.4789 (45)
Distribution loss (46)m = 0.15 x (45)m	19.0273	16.6414	17.1724	14.9713	14.3654	12.3962	11.4869	13.1814	13.3388	15.5451	16.9687	18.4269 (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 (57)
Combi loss	14.0170	12.6448	13.9745	13.4953	13.9246	13.4516	13.8852	13.9107	13.4754	13.9538	13.5366	14.0087 (61)
Total heat required for water heating calculated for each month	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548 (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	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548 (64)
Heat gains from water heating, kWh/month	45.6814	40.0496	41.5592	36.5603	35.3243	30.8412	28.9339	32.6964	32.9366	37.9468	40.9981	44.3485 (65)
										Total per year (kWh/year) = Sum (64)m =		1387.7572 (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	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481	110.0481 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.1497	32.1078	26.1118	19.7683	14.7771	12.4754	13.4801	17.5220	23.5180	29.8615	34.8527	37.1544 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	238.6599	241.1364	234.8956	221.6096	204.8385	189.0761	178.5457	176.0692	182.3100	195.5960	212.3671	228.1295 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389	47.8389 (69)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654	-73.3654 (71)
Water heating gains (Table 5)	61.3997	59.5976	55.8591	50.7782	47.4789	42.8349	38.8897	43.9468	45.7453	51.0037	56.9418	59.6082 (72)
Total internal gains	423.7309	420.3635	404.3882	379.6778	354.6162	331.9081	318.4372	325.0597	339.0949	363.9828	391.6833	412.4138 (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	
North				1.2500	13.4839	0.6300	0.7000		0.7700		5.1511 (74)	
West				1.2900	25.1925	0.6300	0.7000		0.7700		9.9319 (80)	
North				2.1200	13.4839	0.6300	0.7000		0.7700		8.7362 (74)	
North				1.5700	19.1486	0.6300	0.7000		1.0000		11.9321 (82)	
South				3.1500	58.5609	0.6300	0.7000		1.0000		73.2149 (82)	
Solar gains	108.9662	170.0368	266.8354	386.7232	455.6512	517.8510	472.9146	416.2558	321.9289	209.4015	132.6622	86.6968 (83)
Total gains	532.6971	590.4002	671.2236	766.4010	810.2674	849.7590	791.3518	741.3154	661.0238	573.3843	524.3455	499.1105 (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	15.1622	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134	15.3134
alpha	2.0108	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209	2.0209
util living area	0.8352	0.8012	0.7309	0.6221	0.4868	0.3329	0.2413	0.2561	0.4451	0.6529	0.7846	0.8472 (86)
MIT	18.7912	19.0740	19.5982	20.1704	20.6296	20.8834	20.9589	20.9540	20.7745	20.2529	19.4655	18.7512 (87)
Th 2	19.9865	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955	19.9955 (88)
util rest of house	0.8195	0.7829	0.7065	0.5887	0.4407	0.2750	0.1718	0.1828	0.3827	0.6121	0.7614	0.8323 (89)
MIT 2	18.0098	18.2873	18.7872	19.3193	19.7278	19.9302	19.9805	19.9786	19.8559	19.4116	18.6727	17.9789 (90)
Living area fraction									fLA = Living area / (4) =			0.4463 (91)
MIT	18.3586	18.6385	19.1492	19.6992	20.1303	20.3557	20.4172	20.4140	20.2659	19.7871	19.0265	18.3236 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2086	18.4885	18.9992	19.5492	19.9803	20.2057	20.2672	20.2640	20.1159	19.6371	18.8765	18.1736 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7863	0.7507	0.6793	0.5726	0.4400	0.2875	0.1911	0.2029	0.3906	0.5961	0.7312	0.7993 (94)
Useful gains	418.8477	443.2420	455.9514	438.8548	356.4964	244.2951	151.1917	150.4272	258.1912	341.7765	383.3973	398.9348 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	785.7128	764.5872	692.3559	579.9922	417.8916	261.5134	155.9253	155.7293	292.5058	463.8549	636.3143	769.7594 (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	272.9476	215.9440	175.8849	101.6189	45.6781	0.0000	0.0000	0.0000	0.0000	90.8263	182.1003	275.8935 (98)
Space heating												1360.8936 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating per m2 (98) / (4) = 24.7931 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1503.7498 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	272.9476	215.9440	175.8849	101.6189	45.6781	0.0000	0.0000	0.0000	0.0000	90.8263	182.1003	275.8935	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	301.5995	238.6121	194.3480	112.2861	50.4730	0.0000	0.0000	0.0000	0.0000	100.3606	201.2158	304.8547	(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	140.8656	123.5873	128.4573	113.3042	109.6936	96.0930	90.4646	101.7867	102.4009	117.5879	126.6613	136.8548	(64)
Efficiency of water heater (217)m	89.3847	89.3084	89.1212	88.7843	88.2170	87.3000	87.3000	87.3000	87.3000	88.6663	89.1593	87.3000	(216)
Fuel for water heating, kWh/month	157.5947	138.3826	144.1378	127.6174	124.3451	110.0721	103.6249	116.5941	117.2977	132.6185	142.0617	153.0587	(219)
Water heating fuel used												1567.4056	(219)
Annual totals kWh/year													
Space heating fuel - main system												1503.7498	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.3640)													
mechanical ventilation fans (SFP = 0.3640)												54.1137	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												129.1137	(231)
Electricity for lighting (calculated in Appendix L)												255.3657	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3455.6348	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1503.7498	9.7400	146.4652 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1567.4056	9.7400	152.6653 (247)
Mechanical ventilation fans	54.1137	36.8500	19.9409 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	255.3657	36.8500	94.1022 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	36.8500	0.0000 (252)
Total energy cost			544.8112 (255)

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	1503.7498	0.2160	324.8100 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1567.4056	0.2160	338.5596 (264)
Space and water heating			663.3696 (265)
Pumps and fans	129.1137	0.5190	67.0100 (267)
Energy for lighting	255.3657	0.5190	132.5348 (268)
Energy saving/generation technologies			
PV Unit	-312.8000	0.5190	-162.3432 (269)
Total kg/year			700.5712 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1503.7498	1.2200	1834.5748 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1567.4056	1.2200	1912.2348 (264)
Space and water heating			3746.8096 (265)
Pumps and fans	129.1137	3.0700	396.3791 (267)

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

Energy for lighting	255.3657	3.0700	783.9726 (268)
Energy saving/generation technologies			
PV Unit	-312.8000	3.0700	-960.2960 (269)
Primary energy kWh/year			3966.8653 (272)
Primary energy kWh/m ² /year			72.2694 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 90

(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/m ²

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£142	£142	£0
Mains gas	£403	£403	£0
Space heating	£298	£298	£0
Water heating	£153	£153	£0
Lighting	£94	£94	£0
Total cost of fuels	£545	£545	£0
Total cost of uses	£545	£545	£0
Delivered energy	63 kWh/m ²	63 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m ²	13 kg/m ²	13 kg/m ²	0 kg/m ²
Primary energy	72 kWh/m ²	72 kWh/m ²	0 kWh/m ²

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	Detached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	61.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	160.85 (P1)
Transmission heat loss coefficient	40.63 (37)
Summer heat loss coefficient	201.48 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.150	0.980	Wide overhang
West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	0.980	0.880 (P8)
North	1.000	1.00	1.000	1.000 (P8)
South	1.000	1.00	1.000	1.000 (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	1.2500	87.1704	0.6300	0.7000	0.8800	38.0577
West	1.2900	125.2818	0.6300	0.7000	0.9000	57.7300
North	2.1200	87.1704	0.6300	0.7000	0.8800	64.5459
North	1.5700	157.4332	0.6300	0.7000	1.0000	98.1018
South	3.1500	202.9386	0.6300	0.7000	1.0000	253.7210
total:						512.1564

	Jun	Jul	Aug	
Solar gains	554	512	441	(P3)
Internal gains	329	315	322	
Total summer gains	883	828	763	(P5)
Summer gain/loss ratio	4.38	4.11	3.79	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 61.0)	1.57	1.57	1.57	
Threshold temperature	21.36	22.98	22.66	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			