

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-218			Issued on Date	08/09/2023
Assessment Reference	As Built	Prop Type Ref	1F Flat Det		
Property	54, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	83 B	DER	13.90	TER	20.30
Environmental	90 B	% DER<TER	31.52		
CO ₂ Emissions (t/year)	0.69	DFEE	47.95	TFEE	54.89
General Requirements Compliance	Pass	% DFEE<TFEE	12.64		
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) 20.30 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.90 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.16 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.26 (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: 4.79 (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 East: 2.32 m², No overhang
Windows facing South: 1.43 m², No overhang
Windows facing West: 5.52 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.63 W/m²K
Photovoltaic array 519.90 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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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)			
									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							4.7900					
Infiltration rate							0.2395		(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) =	0.2215	(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
	0.2825	0.2769	0.2714	0.2437	0.2382	0.2105	0.2105	0.2049	0.2215	0.2382	0.2492	0.2603
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000
Effective ac	0.5325	0.5269	0.5214	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5103

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)			7.1500	1.3258	9.4792			(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106			(27)
DTC			2.1200	0.6300	1.3356			(26)
140mm Timber Frame	60.3000	9.2700	51.0300	0.1900	9.6957	9.0000	459.2700	(29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000	(29a)
C2V	11.2800		11.2800	0.1400	1.5792	9.0000	101.5200	(30)
Flat Terrace	5.1400		5.1400	0.2000	1.0280	9.0000	46.2600	(30)
Total net area of external elements Aum(A, m2)			98.7900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.9208			(33)
Party Floor			60.9800			30.0000	1829.4000	(32d)
Party Ceilings			44.5600			30.0000	1336.8000	(32b)
Timber			122.1200			9.0000	1099.0800	(32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5231.4300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.7893	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.3123	(36)
Total fabric heat loss						(33) + (36) =	47.2331	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
Daily hot water use	Jan 90.1104	Feb 86.8337	Mar 83.5569	Apr 80.2802	May 77.0035	Jun 73.7267	Jul 73.7267	Aug 77.0035	Sep 80.2802	Oct 83.5569	Nov 86.8337	Dec 90.1104 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)										Total = Sum(45)m =		1288.8982 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	19.4122 (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	14.5782	13.1455	14.5192	14.0115	14.4500	13.9509	14.3953	14.4308	13.9839	14.4906	14.0687	14.5668 (61)
Total heat required for water heating calculated for each month												
	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (64)
								Total per year (kWh/year) =	Sum(64)m =			1459.4896 (64)
Heat gains from water heating, kWh/month												
	48.0769	42.1472	43.7307	38.4638	37.1583	32.4352	30.4230	34.3888	34.6447	39.9235	43.1424	46.6721 (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	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	16.4850	14.6418	11.9075	9.0148	6.7386	5.6890	6.1472	7.9904	10.7247	13.6174	15.8935	16.9431 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460 (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)												
	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681 (71)
Water heating gains (Table 5)												
	64.6195	62.7191	58.7778	53.4220	49.9440	45.0489	40.8911	46.2215	48.1176	53.6606	59.9199	62.7313 (72)
Total internal gains	312.6541	310.7307	299.4683	281.4547	263.3741	245.8442	234.4049	239.7582	248.9756	267.1763	288.0383	303.4844 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
East				2.3200	19.6403		0.7200		0.7000	0.7700	15.9147 (76)	
South				1.4300	46.7521		0.7200		0.7000	0.7700	23.3507 (78)	
West				3.4000	19.6403		0.7200		0.7000	0.7700	23.3233 (80)	
West				2.1200	19.6403		0.7200		0.7000	0.7700	14.5428 (80)	
Solar gains	77.1315	143.4491	221.9745	307.7474	367.0543	372.2276	355.7573	311.6407	252.3966	166.0846	94.7369	64.4039 (83)
Total gains	389.7856	454.1798	521.4428	589.2021	630.4284	618.0718	590.1622	551.3989	501.3722	433.2609	382.7752	367.8883 (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	19.5754	19.6498	19.7247	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193
alpha	2.3050	2.3100	2.3150	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3251
util living area	0.9513	0.9304	0.8927	0.8239	0.7237	0.5955	0.4732	0.5144	0.6998	0.8618	0.9328	0.9567 (86)
MIT	18.2856	18.5964	19.1107	19.7603	20.3095	20.6956	20.8734	20.8414	20.5266	19.7960	18.9429	18.2438 (87)
Th 2	19.9061	19.9098	19.9135	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9208 (88)
util rest of house												
	0.9446	0.9209	0.8778	0.7984	0.6810	0.5266	0.3777	0.4194	0.6387	0.8360	0.9221	0.9508 (89)
MIT 2	16.2904	16.7394	17.4781	18.4022	19.1516	19.6445	19.8414	19.8131	19.4527	18.4725	17.2556	16.2374 (90)
Living area fraction									fLA = Living area / (4) =			0.3819 (91)
MIT	17.0524	17.4487	18.1016	18.9209	19.5938	20.0460	20.2355	20.2058	19.8629	18.9780	17.9000	17.0037 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9024	17.2987	17.9516	18.7709	19.4438	19.8960	20.0855	20.0558	19.7129	18.8280	17.7500	16.8537 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9179	0.8896	0.8427	0.7651	0.6590	0.5243	0.3927	0.4317	0.6248	0.8025	0.8918	0.9260 (94)
Useful gains	357.7931	404.0480	439.4210	450.8262	415.4822	324.0798	231.7383	238.0207	313.2469	347.6978	341.3540	340.6538 (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												
	935.5359	916.9299	843.6732	716.5147	562.1127	384.4258	253.0105	265.3700	407.4305	597.2593	773.0680	925.1258 (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												
	429.8406	344.6567	300.7636	191.2958	109.0931	0.0000	0.0000	0.0000	0.0000	185.6737	310.8341	434.8472 (98)
Space heating												2307.0048 (98)
Space heating per m2										(98) / (4) =		37.8322 (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													2549.1766 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	429.8406	344.6567	300.7636	191.2958	109.0931	0.0000	0.0000	0.0000	0.0000	185.6737	310.8341	434.8472	(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)	474.9620	380.8361	332.3355	211.3765	120.5449	0.0000	0.0000	0.0000	0.0000	205.1644	343.4631	480.4941	(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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814	(64)
Efficiency of water heater (217)m	89.6574	89.6004	89.4832	89.2444	88.8267	87.3000	87.3000	87.3000	87.3000	89.1930	89.5155	89.6823	(217)
Fuel for water heating, kWh/month	165.3063	145.1112	151.0042	133.5178	129.8480	115.7057	108.8997	122.5721	123.3267	138.6499	148.8482	160.5461	(219)
Water heating fuel used												1643.3359	(219)
Annual totals kWh/year													
Space heating fuel - main system												2549.1766	(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)													42.3609 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													117.3609 (231)
Electricity for lighting (calculated in Appendix L)													291.1297 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4601.0031 (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	2549.1766	0.2160	550.6221 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1643.3359	0.2160	354.9606 (264)
Space and water heating			905.5827 (265)
Pumps and fans	117.3609	0.5190	60.9103 (267)
Energy for lighting	291.1297	0.5190	151.0963 (268)
Energy saving/generation technologies			
PV Unit	-519.9000	0.5190	-269.8281 (269)
Total CO2, kg/year			847.7612 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9000 (273)

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

DER			13.9000 ZC1
Total Floor Area		TFA	60.9800
Assumed number of occupants		N	2.0092
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			17.0458 ZC2
CO2 emissions from cooking, equation (L16)			2.7422 ZC3
Total CO2 emissions			33.6880 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			33.6880 ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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) = 0.1301 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3801 (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) =	0.3516 (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	0.4483	0.4395	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3516	0.3780	0.3956	0.4132 (22b)
	0.6005	0.5966	0.5928	0.5748	0.5714	0.5558	0.5558	0.5529	0.5618	0.5714	0.5782	0.5854 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200			(26)				
TER Opening Type (Uw = 1.40)			9.2700	1.3258	12.2898			(27)				
140mm Timber Frame	60.3000	9.2700	51.0300	0.1800	9.1854			(29a)				
WTS	22.0700	2.1200	19.9500	0.1800	3.5910			(29a)				
C2V	11.2800		11.2800	0.1300	1.4664			(30)				
Flat Terrace	5.1400		5.1400	0.1300	0.6682			(30)				
Total net area of external elements Aum(A, m2)			98.7900					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.3208			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								13.7333 (36)				
Total fabric heat loss						(33) + (36) =		43.0541 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	30.4521	30.2542	30.0602	29.1491	28.9786	28.1850	28.1850	28.0380	28.4907	28.9786	29.3235	29.6840 (38)
Heat transfer coeff	73.5062	73.3083	73.1143	72.2031	72.0327	71.2391	71.2391	71.0921	71.5447	72.0327	72.3775	72.7381 (39)
Average = Sum(39)m / 12 =												72.2023 (39)
HLP	1.2054	1.2022	1.1990	1.1840	1.1813	1.1682	1.1682	1.1658	1.1732	1.1813	1.1869	1.1928 (40)
HLP (average)												1.1840 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
Daily hot water use	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)										Total = Sum(45)m =		1288.8982 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	19.4122 (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												

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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	45.9193	39.9673	42.5797	39.5902	39.2401	36.3584	37.5703	39.2401	39.5902	42.5797	42.8221	45.9193 (61)
Solar input	179.5505	156.8420	163.1839	144.7359	140.1299	123.4186	118.2444	131.8148	133.2705	151.7551	161.9955	175.3339 (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	179.5505	156.8420	163.1839	144.7359	140.1299	123.4186	118.2444	131.8148	133.2705	151.7551	161.9955	175.3339 (64)
	55.9122	48.8527	50.7458	44.8585	43.3559	38.0371	36.2167	40.5911	41.0463	46.9457	50.3307	54.5102 (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	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.4850	14.6418	11.9075	9.0148	6.7386	5.6890	6.1472	7.9904	10.7247	13.6174	15.8935	16.9431	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	(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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	(71)
Water heating gains (Table 5)	75.1508	72.6974	68.2067	62.3035	58.2740	52.8293	48.6784	54.5579	57.0087	63.0991	69.9037	73.2664	(72)
Total internal gains	323.1854	320.7091	308.8972	290.3362	271.7041	253.6246	242.1922	248.0947	257.8667	276.6148	298.0221	314.0195	(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
East			2.3200		19.6403		0.6300		0.7000		0.7700		13.9254 (76)
South			1.4300		46.7521		0.6300		0.7000		0.7700		20.4319 (78)
West			5.5200		19.6403		0.6300		0.7000		0.7700		33.1328 (80)
Solar gains	67.4901	125.5180	194.2277	269.2790	321.1725	325.6991	311.2876	272.6856	220.8470	145.3241	82.8948	56.3534	(83)
Total gains	390.6755	446.2270	503.1249	559.6152	592.8766	579.3238	553.4799	520.7803	478.7137	421.9389	380.9169	370.3729	(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	57.6104	57.7659	57.9192	58.6501	58.7889	59.4438	59.4438	59.5667	59.1898	58.7889	58.5088	58.2188	
alpha	4.8407	4.8511	4.8613	4.9100	4.9193	4.9629	4.9629	4.9711	4.9460	4.9193	4.9006	4.8813	
util living area	0.9973	0.9944	0.9858	0.9565	0.8775	0.7198	0.5512	0.6033	0.8443	0.9732	0.9947	0.9979	(86)
MIT	19.7224	19.8763	20.1388	20.4821	20.7708	20.9403	20.9872	20.9803	20.8628	20.4816	20.0405	19.6974	(87)
Th 2	19.9157	19.9183	19.9208	19.9328	19.9350	19.9455	19.9455	19.9474	19.9415	19.9350	19.9305	19.9257	(88)
util rest of house	0.9964	0.9925	0.9807	0.9400	0.8313	0.6268	0.4268	0.4774	0.7708	0.9598	0.9925	0.9972	(89)
MIT 2	18.2216	18.4478	18.8301	19.3262	19.7100	19.9057	19.9408	19.9394	19.8315	19.3352	18.6968	18.1922	(90)
Living area fraction	18.7948	18.9934	19.3299	19.7677	20.1151	20.3008	20.3404	20.3369	20.2254	19.7730	19.2100	18.7671	(91)
MIT	18.7948	18.9934	19.3299	19.7677	20.1151	20.3008	20.3404	20.3369	20.2254	19.7730	19.2100	18.7671	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7948	18.9934	19.3299	19.7677	20.1151	20.3008	20.3404	20.3369	20.2254	19.7730	19.2100	18.7671	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9951	0.9903	0.9770	0.9369	0.8401	0.6602	0.4747	0.5258	0.7931	0.9572	0.9904	0.9961	(94)
Ext temp.	388.7458	441.8777	491.5354	524.2966	498.0965	382.4436	262.7454	273.8261	379.6570	403.8797	377.2629	368.9457	(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	1065.4594	1033.1637	938.0501	784.6816	606.1647	406.1204	266.4650	279.8844	438.2408	660.7574	876.4934	1059.5808	(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	503.4750	397.3442	332.2069	187.4772	80.4027	0.0000	0.0000	0.0000	0.0000	191.1170	359.4460	513.8325	(98)
Space heating per m2												2565.3015	(98)
												42.0679	(99)

8c. Space cooling requirement

Not applicable

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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												2746.5755 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	503.4750	397.3442	332.2069	187.4772	80.4027	0.0000	0.0000	0.0000	0.0000	191.1170	359.4460	513.8325 (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)	539.0524	425.4221	355.6819	200.7251	86.0843	0.0000	0.0000	0.0000	0.0000	204.6221	384.8458	550.1418 (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	179.5505	156.8420	163.1839	144.7359	140.1299	123.4186	118.2444	131.8148	133.2705	151.7551	161.9955	175.3339 (64)
Efficiency of water heater (217)m	87.5067	87.2927	86.8036	85.7036	83.7098	80.3000	80.3000	80.3000	80.3000	85.6329	87.0004	80.3000 (216)
Fuel for water heating, kWh/month	205.1849	179.6737	187.9922	168.8796	167.3996	153.6969	147.2533	164.1529	165.9658	177.2159	186.2009	200.1600 (219)
Water heating fuel used												2103.7756 (219)
Annual totals kWh/year												
Space heating fuel - main system												2746.5755 (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)												291.1297 (232)
Total delivered energy for all uses												5216.4808 (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	2746.5755	0.2160	593.2603 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2103.7756	0.2160	454.4155 (264)
Space and water heating			1047.6758 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	291.1297	0.5190	151.0963 (268)
Total CO2, kg/m2/year			1237.6972 (272)
Emissions per m2 for space and water heating			17.1806 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4778 (272b)
Emissions per m2 for pumps and fans			0.6383 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.1806 * 1.00) + 2.4778 + 0.6383, rounded to 2 d.p.			20.3000 (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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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) = 0.1301 (8)
Measured/design AP50					Yes
Infiltration rate					4.7900
Number of sides sheltered					0.3696 (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) =				0.3419 (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	0.4360	0.4274	0.4189	0.3761	0.3676	0.3248	0.3248	0.3163	0.3419	0.3676	0.3847	0.4018 (22b)
Effective ac	0.5950	0.5913	0.5877	0.5707	0.5676	0.5528	0.5528	0.5500	0.5585	0.5676	0.5740	0.5807 (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)			7.1500	1.3258	9.4792		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	60.3000	9.2700	51.0300	0.1900	9.6957	9.0000	459.2700 (29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000 (29a)
C2V	11.2800		11.2800	0.1400	1.5792	9.0000	101.5200 (30)
Flat Terrace	5.1400		5.1400	0.2000	1.0280	9.0000	46.2600 (30)
Total net area of external elements Aum(A, m ²)			98.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.9208		(33)
Party Floor			60.9800			30.0000	1829.4000 (32d)
Party Ceilings			44.5600			20.0000	891.2000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4785.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.4820 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.3123 (36)
Total fabric heat loss						(33) + (36) =	47.2331 (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	30.1745	29.9873	29.8039	28.9424	28.7812	28.0308	28.0308	27.8919	28.3199	28.7812	29.1073	29.4482 (38)
Heat transfer coeff	77.4076	77.2204	77.0370	76.1755	76.0143	75.2639	75.2639	75.1250	75.5530	76.0143	76.3404	76.6813 (39)
Average = Sum(39)m / 12 =												76.1747 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2694	1.2663	1.2633	1.2492	1.2465	1.2342	1.2342	1.2320	1.2390	1.2465	1.2519	1.2575 (40)
HLP (average)												1.2492 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)										Total = Sum(45)m =		1288.8982 (45)
Distribution loss (46)m = 0.15 x (45)m												

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	28.3966	24.8359	25.6284	22.3435	21.4391	18.5003	17.1432	19.6721	19.9071	23.1998	25.3244	27.5006 (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	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.4850	14.6418	11.9075	9.0148	6.7386	5.6890	6.1472	7.9904	10.7247	13.6174	15.8935	16.9431	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	(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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	(71)
Water heating gains (Table 5)	38.1675	36.9581	34.4468	31.0326	28.8160	25.6948	23.0420	26.4410	27.6487	31.1825	35.1727	36.9632	(72)
Total internal gains	283.2021	281.9698	272.1372	256.0653	239.2460	223.4901	213.5558	216.9778	225.5067	241.6982	260.2911	274.7163	(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	
East	2.3200	19.6403	0.7200	0.7000	0.7700	15.9147	(76)
South	1.4300	46.7521	0.7200	0.7000	0.7700	23.3507	(78)
West	3.4000	19.6403	0.7200	0.7000	0.7700	23.3233	(80)
West	2.1200	19.6403	0.7200	0.7000	0.7700	14.5428	(80)

Solar gains	77.1315	143.4491	221.9745	307.7474	367.0543	372.2276	355.7573	311.6407	252.3966	166.0846	94.7369	64.4039	(83)
Total gains	360.3336	425.4189	494.1117	563.8127	606.3003	595.7177	569.3131	528.6185	477.9033	407.7828	355.0280	339.1202	(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	17.1740	17.2156	17.2566	17.4518	17.4888	17.6631	17.6631	17.6958	17.5956	17.4888	17.4141	17.3367	
alpha	2.1449	2.1477	2.1504	2.1635	2.1659	2.1775	2.1775	2.1797	2.1730	2.1659	2.1609	2.1558	
util living area	0.9526	0.9319	0.8955	0.8300	0.7349	0.6101	0.4906	0.5328	0.7141	0.8684	0.9355	0.9579	(86)
MIT	17.9497	18.2763	18.8278	19.5310	20.1529	20.6149	20.8312	20.7917	20.4148	19.5856	18.6423	17.8908	(87)
Th 2	19.8649	19.8673	19.8697	19.8809	19.8829	19.8927	19.8927	19.8945	19.8889	19.8829	19.8787	19.8743	(88)
util rest of house	0.9462	0.9228	0.8810	0.8052	0.6928	0.5409	0.3920	0.4357	0.6540	0.8438	0.9253	0.9522	(89)
MIT 2	17.0894	17.4125	17.9549	18.6426	19.2285	19.6448	19.8125	19.7895	19.4833	18.7112	17.7861	17.0374	(90)
Living area fraction									fLA = Living area / (4) =			0.3819	(91)
MIT	17.4180	17.7424	18.2883	18.9819	19.5815	20.0153	20.2016	20.1723	19.8390	19.0451	18.1131	17.3633	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4180	17.7424	18.2883	18.9819	19.5815	20.0153	20.2016	20.1723	19.8390	19.0451	18.1131	17.3633	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9273	0.9003	0.8556	0.7816	0.6800	0.5492	0.4214	0.4620	0.6510	0.8209	0.9040	0.9347	(94)
Ext temp.	334.1344	383.0144	422.7728	440.6872	412.3119	327.1782	239.9007	244.2166	311.0945	334.7527	320.9587	316.9653	(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)
Heat loss rate W	1015.4287	991.6976	908.1324	767.9919	599.1101	407.5778	271.0685	283.3911	433.6004	641.9506	840.7457	1009.3825	(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	506.8830	409.0351	361.1075	235.6594	138.9778	0.0000	0.0000	0.0000	0.0000	228.5553	374.2467	515.1584	(98)
Space heating												2769.6233	(98)
Space heating per m2												45.4186	(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	707.4810	556.9531	570.9499	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7145	0.7757	0.7490	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	505.4913	432.0233	427.6338	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	771.6524	739.3423	693.0676	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	191.6360	228.6453	197.4827	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			617.7640 (104)
Intermittency factor (Table 10b)												1.0000 (105)
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	47.9090	57.1613	49.3707	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												154.4410 (107)
Energy for space heating												2.5327 (108)
Energy for space cooling												45.4186 (99)
Total												2.5327 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.9512 (109)
												48.0 (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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1301 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3801 (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) =				0.3516 (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	0.4483	0.4395	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3516	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5714	0.5558	0.5558	0.5529	0.5618	0.5714	0.5782	0.5854 (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)			9.2700	1.3258	12.2898		(27)
140mm Timber Frame	60.3000	9.2700	51.0300	0.1800	9.1854		(29a)
WTS	22.0700	2.1200	19.9500	0.1800	3.5910		(29a)
C2V	11.2800		11.2800	0.1300	1.4664		(30)
Flat Terrace	5.1400		5.1400	0.1300	0.6682		(30)
Total net area of external elements Aum(A, m ²)			98.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.3208		(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)							13.7333 (36)
Total fabric heat loss						(33) + (36) =	43.0541 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	30.4521	30.2542	30.0602	29.1491	28.9786	28.1850	28.1850
Heat transfer coeff	73.5062	73.3083	73.1143	72.2031	72.0327	71.2391	71.2391
Average = Sum(39)m / 12 =							
HLP	1.2054	1.2022	1.1990	1.1840	1.1813	1.1682	1.1682
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
Daily hot water use	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)
Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)												1288.8982 (45)
Distribution loss (46)m = 0.15 x (45)m												
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												

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)
	28.3966	24.8359	25.6284	22.3435	21.4391	18.5003	17.1432	19.6721	19.9071	23.1998	25.3244	27.5006 (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	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.4850	14.6418	11.9075	9.0148	6.7386	5.6890	6.1472	7.9904	10.7247	13.6174	15.8935	16.9431	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	(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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	(71)
Water heating gains (Table 5)	38.1675	36.9581	34.4468	31.0326	28.8160	25.6948	23.0420	26.4410	27.6487	31.1825	35.1727	36.9632	(72)
Total internal gains	283.2021	281.9698	272.1372	256.0653	239.2460	223.4901	213.5558	216.9778	225.5067	241.6982	260.2911	274.7163	(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
East			2.3200		19.6403		0.6300		0.7000		0.7700		13.9254 (76)
South			1.4300		46.7521		0.6300		0.7000		0.7700		20.4319 (78)
West			5.5200		19.6403		0.6300		0.7000		0.7700		33.1328 (80)
Solar gains	67.4901	125.5180	194.2277	269.2790	321.1725	325.6991	311.2876	272.6856	220.8470	145.3241	82.8948	56.3534	(83)
Total gains	350.6922	407.4878	466.3649	525.3443	560.4186	549.1893	524.8435	489.6634	446.3537	387.0222	343.1859	331.0697	(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	57.6104	57.7659	57.9192	58.6501	58.7889	59.4438	59.4438	59.5667	59.1898	58.7889	58.5088	58.2188	
alpha	4.8407	4.8511	4.8613	4.9100	4.9193	4.9629	4.9629	4.9711	4.9460	4.9193	4.9006	4.8813	
util living area	0.9983	0.9962	0.9896	0.9655	0.8958	0.7467	0.5777	0.6351	0.8708	0.9809	0.9966	0.9988	(86)
MIT	19.6621	19.8187	20.0862	20.4391	20.7429	20.9296	20.9843	20.9754	20.8390	20.4341	19.9842	19.6379	(87)
Th 2	19.9157	19.9183	19.9208	19.9328	19.9350	19.9455	19.9455	19.9474	19.9415	19.9350	19.9305	19.9257	(88)
util rest of house	0.9978	0.9949	0.9857	0.9518	0.8538	0.6545	0.4491	0.5056	0.8033	0.9709	0.9952	0.9983	(89)
MIT 2	18.6990	18.8571	19.1247	19.4788	19.7593	19.9127	19.9415	19.9404	19.8504	19.4807	19.0323	18.6828	(90)
Living area fraction									fLA = Living area / (4) =			0.3819	(91)
MIT	19.0669	19.2244	19.4919	19.8456	20.1350	20.3011	20.3398	20.3357	20.2280	19.8448	19.3959	19.0476	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0669	19.2244	19.4919	19.8456	20.1350	20.3011	20.3398	20.3357	20.2280	19.8448	19.3959	19.0476	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9971	0.9938	0.9837	0.9504	0.8628	0.6879	0.4988	0.5557	0.8243	0.9698	0.9942	0.9978	(94)
Ext temp.	349.6904	404.9515	458.7730	499.2972	483.5250	377.7863	261.8020	272.0985	367.9198	375.3224	341.2020	330.3539	(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	1085.4566	1050.0956	949.8927	790.3053	607.5962	406.1389	266.4166	279.7944	438.4254	665.9296	889.9435	1079.9833	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	547.4101	433.5369	365.3931	209.5259	92.3089	0.0000	0.0000	0.0000	0.0000	216.2118	395.0939	557.7243	(98)
Space heating												2817.2048	(98)
Space heating per m2										(98) / (4) =		46.1988	(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	669.6472	527.1691	540.3000	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8595	0.9214	0.8981	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	575.5874	485.7295	485.2458	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	717.2685	687.3647	647.5356	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	102.0103	150.0166	120.7436	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												372.7706	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	25.5026	37.5042	30.1859	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.1926 (107)
Space cooling per m2												1.5282 (108)
Energy for space heating												46.1988 (99)
Energy for space cooling												1.5282 (108)
Total												47.7271 (109)
Target Fabric Energy Efficiency (TFEE)												54.9 (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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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					4.7900
Infiltration rate					0.2395 (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) =				0.2215 (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	0.2437	0.2271	0.2271	0.2160	0.2160	0.2049	0.2049	0.1938	0.1938	0.2105	0.2049	0.2160 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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)			7.1500	1.3258	9.4792		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	60.3000	9.2700	51.0300	0.1900	9.6957	9.0000	459.2700 (29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000 (29a)
C2V	11.2800		11.2800	0.1400	1.5792	9.0000	101.5200 (30)
Flat Terrace	5.1400		5.1400	0.2000	1.0280	9.0000	46.2600 (30)
Total net area of external elements Aum(A, m ²)			98.7900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.9208	(33)
Party Floor			60.9800			30.0000	1829.4000 (32d)
Party Ceilings			44.5600			30.0000	1336.8000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	5231.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		85.7893 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		18.3123 (36)
Total fabric heat loss	(33) + (36) =	47.2331 (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	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555 (38)
Heat transfer coeff	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886 (39)
Average = Sum(39)m / 12 =												72.5886 (39)
HLP	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904 (40)
HLP (average)												1.1904 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	1288.8982 (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	14.5782	13.1455	14.5192	14.0115	14.4500	13.9509	14.3953	14.4308	13.9839	14.4906	14.0687	14.5668 (61)
Total heat required for water heating calculated for each month	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (64)
RHI water heating demand	48.0769	42.1472	43.7307	38.4638	37.1583	32.4352	30.4230	34.3888	34.6447	39.9235	43.1424	46.6721 (65)
Heat gains from water heating, kWh/month												1459 (64)
												1459 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	41.2124	36.6045	29.7688	22.5369	16.8466	14.2226	15.3680	19.9759	26.8117	34.0436	39.7339	42.3578 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.8083	264.5251	257.6790	243.1044	224.7066	207.4152	195.8635	193.1468	199.9929	214.5675	232.9653	250.2567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644 (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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681 (71)
Water heating gains (Table 5)	64.6195	62.7191	58.7778	53.4220	49.9440	45.0489	40.8911	46.2215	48.1176	53.6606	59.9199	62.7313 (72)
Total internal gains	459.8887	456.0971	438.4741	411.3117	383.7456	358.9352	344.3711	351.5927	367.1707	394.5201	424.8676	447.5943 (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			
East				2.3200	25.1925	0.7200	0.7000	0.7700	20.4138 (76)			
South				1.4300	56.7559	0.7200	0.7000	0.7700	28.3472 (78)			
West				3.4000	25.1925	0.7200	0.7000	0.7700	29.9168 (80)			
West				2.1200	25.1925	0.7200	0.7000	0.7700	18.6540 (80)			
Solar gains	97.3318	154.1636	240.4973	335.3017	378.1119	420.4380	387.6584	354.3880	286.6276	190.1607	119.1881	76.9103 (83)
Total gains	557.2205	610.2607	678.9714	746.6134	761.8575	779.3733	732.0295	705.9807	653.7983	584.6808	544.0557	524.5046 (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	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193
Feb	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346
Mar	0.8929	0.8684	0.8132	0.7233	0.5961	0.4271	0.3106	0.3208	0.5308	0.7379	0.8536	0.9025 (86)
MIT	18.9969	19.2136	19.6730	20.1844	20.6235	20.8823	20.9616	20.9588	20.7895	20.3000	19.5795	18.9434 (87)
Th 2	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277 (88)
util rest of house	0.8792	0.8519	0.7896	0.6876	0.5411	0.3504	0.2158	0.2234	0.4546	0.6945	0.8320	0.8897 (89)
MIT 2	17.3184	17.6244	18.2697	18.9699	19.5425	19.8388	19.9105	19.9091	19.7488	19.1449	18.1524	17.2442 (90)
Living area fraction	17.9594	18.2314	18.8057	19.4338	19.9554	20.2373	20.3119	20.3100	20.1463	19.5861	18.6974	17.8932 (91)
Temperature adjustment	17.8094	18.0814	18.6557	19.2838	19.8054	20.0873	20.1619	20.1600	19.9963	19.4361	18.5474	-0.1500
adjusted MIT												17.7432 (93)

8. Space heating requirement

Utilisation	0.8443	0.8163	0.7562	0.6635	0.5344	0.3624	0.2372	0.2452	0.4598	0.6717	0.7974	0.8554 (94)
Useful gains	470.4868	498.1534	513.4123	495.3797	407.1053	282.4418	173.6392	173.1267	300.6375	392.7177	433.8145	448.6792 (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	900.7835	884.2283	802.5147	673.8948	486.7331	303.9513	178.7075	178.5705	340.8977	539.7734	736.5880	888.7162 (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	320.1408	259.4423	215.0922	128.5309	59.2431	0.0000	0.0000	0.0000	0.0000	109.4094	217.9970	327.3875 (98)
Space heating												1637.2432 (98)
RHI space heating demand												1637 (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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design AP50					Yes
Infiltration rate					4.7900
Number of sides sheltered					0.2395 (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) =	0.2215 (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	0.2825	0.2769	0.2714	0.2437	0.2382	0.2105	0.2105	0.2049	0.2215	0.2382	0.2492	0.2603 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5325	0.5269	0.5214	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5103 (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)			7.1500	1.3258	9.4792		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	60.3000	9.2700	51.0300	0.1900	9.6957	9.0000	459.2700 (29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000 (29a)
C2V	11.2800		11.2800	0.1400	1.5792	9.0000	101.5200 (30)
Flat Terrace	5.1400		5.1400	0.2000	1.0280	9.0000	46.2600 (30)
Total net area of external elements Aum(A, m ²)			98.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.9208		(33)
Party Floor			60.9800			30.0000	1829.4000 (32d)
Party Ceilings			44.5600			30.0000	1336.8000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5231.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.7893 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.3123 (36)
Total fabric heat loss						(33) + (36) =	47.2331 (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	27.0016	26.7207	26.4399	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.8781 (38)
Heat transfer coeff	74.2347	73.9538	73.6730	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	73.1112 (39)
Average = Sum(39)m / 12 =												72.9734 (39)
HLP	1.2174	1.2128	1.2081	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1989 (40)
HLP (average)												1.1967 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)										Total =	Sum(45)m =	1288.8982 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	19.4122 (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	14.5782	13.1455	14.5192	14.0115	14.4500	13.9509	14.3953	14.4308	13.9839	14.4906	14.0687	14.5668 (61)
Total heat required for water heating calculated for each month	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (64)
Heat gains from water heating, kWh/month	48.0769	42.1472	43.7307	38.4638	37.1583	32.4352	30.4230	34.3888	34.6447	39.9235	43.1424	46.6721 (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	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	41.2124	36.6045	29.7688	22.5369	16.8466	14.2226	15.3680	19.9759	26.8117	34.0436	39.7339	42.3578 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.8083	264.5251	257.6790	243.1044	224.7066	207.4152	195.8635	193.1468	199.9929	214.5675	232.9653	250.2567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644 (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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681 (71)
Water heating gains (Table 5)	64.6195	62.7191	58.7778	53.4220	49.9440	45.0489	40.8911	46.2215	48.1176	53.6606	59.9199	62.7313 (72)
Total internal gains	459.8887	456.0971	438.4741	411.3117	383.7456	358.9352	344.3711	351.5927	367.1707	394.5201	424.8676	447.5943 (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
East			2.3200		19.6403		0.7200		0.7000		0.7700		15.9147 (76)
South			1.4300		46.7521		0.7200		0.7000		0.7700		23.3507 (78)
West			3.4000		19.6403		0.7200		0.7000		0.7700		23.3233 (80)
West			2.1200		19.6403		0.7200		0.7000		0.7700		14.5428 (80)
Solar gains	77.1315	143.4491	221.9745	307.7474	367.0543	372.2276	355.7573	311.6407	252.3966	166.0846	94.7369		64.4039 (83)
Total gains	537.0203	599.5463	660.4485	719.0591	750.7999	731.1628	700.1284	663.2333	619.5673	560.6048	519.6045		511.9981 (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	19.5754	19.6498	19.7247	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	19.8762
alpha	2.3050	2.3100	2.3150	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3251
util living area	0.9121	0.8865	0.8426	0.7665	0.6621	0.5323	0.4134	0.4474	0.6228	0.7958	0.8843	0.9194 (86)
MIT	18.6573	18.9374	19.3959	19.9678	20.4384	20.7622	20.9054	20.9827	20.6372	20.0257	19.2662	18.6173 (87)
Th 2	19.9061	19.9098	19.9135	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9208 (88)
util rest of house	0.9010	0.8726	0.8230	0.7367	0.6168	0.4649	0.3256	0.3593	0.5593	0.7630	0.8679	0.9092 (89)
MIT 2	16.8196	17.2201	17.8720	18.6764	19.3078	19.7115	19.8649	19.8455	19.5742	18.7754	17.7085	16.7705 (90)
Living area fraction	17.5215	17.8760	18.4540	19.1696	19.7396	20.1128	20.2623	20.2416	19.9802	19.2529	18.3035	17.4759 (92)
MIT	17.5215	17.8760	18.4540	19.1696	19.7396	20.1128	20.2623	20.2416	19.9802	19.2529	18.3035	17.4759 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3715	17.7260	18.3040	19.0196	19.5896	19.9628	20.1123	20.0916	19.8302	19.1029	18.1535	17.3259 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8670	0.8367	0.7874	0.7075	0.6011	0.4673	0.3415	0.3735	0.5530	0.7330	0.8330	0.8764 (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	970.3566	948.5318	869.6368	734.5674	572.6962	389.2788	254.9543	267.9712	415.9481	617.2137	802.3546	959.6475 (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	375.5481	300.3009	260.1151	162.5742	90.3329	0.0000	0.0000	0.0000	0.0000	153.4750	266.0633	380.1151 (98)
Space heating												1988.5245 (98)
Space heating per m2												32.6095 (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													2197.2647 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	375.5481	300.3009	260.1151	162.5742	90.3329	0.0000	0.0000	0.0000	0.0000	153.4750	266.0633	380.1151	(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)	414.9702	331.8242	287.4200	179.6400	99.8153	0.0000	0.0000	0.0000	0.0000	169.5856	293.9926	420.0167	(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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814	(64)
Efficiency of water heater (217)m	89.5709	89.5087	89.3799	89.1184	88.6772	87.3000	87.3000	87.3000	87.3000	89.0436	89.4064	89.5977	(217)
Fuel for water heating, kWh/month	165.4659	145.2599	151.1787	133.7066	130.0670	115.7057	108.8997	122.5721	123.3267	138.8825	149.0297	160.6976	(219)
Water heating fuel used												1644.7922	(219)
Annual totals kWh/year													
Space heating fuel - main system												2197.2647	(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)												42.3609	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												117.3609	(231)
Electricity for lighting (calculated in Appendix L)												291.1297	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4250.5474	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2197.2647	3.4800	76.4648	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1644.7922	3.4800	57.2388	(247)
Mechanical ventilation fans	42.3609	13.1900	5.5874	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	291.1297	13.1900	38.4000	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			307.5835	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2190	(257)
SAP value		82.9955	
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	2197.2647	0.2160	474.6092	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1644.7922	0.2160	355.2751	(264)
Space and water heating			829.8843	(265)
Pumps and fans	117.3609	0.5190	60.9103	(267)
Energy for lighting	291.1297	0.5190	151.0963	(268)
Energy saving/generation technologies				
PV Unit	-519.9000	0.5190	-269.8281	(269)
Total kg/year			772.0628	(272)
CO2 emissions per m2			12.6600	(273)
EI value			90.2381	
EI rating			90	(274)
EI band			B	

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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	$3.48 / 0.8863 = 3.927$, stars = 4
Water heating environmental impact	$0.216 / 0.8863 = 0.2437$, 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	60.9800 (1b)	x 2.5200 (2b)	= 153.6696 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6696 (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) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design AP50					Yes
Infiltration rate					4.7900
Number of sides sheltered					0.2395 (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) =	0.2215 (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	0.2437	0.2271	0.2271	0.2160	0.2160	0.2049	0.2049	0.1938	0.1938	0.2105	0.2049	0.2160 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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)			7.1500	1.3258	9.4792		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	60.3000	9.2700	51.0300	0.1900	9.6957	9.0000	459.2700 (29a)
WTS	22.0700	2.1200	19.9500	0.1500	2.9925	18.0000	359.1000 (29a)
C2V	11.2800		11.2800	0.1400	1.5792	9.0000	101.5200 (30)
Flat Terrace	5.1400		5.1400	0.2000	1.0280	9.0000	46.2600 (30)
Total net area of external elements Aum(A, m ²)			98.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.9208		(33)
Party Floor			60.9800			30.0000	1829.4000 (32d)
Party Ceilings			44.5600			30.0000	1336.8000 (32b)
Timber			122.1200			9.0000	1099.0800 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5231.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.7893 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.3123 (36)
Total fabric heat loss						(33) + (36) =	47.2331 (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	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555	25.3555 (38)
Heat transfer coeff	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886	72.5886 (39)
Average = Sum(39)m / 12 =												72.5886 (39)
HLP	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904	1.1904 (40)
HLP (average)												1.1904 (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												2.0092 (42)
Average daily hot water use (litres/day)												81.9186 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1104	86.8337	83.5569	80.2802	77.0035	73.7267	73.7267	77.0035	80.2802	83.5569	86.8337	90.1104 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	133.6312	116.8747	120.6042	105.1457	100.8898	87.0602	80.6741	92.5747	93.6803	109.1754	119.1735	129.4147 (45)
Energy content (annual)										Total =	Sum(45)m =	1288.8982 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0447	17.5312	18.0906	15.7718	15.1335	13.0590	12.1011	13.8862	14.0520	16.3763	17.8760	19.4122 (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	14.5782	13.1455	14.5192	14.0115	14.4500	13.9509	14.3953	14.4308	13.9839	14.4906	14.0687	14.5668 (61)
Total heat required for water heating calculated for each month	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814 (64)
Heat gains from water heating, kWh/month	48.0769	42.1472	43.7307	38.4638	37.1583	32.4352	30.4230	34.3888	34.6447	39.9235	43.1424	46.6721 (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	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522	120.5522 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	41.2124	36.6045	29.7688	22.5369	16.8466	14.2226	15.3680	19.9759	26.8117	34.0436	39.7339	42.3578 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.8083	264.5251	257.6790	243.1044	224.7066	207.4152	195.8635	193.1468	199.9929	214.5675	232.9653	250.2567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644	49.0644 (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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681 (71)
Water heating gains (Table 5)	64.6195	62.7191	58.7778	53.4220	49.9440	45.0489	40.8911	46.2215	48.1176	53.6606	59.9199	62.7313 (72)
Total internal gains	459.8887	456.0971	438.4741	411.3117	383.7456	358.9352	344.3711	351.5927	367.1707	394.5201	424.8676	447.5943 (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	
East				2.3200	25.1925		0.7200		0.7000	0.7700	20.4138 (76)	
South				1.4300	56.7559		0.7200		0.7000	0.7700	28.3472 (78)	
West				3.4000	25.1925		0.7200		0.7000	0.7700	29.9168 (80)	
West				2.1200	25.1925		0.7200		0.7000	0.7700	18.6540 (80)	
Solar gains	97.3318	154.1636	240.4973	335.3017	378.1119	420.4380	387.6584	354.3880	286.6276	190.1607	119.1881	76.9103 (83)
Total gains	557.2205	610.2607	678.9714	746.6134	761.8575	779.3733	732.0295	705.9807	653.7983	584.6808	544.0557	524.5046 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193	20.0193
alpha	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346	2.3346
util living area	0.8929	0.8684	0.8132	0.7233	0.5961	0.4271	0.3106	0.3208	0.5308	0.7379	0.8536	0.9025 (86)
MIT	18.9969	19.2136	19.6730	20.1844	20.6235	20.8823	20.9616	20.9588	20.7895	20.3000	19.5795	18.9434 (87)
Th 2	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277	19.9277 (88)
util rest of house	0.8792	0.8519	0.7896	0.6876	0.5411	0.3504	0.2158	0.2234	0.4546	0.6945	0.8320	0.8897 (89)
MIT 2	17.3184	17.6244	18.2697	18.9699	19.5425	19.8388	19.9105	19.9091	19.7488	19.1449	18.1524	17.2442 (90)
Living area fraction	17.9594	18.2314	18.8057	19.4338	19.9554	20.2373	20.3119	20.3100	20.1463	19.5861	18.6974	17.8932 (92)
MIT	17.9594	18.2314	18.8057	19.4338	19.9554	20.2373	20.3119	20.3100	20.1463	19.5861	18.6974	17.8932 (92)
Temperature adjustment	17.8094	18.0814	18.6557	19.2838	19.8054	20.0873	20.1619	20.1600	19.9963	19.4361	18.5474	-0.1500
adjusted MIT	17.8094	18.0814	18.6557	19.2838	19.8054	20.0873	20.1619	20.1600	19.9963	19.4361	18.5474	17.7432 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8443	0.8163	0.7562	0.6635	0.5344	0.3624	0.2372	0.2452	0.4598	0.6717	0.7974	0.8554 (94)
Ext temp.	470.4868	498.1534	513.4123	495.3797	407.1053	282.4418	173.6392	173.1267	300.6375	392.7177	433.8145	448.6792 (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	900.7835	884.2283	802.5147	673.8948	486.7331	303.9513	178.7075	178.5705	340.8977	539.7734	736.5880	888.7162 (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	320.1408	259.4423	215.0922	128.5309	59.2431	0.0000	0.0000	0.0000	0.0000	109.4094	217.9970	327.3875 (98)
Space heating per m2												1637.2432 (98)
												(98) / (4) = 26.8489 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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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													1809.1085 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	320.1408	259.4423	215.0922	128.5309	59.2431	0.0000	0.0000	0.0000	0.0000	109.4094	217.9970	327.3875	(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)	353.7467	286.6766	237.6709	142.0231	65.4620	0.0000	0.0000	0.0000	0.0000	120.8944	240.8806	361.7542	(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	148.2093	130.0202	135.1234	119.1572	115.3397	101.0111	95.0694	107.0054	107.6642	123.6659	133.2422	143.9814	(64)
Efficiency of water heater (217)m	89.4623	89.4059	89.2379	88.9318	88.3602	87.3000	87.3000	87.3000	87.3000	88.7735	89.2588	89.4979	(217)
Fuel for water heating, kWh/month	165.6668	145.4268	151.4193	133.9872	130.5336	115.7057	108.8997	122.5721	123.3267	139.3051	149.2762	160.8768	(219)
Water heating fuel used												1646.9959	(219)
Annual totals kWh/year													
Space heating fuel - main system													1809.1085 (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)													42.3609 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													117.3609 (231)
Electricity for lighting (calculated in Appendix L)													291.1297 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3864.5950 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1809.1085	10.2300	185.0718 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1646.9959	10.2300	168.4877 (247)
Mechanical ventilation fans	42.3609	36.7200	15.5549 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	291.1297	36.7200	106.9028 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	36.7200	0.0000 (252)
Total energy cost			606.5572 (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	1809.1085	0.2160	390.7674 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1646.9959	0.2160	355.7511 (264)
Space and water heating			746.5185 (265)
Pumps and fans	117.3609	0.5190	60.9103 (267)
Energy for lighting	291.1297	0.5190	151.0963 (268)
Energy saving/generation technologies			
PV Unit	-519.9000	0.5190	-269.8281 (269)
Total kg/year			688.6971 (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	1809.1085	1.2200	2207.1124 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1646.9959	1.2200	2009.3350 (264)
Space and water heating			4216.4473 (265)
Pumps and fans	117.3609	3.0700	360.2978 (267)
Energy for lighting	291.1297	3.0700	893.7683 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-519.9000	3.0700	-1596.0930 (269)
Primary energy kWh/year			3874.4204 (272)
Primary energy kWh/m2/year			63.5359 (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/m²

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	£150	£150	£0
Mains gas	£457	£457	£0
Space heating	£331	£331	£0
Water heating	£168	£168	£0
Lighting	£107	£107	£0
Total cost of fuels	£607	£607	£0
Total cost of uses	£606	£606	£0
Delivered energy	63 kWh/m²	63 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	64 kWh/m²	64 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	85.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	304.27 (P1)
Transmission heat loss coefficient	47.23 (37)
Summer heat loss coefficient	351.50 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)
South	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
East	2.3200	125.2818	0.7200	0.7000	0.9000	118.6565
South	1.4300	118.5567	0.7200	0.7000	0.9000	69.2114
West	3.4000	125.2818	0.7200	0.7000	0.9000	173.8931
West	2.1200	125.2818	0.7200	0.7000	0.9000	108.4275
total:						470.1885

Solar gains	Jun	Jul	Aug	
	504	470	421	(P3)
Internal gains	356	341	349	
Total summer gains	860	812	769	(P5)
Summer gain/loss ratio	2.45	2.31	2.19	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 85.8)	1.40	1.40	1.40	
Threshold temperature	19.25	21.01	20.89	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			