

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-215			Issued on Date	08/09/2023
Assessment Reference	As Built	Prop Type Ref	1F Flat Det		
Property	51, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	83 B	DER	14.34	TER	20.74
Environmental	90 B	% DER<TER	30.87		
CO ₂ Emissions (t/year)	0.71	DFEE	49.48	TFEE	56.78
General Requirements Compliance	Pass	% DFEE<TFEE	12.86		
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

Mid-floor flat, total floor area 61 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) 20.74 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.34 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (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)	0.20 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.40 (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: 4.82 (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 30
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: Time and temperature zone control 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 (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 3.06 m², No overhang
Windows facing West: 5.53 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.63 W/m²K
Photovoltaic array 521.77 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	61.2000 (1b)	x 2.5200 (2b)	= 154.2240 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.2240 (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							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) =									Air changes per hour			
Pressure test								0.0000 / (5) =	0.0000	(8)		
Measured/design AP50								Yes	4.8200			
Infiltration rate									0.2410	(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) =	0.2229	(21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Mechanical extract ventilation - decentralised	0.2842	0.2787	0.2731	0.2452	0.2396	0.2118	0.2118	0.2062	0.2229	0.2396	0.2508	0.2619
If mechanical ventilation:												0.5000
Effective ac	0.5342	0.5287	0.5231	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5008	0.5119
												(22)
												(22a)
												(22b)
												(23a)
												(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)			6.4700	1.3258	8.5777			(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106			(27)
DTC			2.1200	0.6300	1.3356			(26)
140mm Timber Frame	41.7200	8.5900	33.1300	0.1900	6.2947	9.0000	298.1700	(29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200	(29a)
C2V	17.8000		17.8000	0.1400	2.4920	9.0000	160.2000	(30)
Flat Terrace	5.1500		5.1500	0.2000	1.0300	9.0000	46.3500	(30)
Total net area of external elements Aum(A, m2)			101.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8041			(33)
Party Floor			61.2000			30.0000	1836.0000	(32d)
Party Ceilings			38.2500			30.0000	1147.5000	(32b)
Timber			122.1200			9.0000	1099.0800	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		5218.9200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.2765	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3268	(36)
Total fabric heat loss						(33) + (36) =	47.1308	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0154 (42)
Average daily hot water use (litres/day)												82.0646 (43)
Daily hot water use	Jan 90.2711	Feb 86.9885	Mar 83.7059	Apr 80.4233	May 77.1407	Jun 73.8582	Jul 73.8582	Aug 77.1407	Sep 80.4233	Oct 83.7059	Nov 86.9885	Dec 90.2711 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	133.8694	117.0830	120.8192	105.3331	101.0696	87.2154	80.8179	92.7397	93.8473	109.3700	119.3859	129.6454 (45)
Energy content (annual)										Total = Sum (45)m =		1291.1959 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.0804	17.5625	18.1229	15.8000	15.1604	13.0823	12.1227	13.9110	14.0771	16.4055	17.9079	19.4468 (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	14.5794	13.1466	14.5203	14.0124	14.4508	13.9515	14.3960	14.4315	13.9847	14.4916	14.0699	14.5680 (61)
Total heat required for water heating calculated for each month												
Solar input	148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134 (62)
	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										Solar input (sum of months) = Sum (63)m =		0.0000 (63)
	148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134 (64)
Heat gains from water heating, kWh/month										Total per year (kWh/year) = Sum (64)m =		1461.7987 (64)
	48.1564	42.2168	43.8025	38.5264	37.2184	32.4870	30.4709	34.4438	34.7004	39.9884	43.2133	46.7491 (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	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	16.8201	14.9395	12.1496	9.1980	6.8756	5.8047	6.2722	8.1528	10.9427	13.8943	16.2167	17.2876 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	175.9629	177.7888	173.1875	163.3919	151.0266	139.4050	131.6410	129.8151	134.4164	144.2121	156.5773	168.1990 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768 (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)												
	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141 (71)
Water heating gains (Table 5)												
	64.7264	62.8226	58.8743	53.5088	50.0247	45.1208	40.9556	46.2955	48.1950	53.7479	60.0184	62.8348 (72)
Total internal gains												
	313.7397	311.7812	300.4417	282.3290	264.1572	246.5608	235.0991	240.4937	249.7844	268.0845	289.0427	304.5516 (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				3.0600	10.6334	0.7200	0.7000	0.7700			11.3647 (74)	
West				3.4100	19.6403	0.7200	0.7000	0.7700			23.3919 (80)	
West				2.1200	19.6403	0.7200	0.7000	0.7700			14.5428 (80)	

Solar gains	49.2993	95.9267	159.1154	237.5155	298.2897	309.0939	292.6960	246.1848	186.5075	113.9073	61.3199	40.6698 (83)
Total gains	363.0390	407.7079	459.5571	519.8445	562.4469	555.6547	527.7950	486.6785	436.2919	381.9918	350.3626	345.2214 (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	19.5062	19.5810	19.6563	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9634	19.8086
alpha	2.3004	2.3054	2.3104	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3309	2.3206
util living area												
	0.9574	0.9429	0.9137	0.8545	0.7607	0.6351	0.5139	0.5609	0.7464	0.8874	0.9429	0.9617 (86)
MIT	18.2064	18.4709	18.9624	19.6287	20.2192	20.6473	20.8480	20.8076	20.4467	19.6861	18.8549	18.1746 (87)
Th 2	19.9085	19.9122	19.9159	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9308	19.9233 (88)
util rest of house												
	0.9515	0.9349	0.9011	0.8320	0.7207	0.5665	0.4147	0.4632	0.6891	0.8653	0.9336	0.9564 (89)
MIT 2	16.1788	16.5627	17.2725	18.2277	19.0423	19.5975	19.8252	19.7886	19.3641	18.3267	17.1332	16.1400 (90)
Living area fraction									fLA = Living area / (4) =			0.3806 (91)
MIT	16.9504	17.2889	17.9156	18.7609	19.4902	19.9970	20.2144	20.1764	19.7761	18.8441	17.7884	16.9143 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8004	17.1389	17.7656	18.6109	19.3402	19.8470	20.0644	20.0264	19.6261	18.6941	17.6384	16.7643 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9265	0.9060	0.8676	0.7975	0.6949	0.5605	0.4280	0.4728	0.6699	0.8317	0.9052	0.9331 (94)
Useful gains	336.3714	369.3975	398.7116	414.5675	390.8200	311.4669	225.9167	230.0964	292.2645	317.6866	317.1564	322.1286 (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												
	929.0289	906.1207	830.8647	704.7937	554.5080	380.8148	251.4406	263.1937	401.0701	587.4493	765.2787	919.5189 (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												
	440.9372	360.6780	321.5219	208.9628	121.7839	0.0000	0.0000	0.0000	0.0000	200.7034	322.6481	444.4584 (98)
Space heating												2421.6937 (98)
Space heating per m ²										(98) / (4) =		39.5702 (99)

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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												2675.9046 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	440.9372	360.6780	321.5219	208.9628	121.7839	0.0000	0.0000	0.0000	0.0000	200.7034	322.6481	444.4584 (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)	487.2234	398.5392	355.2728	230.8982	134.5678	0.0000	0.0000	0.0000	0.0000	221.7717	356.5172	491.1142 (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												
Water heating requirement	148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134 (64)
Efficiency of water heater	89.6721	89.6285	89.5278	89.3100	88.9134	87.3000	87.3000	87.3000	87.3000	89.2515	89.5397	87.3000 (216)
Fuel for water heating, kWh/month	165.5463	145.2995	151.1703	133.6307	129.9246	115.8842	109.0651	122.7620	123.5189	138.7781	149.0465	160.7827 (219)
Water heating fuel used												1645.4090 (219)
Annual totals kWh/year												
Space heating fuel - main system												2675.9046 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)												
mechanical ventilation fans (SFP = 0.2260)												42.5137 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												117.5137 (231)
Electricity for lighting (calculated in Appendix L)												297.0486 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												4735.8759 (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	2675.9046	0.2160	577.9954 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1645.4090	0.2160	355.4083 (264)
Space and water heating			933.4037 (265)
Pumps and fans	117.5137	0.5190	60.9896 (267)
Energy for lighting	297.0486	0.5190	154.1682 (268)
Energy saving/generation technologies			
PV Unit	-521.7700	0.5190	-270.7986 (269)
Total CO2, kg/year			877.7629 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3400 (273)

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

DER		14.3400 ZC1
Total Floor Area	TFA	61.2000
Assumed number of occupants	N	2.0154
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.0379 ZC2
CO2 emissions from cooking, equation (L16)		2.7348 ZC3
Total CO2 emissions		34.1127 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		34.1127 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	61.2000 (1b)	x 2.5200 (2b)	= 154.2240 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.2240 (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) = 0.1297 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3797 (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) =				0.3512 (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	0.4478	0.4390	0.4302	0.3863	0.3775	0.3336	0.3336	0.3249	0.3512	0.3775	0.3951	0.4127 (22b)
	0.6003	0.5964	0.5925	0.5746	0.5713	0.5557	0.5557	0.5528	0.5617	0.5713	0.5781	0.5851 (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)			8.5900	1.3258	11.3883		(27)
140mm Timber Frame	41.7200	8.5900	33.1300	0.1800	5.9634		(29a)
WTS	37.2100	2.1200	35.0900	0.1800	6.3162		(29a)
C2V	17.8000		17.8000	0.1300	2.3140		(30)
Flat Terrace	5.1500		5.1500	0.1300	0.6695		(30)
Total net area of external elements Aum(A, m ²)			101.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.7714		(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)							13.3603 (36)
Total fabric heat loss						(33) + (36) =	42.1317 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	30.5494	30.3513	30.1571	29.2449	29.0742	28.2797	28.2797
Heat transfer coeff	72.6811	72.4829	72.2887	71.3765	71.2058	70.4113	70.4113
Average = Sum(39)m / 12 =						70.2642	70.2642
	70.7174	71.2058	71.5511	71.9121	71.3757	71.3757	71.3757
HLP	1.1876	1.1844	1.1812	1.1663	1.1635	1.1505	1.1505
HLP (average)						1.1481	1.1481
Days in month	31	28	31	30	31	30	31
						30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0154 (42)
Average daily hot water use (litres/day)												82.0646 (43)
Daily hot water use	90.2711	86.9885	83.7059	80.4233	77.1407	73.8582	73.8582	77.1407	80.4233	83.7059	86.9885	90.2711 (44)
Energy conte	133.8694	117.0830	120.8192	105.3331	101.0696	87.2154	80.8179	92.7397	93.8473	109.3700	119.3859	129.6454 (45)
Energy content (annual)										Total = Sum(45)m =		1291.1959 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	20.0804	17.5625	18.1229	15.8000	15.1604	13.0823	12.1227	13.9110	14.0771	16.4055	17.9079	19.4468 (46)
Total storage loss												
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)

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Combi 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)
Total heat required for water heating calculated for each month	46.0011	40.0385	42.6556	39.6608	39.3101	36.4232	37.6373	39.3101	39.6608	42.6556	42.8984	46.0011 (61)
Solar input	179.8705	157.1216	163.4748	144.9939	140.3797	123.6386	118.4552	132.0498	133.5081	152.0256	162.2843	175.6465 (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	179.8705	157.1216	163.4748	144.9939	140.3797	123.6386	118.4552	132.0498	133.5081	152.0256	162.2843	175.6465 (64)
	56.0119	48.9397	50.8363	44.9385	43.4332	38.1049	36.2813	40.6635	41.1194	47.0294	50.4204	54.6074 (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	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.8201	14.9395	12.1496	9.1980	6.8756	5.8047	6.2722	8.1528	10.9427	13.8943	16.2167	17.2876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.9629	177.7888	173.1875	163.3919	151.0266	139.4050	131.6410	129.8151	134.4164	144.2121	156.5773	168.1990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	(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)	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	(71)
Water heating gains (Table 5)	75.2848	72.8270	68.3283	62.4145	58.3779	52.9235	48.7652	54.6552	57.1103	63.2116	70.0284	73.3970	(72)
Total internal gains	324.2981	321.7856	309.8957	291.2347	272.5104	254.3635	242.9086	248.8534	258.6997	277.5482	299.0527	315.1138	(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					3.0600	10.6334	0.6300		0.7000			0.7700			9.9441 (74)
West					5.5300	19.6403	0.6300		0.7000			0.7700			33.1928 (80)
Solar gains	43.1369	83.9359	139.2260	207.8261	261.0035	270.4572	256.1090	215.4117	163.1941	99.6689	53.6549			35.5861 (83)	
Total gains	367.4350	405.7215	449.1217	499.0608	533.5139	524.8206	499.0176	464.2651	421.8938	377.2171	352.7075			350.6999 (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	58.4747	58.6345	58.7920	59.5434	59.6861	60.3596	60.3596	60.4860	60.0984	59.6861	59.3981	59.1000	
alpha	4.8983	4.9090	4.9195	4.9696	4.9791	5.0240	5.0240	5.0324	5.0066	4.9791	4.9599	4.9400	
util living area	0.9980	0.9963	0.9911	0.9713	0.9086	0.7647	0.5981	0.6577	0.8878	0.9826	0.9962	0.9984	(86)
MIT	19.7089	19.8368	20.0798	20.4202	20.7284	20.9243	20.9826	20.9725	20.8262	20.4338	20.0164	19.6893	(87)
Th 2	19.9299	19.9325	19.9351	19.9471	19.9493	19.9598	19.9598	19.9617	19.9558	19.9493	19.9448	19.9400	(88)
util rest of house	0.9973	0.9951	0.9878	0.9596	0.8701	0.6744	0.4681	0.5277	0.8257	0.9735	0.9947	0.9979	(89)
MIT 2	18.2120	18.4005	18.7560	19.2532	19.6731	19.9071	19.9531	19.9499	19.8081	19.2800	18.6720	18.1905	(90)
Living area fraction	18.7817	18.9471	19.2598	19.6973	20.0747	20.2942	20.3449	20.3391	20.1955	19.7191	19.1836	18.7609	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7817	18.9471	19.2598	19.6973	20.0747	20.2942	20.3449	20.3391	20.1955	19.7191	19.1836	18.7609	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9962	0.9934	0.9849	0.9560	0.8755	0.7059	0.5181	0.5775	0.8423	0.9708	0.9930	0.9970	(94)
Ext temp.	366.0522	403.0437	442.3429	477.1268	467.0774	370.4475	258.5282	268.1160	355.3791	366.2106	350.2501	349.6487	(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	1052.5450	1018.1757	922.3877	770.6751	596.3287	400.9383	263.6835	276.7751	431.0598	649.3334	864.5981	1047.1043	(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	510.7507	413.3687	357.1533	211.3547	96.1629	0.0000	0.0000	0.0000	0.0000	210.6434	370.3306	518.9070	(98)
												2688.6713	(98)
												43.9325	(99)

8c. Space cooling requirement

Not applicable

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

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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													2878.6631 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	510.7507	413.3687	357.1533	211.3547	96.1629	0.0000	0.0000	0.0000	0.0000	210.6434	370.3306	518.9070	(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)	546.8423	442.5789	382.3911	226.2899	102.9581	0.0000	0.0000	0.0000	0.0000	225.5283	396.4995	555.5750	(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	179.8705	157.1216	163.4748	144.9939	140.3797	123.6386	118.4552	132.0498	133.5081	152.0256	162.2843	175.6465	(64)
Efficiency of water heater (217)m	87.5326	87.3733	86.9654	85.9988	84.1208	80.3000	80.3000	80.3000	80.3000	85.8724	87.0634	87.6132	(217)
Fuel for water heating, kWh/month	205.4899	179.8279	187.9768	168.6000	166.8787	153.9709	147.5158	164.4456	166.2617	177.0366	186.3979	200.4796	(219)
Water heating fuel used												2104.8812	(219)
Annual totals kWh/year													
Space heating fuel - main system												2878.6631	(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)												297.0486	(232)
Total delivered energy for all uses												5355.5928	(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	2878.6631	0.2160	621.7912 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2104.8812	0.2160	454.6543 (264)
Space and water heating			1076.4456 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	297.0486	0.5190	154.1682 (268)
Total CO2, kg/m2/year			1269.5388 (272)
Emissions per m2 for space and water heating			17.5890 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5191 (272b)
Emissions per m2 for pumps and fans			0.6360 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.5890 * 1.00) + 2.5191 + 0.6360, rounded to 2 d.p.			20.7400 (273)

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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	61.2000 (1b)	x 2.5200 (2b)	= 154.2240 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.2240 (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) = 0.1297 (8)
Measured/design AP50					Yes
Infiltration rate					4.8200
Number of sides sheltered					0.3707 (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) =				0.3429 (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	0.4372	0.4286	0.4200	0.3772	0.3686	0.3257	0.3257	0.3172	0.3429	0.3686	0.3857	0.4029 (22b)
	0.5956	0.5918	0.5882	0.5711	0.5679	0.5531	0.5531	0.5503	0.5588	0.5679	0.5744	0.5812 (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)			6.4700	1.3258	8.5777		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	41.7200	8.5900	33.1300	0.1900	6.2947	9.0000	298.1700 (29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200 (29a)
C2V	17.8000		17.8000	0.1400	2.4920	9.0000	160.2000 (30)
Flat Terrace	5.1500		5.1500	0.2000	1.0300	9.0000	46.3500 (30)
Total net area of external elements Aum(A, m ²)			101.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8041		(33)
Party Floor			61.2000			30.0000	1836.0000 (32d)
Party Ceilings			38.2500			20.0000	765.0000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4836.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.0265 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3268 (36)
Total fabric heat loss						(33) + (36) =	47.1308 (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	30.3104	30.1215	29.9364	29.0669	28.9043	28.1470	28.1470	28.0068	28.4387	28.9043	29.2334	29.5774 (38)
Heat transfer coeff	77.4412	77.2524	77.0673	76.1978	76.0351	75.2778	75.2778	75.1376	75.5695	76.0351	76.3642	76.7083 (39)
Average = Sum(39)m / 12 =												76.1970 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2654	1.2623	1.2593	1.2451	1.2424	1.2300	1.2300	1.2277	1.2348	1.2424	1.2478	1.2534 (40)
HLP (average)												1.2450 (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												2.0154 (42)
Average daily hot water use (litres/day)												82.0646 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	90.2711	86.9885	83.7059	80.4233	77.1407	73.8582	73.8582	77.1407	80.4233	83.7059	86.9885	90.2711 (44)
Energy conte	133.8694	117.0830	120.8192	105.3331	101.0696	87.2154	80.8179	92.7397	93.8473	109.3700	119.3859	129.6454 (45)
Energy content (annual)										Total = Sum(45)m =		1291.1959 (45)
Distribution loss (46)m = 0.15 x (45)m												

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Calculation Type: New Build (As Built)

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Water 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 (46)
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	28.4472	24.8801	25.6741	22.3833	21.4773	18.5333	17.1738	19.7072	19.9426	23.2411	25.3695	27.5496 (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	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.8201	14.9395	12.1496	9.1980	6.8756	5.8047	6.2722	8.1528	10.9427	13.8943	16.2167	17.2876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.9629	177.7888	173.1875	163.3919	151.0266	139.4050	131.6410	129.8151	134.4164	144.2121	156.5773	168.1990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	(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)	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	(71)
Water heating gains (Table 5)	38.2355	37.0240	34.5082	31.0879	28.8673	25.7407	23.0831	26.4882	27.6980	31.2381	35.2354	37.0291	(72)
Total internal gains	284.2488	282.9826	273.0756	256.9081	239.9998	224.1806	214.2266	217.6863	226.2874	242.5747	261.2597	275.7459	(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	3.0600	10.6334	0.7200	0.7000	0.7700	11.3647 (74)
West	3.4100	19.6403	0.7200	0.7000	0.7700	23.3919 (80)
West	2.1200	19.6403	0.7200	0.7000	0.7700	14.5428 (80)

Solar gains	49.2993	95.9267	159.1154	237.5155	298.2897	309.0939	292.6960	246.1848	186.5075	113.9073	61.3199	40.6698	(83)
Total gains	333.5482	378.9094	432.1910	494.4236	538.2896	533.2745	506.9225	463.8711	412.7949	356.4820	322.5796	316.4157	(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	17.3480	17.3904	17.4322	17.6311	17.6688	17.8466	17.8466	17.8799	17.7777	17.6688	17.5927	17.5138	
alpha	2.1565	2.1594	2.1621	2.1754	2.1779	2.1898	2.1898	2.1920	2.1852	2.1779	2.1728	2.1676	
util living area	0.9595	0.9453	0.9173	0.8613	0.7727	0.6510	0.5333	0.5815	0.7618	0.8948	0.9464	0.9636	(86)
MIT	17.8910	18.1677	18.6912	19.4027	20.0615	20.5641	20.8029	20.7540	20.3310	19.4796	18.5682	17.8429	(87)
Th 2	19.8681	19.8705	19.8729	19.8841	19.8862	19.8961	19.8961	19.8979	19.8923	19.8862	19.8820	19.8775	(88)
util rest of house	0.9539	0.9378	0.9052	0.8396	0.7335	0.5825	0.4312	0.4821	0.7059	0.8739	0.9378	0.9586	(89)
MIT 2	17.0331	17.3081	17.8256	18.5261	19.1527	19.6110	19.8005	19.7709	19.4193	18.6147	17.7157	16.9916	(90)
Living area fraction									fLA = Living area / (4) =			0.3806	(91)
MIT	17.3596	17.6352	18.1550	18.8597	19.4986	19.9737	20.1819	20.1450	19.7663	18.9438	18.0401	17.3156	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3596	17.6352	18.1550	18.8597	19.4986	19.9737	20.1819	20.1450	19.7663	18.9438	18.0401	17.3156	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9368	0.9176	0.8816	0.8155	0.7178	0.5879	0.4598	0.5065	0.6985	0.8514	0.9184	0.9427	(94)
Ext temp.	312.4734	347.6943	381.0202	403.1783	386.3813	313.4896	233.0808	234.9722	288.3451	303.4953	296.2477	298.2771	(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	1011.3487	983.8234	898.2210	758.9056	592.9665	404.5233	269.6407	281.3932	428.1988	634.4243	835.4334	1006.0723	(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	519.9633	427.4787	384.7974	256.1236	153.6994	0.0000	0.0000	0.0000	0.0000	246.2112	388.2137	526.5996	(98)
Space heating per m2												2903.0869	(98)
												(98) / (4) =	47.4361 (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	707.6117	557.0560	571.0458	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6823	0.7457	0.7133	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	482.7971	415.3773	407.3140	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	699.0127	666.7693	617.7870	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	155.6752	187.0357	156.5919	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												499.3028 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	38.9188	46.7589	39.1480	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												124.8257 (107)
Space cooling per m2												2.0396 (108)
Energy for space heating												47.4361 (99)
Energy for space cooling												2.0396 (108)
Total												49.4757 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.5 (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	61.2000 (1b)	x 2.5200 (2b)	= 154.2240 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.2240 (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) = 0.1297 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3797 (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) =				0.3512 (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	0.4478	0.4390	0.4302	0.3863	0.3775	0.3336	0.3336	0.3249	0.3512	0.3775	0.3951	0.4127 (22b)
	0.6003	0.5964	0.5925	0.5746	0.5713	0.5557	0.5557	0.5528	0.5617	0.5713	0.5781	0.5851 (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)			8.5900	1.3258	11.3883		(27)
140mm Timber Frame	41.7200	8.5900	33.1300	0.1800	5.9634		(29a)
WTS	37.2100	2.1200	35.0900	0.1800	6.3162		(29a)
C2V	17.8000		17.8000	0.1300	2.3140		(30)
Flat Terrace	5.1500		5.1500	0.1300	0.6695		(30)
Total net area of external elements Aum(A, m ²)			101.8800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.7714		(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)							13.3603 (36)
Total fabric heat loss						(33) + (36) =	42.1317 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	30.5494	30.3513	30.1571	29.2449	29.0742	28.2797	28.2797
Heat transfer coeff	72.6811	72.4829	72.2887	71.3765	71.2058	70.4113	70.4113
Average = Sum(39)m / 12 =						70.2642	70.2642
	70.7174	71.2058	71.5511	71.9121	71.3757	71.9121	71.3757
HLP	1.1876	1.1844	1.1812	1.1663	1.1635	1.1505	1.1505
HLP (average)						1.1481	1.1481
Days in month	31	28	31	30	31	30	31
						30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0154 (42)
Average daily hot water use (litres/day)												82.0646 (43)
Daily hot water use	90.2711	86.9885	83.7059	80.4233	77.1407	73.8582	73.8582	77.1407	80.4233	83.7059	86.9885	90.2711 (44)
Energy conte	133.8694	117.0830	120.8192	105.3331	101.0696	87.2154	80.8179	92.7397	93.8473	109.3700	119.3859	129.6454 (45)
Energy content (annual)										Total = Sum(45)m =		1291.1959 (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 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
	28.4472	24.8801	25.6741	22.3833	21.4773	18.5333	17.1738	19.7072	19.9426	23.2411	25.3695	27.5496 (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	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676	100.7676 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.8201	14.9395	12.1496	9.1980	6.8756	5.8047	6.2722	8.1528	10.9427	13.8943	16.2167	17.2876 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.9629	177.7888	173.1875	163.3919	151.0266	139.4050	131.6410	129.8151	134.4164	144.2121	156.5773	168.1990 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768	33.0768 (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)	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141 (71)
Water heating gains (Table 5)	38.2355	37.0240	34.5082	31.0879	28.8673	25.7407	23.0831	26.4882	27.6980	31.2381	35.2354	37.0291 (72)
Total internal gains	284.2488	282.9826	273.0756	256.9081	239.9998	224.1806	214.2266	217.6863	226.2874	242.5747	261.2597	275.7459 (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					3.0600	10.6334		0.6300	0.7000	0.7700	9.9441 (74)	
West					5.5300	19.6403		0.6300	0.7000	0.7700	33.1928 (80)	

Solar gains	43.1369	83.9359	139.2260	207.8261	261.0035	270.4572	256.1090	215.4117	163.1941	99.6689	53.6549	35.5861 (83)
Total gains	327.3858	366.9185	412.3016	464.7341	501.0034	494.6378	470.3355	433.0980	389.4815	342.2436	314.9146	311.3320 (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	58.4747	58.6345	58.7920	59.5434	59.6861	60.3596	60.3596	60.4860	60.0984	59.6861	59.3981	59.1000
alpha	4.8983	4.9090	4.9195	4.9696	4.9791	5.0240	5.0240	5.0324	5.0066	4.9791	4.9599	4.9400
util living area	0.9988	0.9977	0.9938	0.9782	0.9252	0.7929	0.6287	0.6939	0.9120	0.9884	0.9977	0.9991 (86)
MIT	19.6484	19.7786	20.0258	20.3742	20.6958	20.9103	20.9783	20.9652	20.7965	20.3842	19.9596	19.6296 (87)
Th 2	19.9299	19.9325	19.9351	19.9471	19.9493	19.9598	19.9598	19.9617	19.9558	19.9493	19.9448	19.9400 (88)
util rest of house	0.9984	0.9968	0.9914	0.9690	0.8915	0.7052	0.4949	0.5618	0.8580	0.9820	0.9968	0.9988 (89)
MIT 2	18.6967	18.8286	19.0769	19.4297	19.7338	19.9159	19.9540	19.9511	19.8332	19.4447	19.0193	18.6859 (90)
Living area fraction									fLA = Living area / (4) =			0.3806 (91)
MIT	19.0589	19.1901	19.4380	19.7891	20.0999	20.2944	20.3438	20.3370	20.1998	19.8022	19.3771	19.0451 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0589	19.1901	19.4380	19.7891	20.0999	20.2944	20.3438	20.3370	20.1998	19.8022	19.3771	19.0451 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	326.7055	365.4627	408.1691	449.5207	449.4709	364.1066	257.0880	265.4081	340.0242	335.6662	313.6654	310.8307 (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	1072.6912	1035.7915	935.2707	777.2250	598.1238	400.9474	263.6065	276.6303	431.3612	655.2513	878.4427	1067.5388 (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	555.0133	450.4609	392.1636	235.9471	110.5978	0.0000	0.0000	0.0000	0.0000	237.7713	406.6396	562.9909 (98)
Space heating												2951.5845 (98)
Space heating per m2												48.2285 (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	661.8667	521.0440	534.0081	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8289	0.8993	0.8678	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	548.6051	468.5983	463.4320	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	653.8528	624.0053	581.8185	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	75.7783	115.6228	88.0795	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												279.4807 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	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	18.9446	28.9057	22.0199	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											69.8702 (107)
Space cooling per m2											1.1417 (108)
Energy for space heating											48.2285 (99)
Energy for space cooling											1.1417 (108)
Total											49.3702 (109)
Target Fabric Energy Efficiency (TFEE)											56.8 (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	61.2000 (1b)	x 2.5200 (2b)	= 154.2240 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.2240 (5)

2. Ventilation rate

	main		secondary		other		total		m3 per hour			
	heating		heating									
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							0 * 10 =	0.0000	(7a)			
Number of passive vents							0 * 10 =	0.0000	(7b)			
Number of flueless gas fires							0 * 40 =	0.0000	(7c)			
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000	(8)			
Pressure test							Yes					
Measured/design AP50							4.8200					
Infiltration rate							0.2410	(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) =	0.2229	(21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
Mechanical extract ventilation - decentralised	0.2452	0.2285	0.2285	0.2174	0.2174	0.2062	0.2062	0.1951	0.1951	0.2118	0.2062	0.2174 (22b)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	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)			6.4700	1.3258	8.5777		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	41.7200	8.5900	33.1300	0.1900	6.2947	9.0000	298.1700 (29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200 (29a)
C2V	17.8000		17.8000	0.1400	2.4920	9.0000	160.2000 (30)
Flat Terrace	5.1500		5.1500	0.2000	1.0300	9.0000	46.3500 (30)
Total net area of external elements Aum(A, m ²)			101.8800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.8041		(33)
Party Floor			61.2000			30.0000	1836.0000 (32d)
Party Ceilings			38.2500			30.0000	1147.5000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5218.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.2765 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3268 (36)
Total fabric heat loss							(33) + (36) = 47.1308 (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	25.4470	25.4470	25.4470	25.4470	25.4470	25.4470	25.4470	25.4470	25.4470	25.4470	25.4470	25.4470 (38)
Heat transfer coeff	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778 (39)
Average = Sum(39)m / 12 =												72.5778 (39)
HLP	1.1859	1.1859	1.1859	1.1859	1.1859	1.1859	1.1859	1.1859	1.1859	1.1859	1.1859	1.1859 (40)
HLP (average)												1.1859 (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												2.0154 (42)
Average daily hot water use (litres/day)												82.0646 (43)
Daily hot water use	Jan 90.2711	Feb 86.9885	Mar 83.7059	Apr 80.4233	May 77.1407	Jun 73.8582	Jul 73.8582	Aug 77.1407	Sep 80.4233	Oct 83.7059	Nov 86.9885	Dec 90.2711 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	133.8694	117.0830	120.8192	105.3331	101.0696	87.2154	80.8179	92.7397	93.8473	109.3700	119.3859	129.6454 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0804	17.5625	18.1229	15.8000	15.1604	13.0823	12.1227	13.9110	14.0771	16.4055	17.9079	1291.1959 (45)
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	14.5794	13.1466	14.5203	14.0124	14.4508	13.9515	14.3960	14.4315	13.9847	14.4916	14.0699	14.5680 (61)
Total heat required for water heating calculated for each month	148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134 (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	148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134 (64)
RHI water heating demand	48.1564	42.2168	43.8025	38.5264	37.2184	32.4870	30.4709	34.4438	34.7004	39.9884	43.2133	46.7491 (65)
Heat gains from water heating, kWh/month												
	48.1564	42.2168	43.8025	38.5264	37.2184	32.4870	30.4709	34.4438	34.7004	39.9884	43.2133	46.7491 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.0503	37.3487	30.3740	22.9951	17.1891	14.5118	15.6805	20.3821	27.3568	34.7357	40.5417	43.2190 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	262.6312	265.3565	258.4888	243.8684	225.4128	208.0671	196.4791	193.7539	200.6215	215.2419	233.6975	251.0432 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075 (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)	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141 (71)
Water heating gains (Table 5)	64.7264	62.8226	58.8743	53.5088	50.0247	45.1208	40.9556	46.2955	48.1950	53.7479	60.0184	62.8348 (72)
Total internal gains	461.8224	457.9423	440.1516	412.7869	385.0411	360.1142	345.5297	352.8459	368.5878	396.1400	426.6721	449.5115 (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				3.0600	13.4839	0.7200	0.7000	0.7700	14.4112 (74)			
West				3.4100	25.1925	0.7200	0.7000	0.7700	30.0048 (80)			
West				2.1200	25.1925	0.7200	0.7000	0.7700	18.6540 (80)			
Solar gains	63.0700	104.6811	175.2077	262.7090	311.2431	353.1476	283.9630	215.2183	132.5020	78.2527	49.2109 (83)	
Total gains	524.8923	562.6233	615.3593	675.4959	696.2842	713.2618	668.3478	636.8089	583.8061	528.6419	504.9248	498.7224 (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	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744
alpha	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316
util living area	0.9032	0.8847	0.8385	0.7559	0.6295	0.4580	0.3366	0.3511	0.5731	0.7698	0.8699	0.9105 (86)
MIT	18.9204	19.1099	19.5574	20.0907	20.5732	20.8627	20.9541	20.9498	20.7500	20.2219	19.4983	18.8802 (87)
Th 2	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313 (88)
util rest of house	0.8906	0.8698	0.8170	0.7222	0.5749	0.3783	0.2355	0.2464	0.4956	0.7290	0.8500	0.8986 (89)
MIT 2	17.2138	17.4830	18.1161	18.8533	19.4894	19.8259	19.9103	19.9081	19.7147	19.0509	18.0444	17.1580 (90)
Living area fraction	17.8633	18.1021	18.6646	19.3242	19.9019	20.2204	20.3075	20.3045	20.1087	19.4965	18.5977	17.8134 (92)
MIT	17.8633	18.1021	18.6646	19.3242	19.9019	20.2204	20.3075	20.3045	20.1087	19.4965	18.5977	17.8134 (92)
Temperature adjustment	17.7133	17.9521	18.5146	19.1742	19.7519	20.0704	20.1575	20.1545	19.9587	19.3465	18.4477	-0.1500
adjusted MIT	17.7133	17.9521	18.5146	19.1742	19.7519	20.0704	20.1575	20.1545	19.9587	19.3465	18.4477	17.6634 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	449.4457	469.4659	481.3861	469.3297	393.3457	277.6266	172.2770	171.4661	290.5937	371.5518	411.5805	431.3723 (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	893.6696	874.7182	792.1595	665.8407	482.7785	302.6805	178.3609	178.1431	338.1186	533.1957	729.2406	882.7921 (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	330.5026	272.3295	231.2154	141.4879	66.5380	0.0000	0.0000	0.0000	0.0000	120.2631	228.7153	335.8563 (98)
Space heating												1726.9082 (98)
RHI space heating demand												1727 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	61.2000 (1b)	x 2.5200 (2b)	= 154.2240 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.2240 (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					4.8200
Infiltration rate					0.2410 (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) =				0.2229 (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	0.2842	0.2787	0.2731	0.2452	0.2396	0.2118	0.2118	0.2062	0.2229	0.2396	0.2508	0.2619 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5342	0.5287	0.5231	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5008	0.5119 (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)			6.4700	1.3258	8.5777		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	41.7200	8.5900	33.1300	0.1900	6.2947	9.0000	298.1700 (29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200 (29a)
C2V	17.8000		17.8000	0.1400	2.4920	9.0000	160.2000 (30)
Flat Terrace	5.1500		5.1500	0.2000	1.0300	9.0000	46.3500 (30)
Total net area of external elements Aum(A, m2)			101.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8041		(33)
Party Floor			61.2000			30.0000	1836.0000 (32d)
Party Ceilings			38.2500			30.0000	1147.5000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			5218.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.2765 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3268 (36)
Total fabric heat loss						(33) + (36) =	47.1308 (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	27.1890	26.9054	26.6218	25.4470	25.4470	25.4470	25.4470	25.4470	25.4470	25.4470	25.4872	26.0545 (38)
Heat transfer coeff	74.3199	74.0362	73.7526	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.6180	73.1853 (39)
Average = Sum(39)m / 12 =												72.9964 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2144	1.2097	1.2051	1.1859	1.1859	1.1859	1.1859	1.1859	1.1859	1.1859	1.1866	1.1958 (40)
HLP (average)												1.1928 (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												2.0154 (42)
Average daily hot water use (litres/day)												82.0646 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.2711	86.9885	83.7059	80.4233	77.1407	73.8582	73.8582	77.1407	80.4233	83.7059	86.9885	90.2711 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	133.8694	117.0830	120.8192	105.3331	101.0696	87.2154	80.8179	92.7397	93.8473	109.3700	119.3859	129.6454 (45)
Energy content (annual)	Total = Sum (45)m =											1291.1959 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.0804	17.5625	18.1229	15.8000	15.1604	13.0823	12.1227	13.9110	14.0771	16.4055	17.9079	19.4468 (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	14.5794	13.1466	14.5203	14.0124	14.4508	13.9515	14.3960	14.4315	13.9847	14.4916	14.0699	14.5680 (61)
Total heat required for water heating calculated for each month												
	148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134 (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	148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134 (64)
	Total per year (kWh/year) = Sum (64)m =											1461.7987 (64)
Heat gains from water heating, kWh/month												
	48.1564	42.2168	43.8025	38.5264	37.2184	32.4870	30.4709	34.4438	34.7004	39.9884	43.2133	46.7491 (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	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.0503	37.3487	30.3740	22.9951	17.1891	14.5118	15.6805	20.3821	27.3568	34.7357	40.5417	43.2190 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	262.6312	265.3565	258.4888	243.8684	225.4128	208.0671	196.4791	193.7539	200.6215	215.2419	233.6975	251.0432 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075 (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)	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141 (71)
Water heating gains (Table 5)	64.7264	62.8226	58.8743	53.5088	50.0247	45.1208	40.9556	46.2955	48.1950	53.7479	60.0184	62.8348 (72)
Total internal gains	461.8224	457.9423	440.1516	412.7869	385.0411	360.1142	345.5297	352.8459	368.5878	396.1400	426.6721	449.5115 (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				3.0600	10.6334	0.7200	0.7000		0.7700		11.3647 (74)	
West				3.4100	19.6403	0.7200	0.7000		0.7700		23.3919 (80)	
West				2.1200	19.6403	0.7200	0.7000		0.7700		14.5428 (80)	
Solar gains	49.2993	95.9267	159.1154	237.5155	298.2897	309.0939	292.6960	246.1848	186.5075	113.9073	61.3199	40.6698 (83)
Total gains	511.1217	553.8690	599.2670	650.3024	683.3308	669.2082	638.2256	599.0307	555.0953	510.0473	487.9920	490.1813 (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	19.5062	19.5810	19.6563	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9634	19.8086
alpha	2.3004	2.3054	2.3104	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3309	2.3206
util living area	0.9193	0.9006	0.8648	0.7963	0.6955	0.5653	0.4451	0.4837	0.6631	0.8217	0.8958	0.9253 (86)
MIT	18.5887	18.8292	19.2709	19.8615	20.3690	20.7277	20.8886	20.8606	20.5806	19.9392	19.1923	18.5573 (87)
Th 2	19.9085	19.9122	19.9159	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9308	19.9233 (88)
util rest of house	0.9090	0.8881	0.8471	0.7687	0.6516	0.4971	0.3533	0.3919	0.6007	0.7914	0.8807	0.9158 (89)
MIT 2	16.7245	17.0705	17.7022	18.5395	19.2271	19.6803	19.8560	19.8317	19.5157	18.6652	17.6082	16.6875 (90)
Living area fraction	fLA = Living area / (4) =											0.3806 (91)
MIT	17.4339	17.7398	18.2992	19.0426	19.6617	20.0789	20.2490	20.2232	19.9210	19.1500	18.2111	17.3991 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2839	17.5898	18.1492	18.8926	19.5117	19.9289	20.0990	20.0732	19.7710	19.0000	18.0611	17.2491 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8757	0.8530	0.8111	0.7370	0.6323	0.4970	0.3686	0.4049	0.5902	0.7594	0.8462	0.8838 (94)
Useful gains	447.5996	472.4320	486.0501	479.2738	432.0530	332.5806	235.2467	242.5731	327.6122	387.3500	412.9164	433.2032 (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	964.9651	939.5061	859.1570	725.2379	566.9540	386.7575	253.9477	266.5957	411.5882	609.6565	795.9701	955.0005 (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	384.9199	313.8738	277.5915	177.0941	100.3663	0.0000	0.0000	0.0000	0.0000	165.3961	275.7986	388.2172 (98)
Space heating												2083.2576 (98)
Space heating per m ²												(98) / (4) = 34.0402 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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													2301.9421 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	384.9199	313.8738	277.5915	177.0941	100.3663	0.0000	0.0000	0.0000	0.0000	165.3961	275.7986	388.2172	(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)	425.3259	346.8219	306.7310	195.6841	110.9020	0.0000	0.0000	0.0000	0.0000	182.7581	304.7499	428.9693	(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													
Water heating requirement	148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134	(64)
Efficiency of water heater													87.3000 (216)
(217)m	89.5860	89.5376	89.4257	89.1839	88.7591	87.3000	87.3000	87.3000	87.3000	89.1015	89.4310	89.6103	(217)
Fuel for water heating, kWh/month													
	165.7053	145.4469	151.3430	133.8196	130.1506	115.8842	109.0651	122.7620	123.5189	139.0118	149.2276	160.9339	(219)
Water heating fuel used													1646.8691 (219)
Annual totals kWh/year													
Space heating fuel - main system													2301.9421 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)													42.5137 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													117.5137 (231)
Electricity for lighting (calculated in Appendix L)													297.0486 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4363.3734 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2301.9421	3.4800	80.1076 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1646.8691	3.4800	57.3110 (247)
Mechanical ventilation fans	42.5137	13.1900	5.6076 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	297.0486	13.1900	39.1807 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			312.0994 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	1.2343	(257)
SAP value	82.7816	
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	2301.9421	0.2160	497.2195 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1646.8691	0.2160	355.7237 (264)
Space and water heating			852.9432 (265)
Pumps and fans	117.5137	0.5190	60.9896 (267)
Energy for lighting	297.0486	0.5190	154.1682 (268)
Energy saving/generation technologies			
PV Unit	-521.7700	0.5190	-270.7986 (269)
Total kg/year			797.3024 (272)
CO2 emissions per m2			13.0300 (273)
EI value			89.9399
EI rating			90 (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	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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	$3.48 / 0.8865 = 3.925$, stars = 4
Water heating environmental impact	$0.216 / 0.8865 = 0.2436$, 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	61.2000 (1b)	x 2.5200 (2b)	= 154.2240 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.2240 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
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							0 * 10 =	0.0000	(7a)			
Number of passive vents							0 * 10 =	0.0000	(7b)			
Number of flueless gas fires							0 * 40 =	0.0000	(7c)			
							Air changes per hour					
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000	(8)			
Pressure test							Yes					
Measured/design AP50							4.8200					
Infiltration rate							0.2410		(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) =	0.2229	(21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000
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
Adj infilt rate												
	0.2452	0.2285	0.2285	0.2174	0.2174	0.2062	0.2062	0.1951	0.1951	0.2118	0.2062	0.2174
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

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)			6.4700	1.3258	8.5777		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	41.7200	8.5900	33.1300	0.1900	6.2947	9.0000	298.1700 (29a)
WTS	37.2100	2.1200	35.0900	0.1500	5.2635	18.0000	631.6200 (29a)
C2V	17.8000		17.8000	0.1400	2.4920	9.0000	160.2000 (30)
Flat Terrace	5.1500		5.1500	0.2000	1.0300	9.0000	46.3500 (30)
Total net area of external elements Aum(A, m ²)			101.8800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8041		(33)
Party Floor			61.2000			30.0000	1836.0000 (32d)
Party Ceilings			38.2500			30.0000	1147.5000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5218.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.2765 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3268 (36)
Total fabric heat loss						(33) + (36) =	47.1308 (37)

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

(38)m	Jan 25.4470	Feb 25.4470	Mar 25.4470	Apr 25.4470	May 25.4470	Jun 25.4470	Jul 25.4470	Aug 25.4470	Sep 25.4470	Oct 25.4470	Nov 25.4470	Dec 25.4470 (38)
Heat transfer coeff	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778	72.5778 (39)
Average = Sum(39)m / 12 =												72.5778 (39)
HLP	Jan 1.1859	Feb 1.1859	Mar 1.1859	Apr 1.1859	May 1.1859	Jun 1.1859	Jul 1.1859	Aug 1.1859	Sep 1.1859	Oct 1.1859	Nov 1.1859	Dec 1.1859 (40)
HLP (average)												1.1859 (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												2.0154 (42)
Average daily hot water use (litres/day)												82.0646 (43)
Daily hot water use	Jan 90.2711	Feb 86.9885	Mar 83.7059	Apr 80.4233	May 77.1407	Jun 73.8582	Jul 73.8582	Aug 77.1407	Sep 80.4233	Oct 83.7059	Nov 86.9885	Dec 90.2711 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	133.8694	117.0830	120.8192	105.3331	101.0696	87.2154	80.8179	92.7397	93.8473	109.3700	119.3859	129.6454 (45)
Energy content (annual)										Total = Sum (45)m =		1291.1959 (45)
Distribution loss (46)m = 0.15 x (45)m												
20.0804	17.5625	18.1229	15.8000	15.1604	13.0823	12.1227	13.9110	14.0771	16.4055	17.9079	19.4468 (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	14.5794	13.1466	14.5203	14.0124	14.4508	13.9515	14.3960	14.4315	13.9847	14.4916	14.0699	14.5680 (61)
Total heat required for water heating calculated for each month												
148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134 (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 (63)	
										Solar input (sum of months) = Sum (63)m =		0.0000 (63)
Output from w/h												
148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134 (64)	
Heat gains from water heating, kWh/month										Total per year (kWh/year) = Sum (64)m =		1461.7987 (64)
48.1564	42.2168	43.8025	38.5264	37.2184	32.4870	30.4709	34.4438	34.7004	39.9884	43.2133	46.7491 (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	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211	120.9211 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
42.0503	37.3487	30.3740	22.9951	17.1891	14.5118	15.6805	20.3821	27.3568	34.7357	40.5417	43.2190 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
262.6312	265.3565	258.4888	243.8684	225.4128	208.0671	196.4791	193.7539	200.6215	215.2419	233.6975	251.0432 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075	49.1075 (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 (70)	
Losses e.g. evaporation (negative values) (Table 5)												
-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141	-80.6141 (71)	
Water heating gains (Table 5)												
64.7264	62.8226	58.8743	53.5088	50.0247	45.1208	40.9556	46.2955	48.1950	53.7479	60.0184	62.8348 (72)	
Total internal gains												
461.8224	457.9423	440.1516	412.7869	385.0411	360.1142	345.5297	352.8459	368.5878	396.1400	426.6721	449.5115 (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				3.0600	13.4839	0.7200	0.7000	0.7700	14.4112 (74)			
West				3.4100	25.1925	0.7200	0.7000	0.7700	30.0048 (80)			
West				2.1200	25.1925	0.7200	0.7000	0.7700	18.6540 (80)			
Solar gains	63.0700	104.6811	175.2077	262.7090	311.2431	353.1476	322.8181	283.9630	215.2183	132.5020	78.2527	49.2109 (83)
Total gains	524.8923	562.6233	615.3593	675.4959	696.2842	713.2618	668.3478	636.8089	583.8061	528.6419	504.9248	498.7224 (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	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	19.9744	
alpha	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	2.3316	
util living area												
0.9032	0.8847	0.8385	0.7559	0.6295	0.4580	0.3366	0.3511	0.5731	0.7698	0.8699	0.9105 (86)	
MIT	18.9204	19.1099	19.5574	20.0907	20.5732	20.8627	20.9541	20.9498	20.7500	20.2219	19.4983	18.8802 (87)
Th 2	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313	19.9313 (88)
util rest of house												
0.8906	0.8698	0.8170	0.7222	0.5749	0.3783	0.2355	0.2464	0.4956	0.7290	0.8500	0.8986 (89)	
MIT 2	17.2138	17.4830	18.1161	18.8533	19.4894	19.8259	19.9103	19.9081	19.7147	19.0509	18.0444	17.1580 (90)
Living area fraction									fLA = Living area / (4) =			0.3806 (91)
MIT	17.8633	18.1021	18.6646	19.3242	19.9019	20.2204	20.3075	20.3045	20.1087	19.4965	18.5977	17.8134 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7133	17.9521	18.5146	19.1742	19.7519	20.0704	20.1575	20.1545	19.9587	19.3465	18.4477	17.6634 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8563	0.8344	0.7823	0.6948	0.5649	0.3892	0.2578	0.2693	0.4978	0.7028	0.8151	0.8650 (94)
Useful gains	449.4457	469.4659	481.3861	469.3297	393.3457	277.6266	172.2770	171.4661	290.5937	371.5518	411.5805	431.3723 (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												
893.6696	874.7182	792.1595	665.8407	482.7785	302.6805	178.3609	178.1431	338.1186	533.1957	729.2406	882.7921 (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												
330.5026	272.3295	231.2154	141.4879	66.5380	0.0000	0.0000	0.0000	0.0000	0.0000	120.2631	228.7153	335.8563 (98)
Space heating												1726.9082 (98)
Space heating per m2										(98) / (4) =		28.2175 (99)

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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 1908.1858 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	330.5026	272.3295	231.2154	141.4879	66.5380	0.0000	0.0000	0.0000	0.0000	120.2631	228.7153	335.8563	(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)	365.1963	300.9166	255.4866	156.3402	73.5227	0.0000	0.0000	0.0000	0.0000	132.8874	252.7240	371.1120	(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													
Water heating requirement	148.4488	130.2297	135.3395	119.3455	115.5204	101.1669	95.2139	107.1712	107.8320	123.8616	133.4558	144.2134	(64)
Efficiency of water heater (217)m	89.4834	89.4394	89.2915	89.0072	88.4429	87.3000	87.3000	87.3000	87.3000	88.8476	89.2939	87.3000	(216)
Fuel for water heating, kWh/month	165.8955	145.6066	151.5704	134.0853	130.6158	115.8842	109.0651	122.7620	123.5189	139.4089	149.4567	161.1064	(219)
Water heating fuel used												1648.9759	(219)
Annual totals kWh/year													
Space heating fuel - main system												1908.1858	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
 (MEVDecentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)
 mechanical ventilation fans (SFP = 0.2260) 42.5137 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 117.5137 (231)
 Electricity for lighting (calculated in Appendix L) 297.0486 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 Total delivered energy for all uses 3971.7239 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1908.1858	10.2300	195.2074	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1648.9759	10.2300	168.6902	(247)
Mechanical ventilation fans	42.5137	36.7200	15.6110	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	297.0486	36.7200	109.0762	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	36.7200	0.0000	(252)
Total energy cost			619.1249	(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	1908.1858	0.2160	412.1681	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1648.9759	0.2160	356.1788	(264)
Space and water heating			768.3469	(265)
Pumps and fans	117.5137	0.5190	60.9896	(267)
Energy for lighting	297.0486	0.5190	154.1682	(268)
Energy saving/generation technologies				
PV Unit	-521.7700	0.5190	-270.7986	(269)
Total kg/year			712.7061	(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	1908.1858	1.2200	2327.9867	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1648.9759	1.2200	2011.7506	(264)
Space and water heating			4339.7372	(265)
Pumps and fans	117.5137	3.0700	360.7670	(267)
Energy for lighting	297.0486	3.0700	911.9391	(268)
Energy saving/generation technologies				
PV Unit	-521.7700	3.0700	-1601.8339	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/year
Primary energy kWh/m²/year

4010.6094 (272)
65.5328 (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: SAP change Cost change CO2 change
(none)

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 524 TEST (01 Aug 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	£152	£152	£0
Mains gas	£467	£467	£0
Space heating	£341	£341	£0
Water heating	£169	£169	£0
Lighting	£109	£109	£0
Total cost of fuels	£619	£619	£0
Total cost of uses	£619	£619	£0
Delivered energy	65 kWh/m ²	65 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m ²	12 kg/m ²	12 kg/m ²	0 kg/m ²
Primary energy	66 kWh/m ²	66 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	South
Overshading	Average or unknown
Thermal mass parameter	85.3 (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	203.58 (P1)
Transmission heat loss coefficient	47.13 (37)
Summer heat loss coefficient	250.71 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	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	3.0600	87.1704	0.7200	0.7000	0.9000	108.8946
West	3.4100	125.2818	0.7200	0.7000	0.9000	174.4046
West	2.1200	125.2818	0.7200	0.7000	0.9000	108.4275
total:						391.7266

	Jun	Jul	Aug	
Solar gains	424	392	337	(P3)
Internal gains	357	343	350	
Total summer gains	781	734	687	(P5)

Summer gain/loss ratio	3.11	2.93	2.74	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 85.3)	1.40	1.40	1.40	
Threshold temperature	19.92	21.63	21.44	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight