



SAP Report Submission for Building Regulations Compliance

Client: Zoe Lewis Architects

Project: 21, Derby Road
Reading, RG4 5HE

Contact: Nikki Kells
Nikki Kells
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Report Issue Date: 03/01/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	21 Derby Road			Issued on Date	03/01/2023
Assessment Reference	2318N	Prop Type Ref			
Property	21, Derby Road, Reading, RG4 5HE				
SAP Rating	87 B	DER	10.76	TER	18.56
Environmental	88 B	% DER<TER	42.03		
CO ₂ Emissions (t/year)	3.08	DFEE	39.49	TFEE	51.96
General Requirements Compliance	Pass	% DFEE<TFEE	23.99		
Assessor Details	Mrs. Nikki Kells, Nikki Kells, Tel: 020 3723 1613, info@sapsuk.co.uk			Assessor ID	L822-0001
Client	Zoe Lewis Architects, Zoe Lewis Architects				

FULL SAP CALCULATION PRINTOUT

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

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DWELLING AS DESIGNED

Detached House, total floor area 326 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 18.56 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 10.76 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)39.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Air-to-water heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 2.01 kWh/day	
Permitted by DBSCG 2.56	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:	Average
Windows facing North:	16.53 m ² , No overhang
Windows facing East:	7.64 m ² , No overhang
Windows facing South:	36.97 m ² , No overhang
Windows facing West:	2.82 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.10 W/m ² K
Roof U-value	0.11 W/m ² K
Roof U-value	0.10 W/m ² K
Thermal bridging y-value	0.035 W/m ² K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	158.0200 (1b)	x 2.7800 (2b)	= 439.2956 (1b) - (3b)
First floor	168.3000 (1c)	x 2.2000 (2c)	= 370.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	326.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 809.5556 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.0741 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3241 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2755 (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	0.3513	0.3444	0.3375	0.3030	0.2962	0.2617	0.2617	0.2548	0.2755	0.2962	0.3099	0.3237 (22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524 (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
1.2 Window (Uw = 1.20)			63.9600	1.1450	73.2366		(27)
Half Glazed Door			7.0000	1.2000	8.4000		(26a)
Rooflight (Uw = 1.20)			11.9600	1.1450	13.6947		(27a)
Ground Floor			133.9200	0.1300	17.4096	110.0000	14731.2000 (28a)
Floor Over Garage			24.1000	0.1400	3.3740		(28b)
Cavity Walls	235.8900	68.6000	167.2900	0.1800	30.1122	60.0000	10037.4000 (29a)
Sheltered Garage	23.3800		23.3800	0.1524	3.5627	60.0000	1402.8000 (29a)
Dormer Walls	10.1400	2.3600	7.7800	0.1800	1.4004	18.0000	140.0400 (29a)
Ashlar Walls	5.3400		5.3400	0.1000	0.5340	18.0000	96.1200 (29a)
FF Plane	131.4700	7.2800	124.1900	0.1100	13.6609	9.0000	1117.7100 (30)
FF Sloped	44.8200		44.8200	0.1400	6.2748	9.0000	403.3800 (30)
GF Plane	2.9800		2.9800	0.1000	0.2980	9.0000	26.8200 (30)
GF Sloped	16.0300	4.6800	11.3500	0.1400	1.5890	9.0000	102.1500 (30)
Total net area of external elements Aum(A, m ²)			628.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	173.5469		(33)
Internal Wall			475.8000			9.0000	4282.2000 (32c)
Internal Floor			144.2000			18.0000	2595.6000 (32d)
GF Internal Ceiling			144.2000			18.0000	2595.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	37531.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							115.0129 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7237 (36)
Total fabric heat loss						(33) + (36) =	195.2707 (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	150.0578	149.4178	148.7905	145.8440	145.2928	142.7265	142.7265	142.2513	143.7150	145.2928	146.4080	147.5739 (38)
Heat transfer coeff	345.3284	344.6885	344.0612	341.1147	340.5634	337.9972	337.9972	337.5219	338.9857	340.5634	341.6787	342.8446 (39)
Average = Sum(39)m / 12 =												341.1121 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0583	1.0563	1.0544	1.0453	1.0436	1.0358	1.0358	1.0343	1.0388	1.0436	1.0471	1.0506 (40)
HLP (average)												1.0453 (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	3.1661 (42)
Average daily hot water use (litres/day)	109.3960 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.3356	115.9597	111.5839	107.2080	102.8322	98.4564	98.4564	102.8322	107.2080	111.5839	115.9597	120.3356	(44)
Energy conte	178.4542	156.0772	161.0576	140.4140	134.7305	116.2622	107.7340	123.6264	125.1029	145.7953	159.1470	172.8233	(45)
Energy content (annual)	Total = Sum (45)m =												1721.2245 (45)
Distribution loss (46)m = 0.15 x (45)m	26.7681	23.4116	24.1586	21.0621	20.2096	17.4393	16.1601	18.5440	18.7654	21.8693	23.8720	25.9235	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(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	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(64)
Total per year (kWh/year) = Sum (64)m =													2392.0599 (64)
Heat gains from water heating, kWh/month	104.9161	93.0647	99.1317	90.7974	90.3779	82.7669	81.4016	86.6858	85.7064	94.0570	97.0261	103.0438	(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	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.7250	37.9480	30.8614	23.3640	17.4649	14.7446	15.9321	20.7091	27.7957	35.2930	41.1922	43.9125	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	479.2448	484.2178	471.6859	445.0068	411.3293	379.6772	358.5317	353.5586	366.0906	392.7696	426.4471	458.0992	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	(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)	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	(71)
Water heating gains (Table 5)	141.0162	138.4892	133.2415	126.1074	121.4757	114.9540	109.4108	116.5132	119.0367	126.4207	134.7585	138.4997	(72)
Total internal gains	736.4782	734.1472	709.2810	667.9705	623.7622	582.8681	557.3667	564.2731	586.4152	627.9755	675.8900	714.0036	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	16.5300	10.6334	0.6300	0.7000	0.7700	53.7176	(74)
East	7.6400	19.6403	0.6300	0.7000	0.7700	45.8577	(76)
South	36.9700	46.7521	0.6300	0.7000	0.7700	528.2288	(78)
West	2.8200	19.6403	0.6300	0.7000	0.7700	16.9265	(80)
North	2.4000	15.2954	0.6300	0.7000	1.0000	14.5698	(82)
East	5.4400	25.9287	0.6300	0.7000	1.0000	56.9531	(82)
South	1.8400	47.0123	0.6300	0.7000	1.0000	34.3329	(82)
West	2.2800	26.6072	0.6300	0.7000	1.0000	23.7546	(82)

Solar gains	774.3411	1341.4887	1895.4589	2449.4417	2835.9060	2856.0771	2736.6294	2442.0462	2086.3005	1498.7811	931.5743	660.0294	(83)
Total gains	1510.8193	2075.6359	2604.7399	3117.4122	3459.6681	3438.9452	3293.9961	3006.3193	2672.7157	2126.7567	1607.4643	1374.0331	(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	30.1895	30.2455	30.3007	30.5624	30.6119	30.8443	30.8443	30.8877	30.7543	30.6119	30.5120	30.4082	
alpha	3.0126	3.0164	3.0200	3.0375	3.0408	3.0563	3.0563	3.0592	3.0503	3.0408	3.0341	3.0272	
util living area	0.9869	0.9671	0.9276	0.8461	0.7184	0.5623	0.4288	0.4809	0.7008	0.9029	0.9750	0.9900	(86)
MIT	19.2520	19.5359	19.9116	20.3310	20.6457	20.8222	20.8827	20.8703	20.7299	20.2794	19.6724	19.2002	(87)
Th 2	20.0351	20.0367	20.0383	20.0457	20.0471	20.0536	20.0536	20.0548	20.0511	20.0471	20.0443	20.0413	(88)
util rest of house	0.9846	0.9617	0.9157	0.8213	0.6745	0.4958	0.3446	0.3940	0.6394	0.8815	0.9700	0.9883	(89)
MIT 2	17.6622	18.0747	18.6147	19.2075	19.6268	19.8456	19.9063	19.8979	19.7455	19.1510	18.2814	17.5912	(90)
Living area fraction	fLA = Living area / (4) =												0.0703 (91)
MIT	17.7740	18.1774	18.7059	19.2865	19.6984	19.9142	19.9749	19.9663	19.8147	19.2303	18.3792	17.7043	(92)
Temperature adjustment													0.0000
adjusted MIT	17.7740	18.1774	18.7059	19.2865	19.6984	19.9142	19.9749	19.9663	19.8147	19.2303	18.3792	17.7043	(93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9475	0.8948	0.7982	0.6567	0.4854	0.3373	0.3854	0.6222	0.8583	0.9577	0.9821	(94)
Useful gains	1476.0034	1966.6283	2330.8157	2488.2647	2271.9599	1669.2079	1111.1356	1158.7164	1663.0173	1825.4427	1539.4728	1349.4129	(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	4652.9459	4576.5597	4199.5804	3542.9947	2723.9628	1796.1891	1140.7097	1203.6953	1937.2132	2939.1725	3853.8674	4629.8688	(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	2363.6452	1753.8739	1390.3609	759.4056	336.2901	0.0000	0.0000	0.0000	0.0000	828.6150	1666.3641	2440.6592	(98)
Space heating												11539.2141	(98)
Space heating per m2											(98) / (4) =	35.3617	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4617.5326	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	2363.6452	1753.8739	1390.3609	759.4056	336.2901	0.0000	0.0000	0.0000	0.0000	828.6150	1666.3641	2440.6592	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	945.8364	701.8303	556.3669	303.8838	134.5699	0.0000	0.0000	0.0000	0.0000	331.5786	666.8124	976.6543	(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	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
Fuel for water heating, kWh/month	134.4542	118.5257	124.5190	111.6797	109.4835	97.8866	94.0657	103.1419	102.9355	115.8026	122.3782	131.2384	(219)	
Water heating fuel used												1366.1107	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4617.5326	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump												30.0000	(230c)	
Total electricity for the above, kWh/year												30.0000	(231)	
Electricity for lighting (calculated in Appendix L)												754.5372	(232)	
Total delivered energy for all uses												6768.1806	(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	4617.5326	0.5190	2396.4994	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1366.1107	0.5190	709.0115	(264)
Space and water heating			3105.5109	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	754.5372	0.5190	391.6048	(268)
Total CO2, kg/year			3512.6857	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.7600	(273)

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

DER		10.7600	ZC1
Total Floor Area	TFA	326.3200	
Assumed number of occupants	N	3.1661	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		8.7028	ZC2
CO2 emissions from cooking, equation (L16)		0.5975	ZC3
Total CO2 emissions		20.0604	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		20.0604	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	158.0200 (1b)	x 2.7800 (2b)	= 439.2956 (1b) - (3b)
First floor	168.3000 (1c)	x 2.2000 (2c)	= 370.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	326.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 809.5556 (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					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.0494 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2994 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2545 (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	0.3245	0.3181	0.3118	0.2799	0.2736	0.2418	0.2418	0.2354	0.2545	0.2736	0.2863	0.2990 (22b)
Effective ac	0.5526	0.5506	0.5486	0.5392	0.5374	0.5292	0.5292	0.5277	0.5324	0.5374	0.5410	0.5447 (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 Semi-glazed door			7.0000	1.2000	8.4000		(26a)
TER Opening Type (Uw = 1.40)			62.8400	1.3258	83.3106		(27)
TER Room Window (Uw = 1.70)			11.7600	1.5918	18.7191		(27a)
Ground Floor			133.9200	0.1300	17.4096		(28a)
Floor Over Garage			24.1000	0.1300	3.1330		(28b)
Cavity Walls	235.8900	67.5200	168.3700	0.1800	30.3066		(29a)
Sheltered Garage	23.3800		23.3800	0.1800	4.2084		(29a)
Dormer Walls	10.1400	2.3200	7.8200	0.1800	1.4076		(29a)
Ashlar Walls	5.3400		5.3400	0.1800	0.9612		(29a)
FF Plane	131.4700	7.1600	124.3100	0.1300	16.1603		(30)
FF Sloped	44.8200		44.8200	0.1300	5.8266		(30)
GF Plane	2.9800		2.9800	0.1300	0.3874		(30)
GF Sloped	16.0300	4.6000	11.4300	0.1300	1.4859		(30)
Total net area of external elements Aum(A, m ²)			628.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	191.7163		(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)							32.5361 (36)
Total fabric heat loss						(33) + (36) =	224.2524 (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	147.6411	147.0949	146.5596	144.0452	143.5748	141.3848	141.3848	140.9793	142.2284	143.5748	144.5265	145.5214 (38)
Heat transfer coeff	371.8935	371.3473	370.8120	368.2976	367.8272	365.6372	365.6372	365.2317	366.4808	367.8272	368.7789	369.7738 (39)
Average = Sum(39)m / 12 =												368.2954 (39)
HLP	1.1397	1.1380	1.1363	1.1286	1.1272	1.1205	1.1205	1.1192	1.1231	1.1272	1.1301	1.1332 (40)
HLP (average)												1.1286 (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												3.1661 (42)
Average daily hot water use (litres/day)												109.3960 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	120.3356	115.9597	111.5839	107.2080	102.8322	98.4564	98.4564	102.8322	107.2080	111.5839	115.9597	120.3356 (44)

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Energy content (annual)	178.4542	156.0772	161.0576	140.4140	134.7305	116.2622	107.7340	123.6264	125.1029	145.7953	159.1470	172.8233 (45)
Distribution loss (46)m = 0.15 x (45)m	26.7681	23.4116	24.1586	21.0621	20.2096	17.4393	16.1601	18.5440	18.7654	21.8693	23.8720	25.9235 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
233.3610	205.6704	215.9644	193.5496	189.6373	169.3978	162.6408	178.5332	178.2385	200.7021	212.2826	227.7301	(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												
233.3610	205.6704	215.9644	193.5496	189.6373	169.3978	162.6408	178.5332	178.2385	200.7021	212.2826	227.7301	(64)
Heat gains from water heating, kWh/month												
103.2614	91.5702	97.4771	89.1961	88.7233	81.1657	79.7470	85.0312	84.1052	92.4024	95.4249	101.3892	(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	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
42.7250	37.9480	30.8614	23.3640	17.4649	14.7446	15.9321	20.7091	27.7957	35.2930	41.1922	43.9125	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
479.2448	484.2178	471.6859	445.0068	411.3293	379.6772	358.5317	353.5586	366.0906	392.7696	426.4471	458.0992	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	(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)												
-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	(71)
Water heating gains (Table 5)												
138.7923	136.2652	131.0176	123.8835	119.2518	112.7301	107.1868	114.2892	116.8128	124.1967	132.5345	136.2758	(72)
Total internal gains	734.2543	731.9233	707.0571	665.7466	621.5382	580.6441	555.1428	562.0492	584.1912	625.7516	673.6660	711.7797 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
North		16.2500	10.6334	0.6300	0.7000	0.7700	52.8077 (74)					
East		7.5100	19.6403	0.6300	0.7000	0.7700	45.0774 (76)					
South		36.3100	46.7521	0.6300	0.7000	0.7700	518.7987 (78)					
West		2.7700	19.6403	0.6300	0.7000	0.7700	16.6264 (80)					
North		2.3600	15.2954	0.6300	0.7000	1.0000	14.3270 (82)					
East		5.3500	25.9287	0.6300	0.7000	1.0000	56.0108 (82)					
South		1.8100	47.0123	0.6300	0.7000	1.0000	33.7731 (82)					
West		2.2400	26.6072	0.6300	0.7000	1.0000	23.3375 (82)					
Solar gains	760.7586	1318.0036	1862.3863	2406.8700	2786.7541	2806.6312	2689.2288	2399.6564	2049.9556	1472.5730	915.2424	648.4465 (83)
Total gains	1495.0129	2049.9268	2569.4434	3072.6165	3408.2923	3387.2753	3244.3716	2961.7056	2634.1468	2098.3246	1588.9084	1360.2262 (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	60.9344	61.0240	61.1121	61.5293	61.6080	61.9770	61.9770	62.0459	61.8344	61.6080	61.4491	61.2837
alpha	5.0623	5.0683	5.0741	5.1020	5.1072	5.1318	5.1318	5.1364	5.1223	5.1072	5.0966	5.0856
util living area	0.9994	0.9971	0.9875	0.9480	0.8378	0.6551	0.4889	0.5535	0.8191	0.9784	0.9982	0.9997 (86)
MIT	19.6400	19.8651	20.1808	20.5541	20.8366	20.9650	20.9935	20.9882	20.8927	20.4878	19.9775	19.5992 (87)
Th 2	19.9686	19.9699	19.9713	19.9775	19.9787	19.9841	19.9841	19.9851	19.9820	19.9787	19.9763	19.9738 (88)
util rest of house	0.9992	0.9961	0.9831	0.9294	0.7858	0.5656	0.3797	0.4384	0.7430	0.9675	0.9975	0.9995 (89)
MIT 2	18.1386	18.4684	18.9277	19.4594	19.8234	19.9618	19.9818	19.9804	19.8980	19.3778	18.6379	18.0825 (90)
Living area fraction												
MIT	18.2441	18.5666	19.0158	19.5364	19.8946	20.0323	20.0529	20.0513	19.9679	19.4558	18.7321	18.1891 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2441	18.5666	19.0158	19.5364	19.8946	20.0323	20.0529	20.0513	19.9679	19.4558	18.7321	18.1891 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9987	0.9940	0.9771	0.9192	0.7809	0.5701	0.3873	0.4461	0.7418	0.9596	0.9960	0.9992 (94)
Useful gains	1493.0509	2037.5266	2510.7275	2824.3201	2661.6795	1931.0696	1256.4295	1321.3029	1954.0761	2013.5438	1582.5567	1359.1016 (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												

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Month fraction	5185.7276	5075.0552	4641.0196	3917.3596	3014.2046	1986.2476	1262.5254	1333.5637	2150.4822	3257.4140	4289.6676	5172.7990 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	2747.3515	2041.2192	1584.9373	786.9885	262.2787	0.0000	0.0000	0.0000	0.0000	925.4394	1949.1198	2837.3909 (98)
Space heating requirement												13134.7253 (98)
Space heating requirement per m2											(98) / (4) =	40.2511 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												14047.8345 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2747.3515	2041.2192	1584.9373	786.9885	262.2787	0.0000	0.0000	0.0000	0.0000	925.4394	1949.1198	2837.3909 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	2938.3438	2183.1222	1695.1201	841.6989	280.5119	0.0000	0.0000	0.0000	0.0000	989.7748	2084.6201	3034.6427 (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	233.3610	205.6704	215.9644	193.5496	189.6373	169.3978	162.6408	178.5332	178.2385	200.7021	212.2826	227.7301 (64)
Efficiency of water heater	89.5598	89.4027	89.0678	88.1665	85.6792	79.8000	79.8000	79.8000	79.8000	88.3878	89.3237	79.8000 (216)
Fuel for water heating, kWh/month	260.5643	230.0494	242.4719	219.5274	221.3342	212.2780	203.8105	223.7258	223.3565	227.0699	237.6555	254.1423 (219)
Water heating fuel used												2755.9855 (219)
Annual totals kWh/year												
Space heating fuel - main system												14047.8345 (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)												754.5372 (232)
Total delivered energy for all uses												17633.3573 (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	14047.8345	0.2160	3034.3323 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2755.9855	0.2160	595.2929 (264)
Space and water heating			3629.6251 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	754.5372	0.5190	391.6048 (268)
Total CO2, kg/m2/year			4060.1550 (272)
Emissions per m2 for space and water heating			11.1229 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.2001 (272b)
Emissions per m2 for pumps and fans			0.1193 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.1229 * 1.55) + 1.2001 + 0.1193, rounded to 2 d.p.			18.5600 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	158.0200 (1b)	x 2.7800 (2b)	= 439.2956 (1b) - (3b)
First floor	168.3000 (1c)	x 2.2000 (2c)	= 370.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	326.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 809.5556 (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																4 * 10 =	40.0000 (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) =					40.0000 / (5) =	0.0494 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.2994 (18)		
Number of sides sheltered															2 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2545 (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 (22)					
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 (22a)					
	0.3245	0.3181	0.3118	0.2799	0.2736	0.2418	0.2418	0.2354	0.2545	0.2736	0.2863	0.2990 (22b)					
Effective ac	0.5526	0.5506	0.5486	0.5392	0.5374	0.5292	0.5292	0.5277	0.5324	0.5374	0.5410	0.5447 (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
1.2 Window (Uw = 1.20)			63.9600	1.1450	73.2366		(27)
Half Glazed Door			7.0000	1.2000	8.4000		(26a)
Rooflight (Uw = 1.20)			11.9600	1.1450	13.6947		(27a)
Ground Floor			133.9200	0.1300	17.4096	110.0000	14731.2000 (28a)
Floor Over Garage			24.1000	0.1400	3.3740		(28b)
Cavity Walls	235.8900	68.6000	167.2900	0.1800	30.1122	60.0000	10037.4000 (29a)
Sheltered Garage	23.3800		23.3800	0.1524	3.5627	60.0000	1402.8000 (29a)
Dormer Walls	10.1400	2.3600	7.7800	0.1800	1.4004	18.0000	140.0400 (29a)
Ashlar Walls	5.3400		5.3400	0.1000	0.5340	18.0000	96.1200 (29a)
FF Plane	131.4700	7.2800	124.1900	0.1100	13.6609	9.0000	1117.7100 (30)
FF Sloped	44.8200		44.8200	0.1400	6.2748	9.0000	403.3800 (30)
GF Plane	2.9800		2.9800	0.1000	0.2980	9.0000	26.8200 (30)
GF Sloped	16.0300	4.6800	11.3500	0.1400	1.5890	9.0000	102.1500 (30)
Total net area of external elements Aum(A, m ²)			628.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	173.5469		(33)
Internal Wall			475.8000			9.0000	4282.2000 (32c)
Internal Floor			144.2000			18.0000	2595.6000 (32d)
GF Internal Ceiling			144.2000			9.0000	1297.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	36233.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							111.0359 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7237 (36)
Total fabric heat loss						(33) + (36) =	195.2707 (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	147.6411	147.0949	146.5596	144.0452	143.5748	141.3848	141.3848	140.9793	142.2284	143.5748	144.5265	145.5214 (38)
Heat transfer coeff	342.9117	342.3656	341.8303	339.3159	338.8454	336.6555	336.6555	336.2499	337.4990	338.8454	339.7971	340.7921 (39)
Average = Sum(39)m / 12 =												339.3136 (39)
HLP	Jan 1.0508	Feb 1.0492	Mar 1.0475	Apr 1.0398	May 1.0384	Jun 1.0317	Jul 1.0317	Aug 1.0304	Sep 1.0343	Oct 1.0384	Nov 1.0413	Dec 1.0443 (40)
HLP (average)												1.0398 (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	3.1661 (42)
Average daily hot water use (litres/day)	109.3960 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.3356	115.9597	111.5839	107.2080	102.8322	98.4564	98.4564	102.8322	107.2080	111.5839	115.9597	120.3356	(44)
Energy conte	178.4542	156.0772	161.0576	140.4140	134.7305	116.2622	107.7340	123.6264	125.1029	145.7953	159.1470	172.8233	(45)
Energy content (annual)										Total =	Sum (45)m =	1721.2245	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	37.9215	33.1664	34.2247	29.8380	28.6302	24.7057	22.8935	26.2706	26.5844	30.9815	33.8187	36.7250	(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	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.7250	37.9480	30.8614	23.3640	17.4649	14.7446	15.9321	20.7091	27.7957	35.2930	41.1922	43.9125	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	479.2448	484.2178	471.6859	445.0068	411.3293	379.6772	358.5317	353.5586	366.0906	392.7696	426.4471	458.0992	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	(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)	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	(71)
Water heating gains (Table 5)	50.9698	49.3548	46.0010	41.4416	38.4815	34.3135	30.7708	35.3100	36.9227	41.6418	46.9705	49.3615	(72)
Total internal gains	643.4318	642.0128	619.0405	580.3047	537.7679	499.2275	475.7267	480.0699	501.3012	540.1967	585.1020	621.8654	(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				16.5300	10.6334		0.6300		0.7000		0.7700		53.7176 (74)
East				7.6400	19.6403		0.6300		0.7000		0.7700		45.8577 (76)
South				36.9700	46.7521		0.6300		0.7000		0.7700		528.2288 (78)
West				2.8200	19.6403		0.6300		0.7000		0.7700		16.9265 (80)
North				2.4000	15.2954		0.6300		0.7000		1.0000		14.5698 (82)
East				5.4400	25.9287		0.6300		0.7000		1.0000		56.9531 (82)
South				1.8400	47.0123		0.6300		0.7000		1.0000		34.3329 (82)
West				2.2800	26.6072		0.6300		0.7000		1.0000		23.7546 (82)
Solar gains	774.3411	1341.4887	1895.4589	2449.4417	2835.9060	2856.0771	2736.6294	2442.0462	2086.3005	1498.7811	931.5743	660.0294	(83)
Total gains	1417.7728	1983.5014	2514.4993	3029.7464	3373.6739	3355.3046	3212.3562	2922.1160	2587.6017	2038.9778	1516.6763	1281.8948	(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	29.3509	29.3978	29.4438	29.6620	29.7032	29.8964	29.8964	29.9324	29.8217	29.7032	29.6200	29.5335		
alpha	2.9567	2.9599	2.9629	2.9775	2.9802	2.9931	2.9931	2.9955	2.9881	2.9802	2.9747	2.9689		
util living area	0.9878	0.9684	0.9292	0.8488	0.7227	0.5686	0.4355	0.4891	0.7085	0.9069	0.9766	0.9908	(86)	
MIT	18.7050	19.0937	19.6085	20.1832	20.6201	20.8682	20.9560	20.9372	20.7357	20.1078	19.2746	18.6314	(87)	
Th 2	20.0412	20.0426	20.0439	20.0503	20.0515	20.0570	20.0570	20.0581	20.0549	20.0515	20.0491	20.0465	(88)	
util rest of house	0.9858	0.9632	0.9178	0.8248	0.6797	0.5026	0.3510	0.4021	0.6483	0.8866	0.9720	0.9893	(89)	
MIT 2	17.9191	18.3049	18.8108	19.3663	19.7655	19.9766	20.0377	20.0286	19.8777	19.3084	18.4919	17.8496	(90)	
Living area fraction									fLA =	Living area / (4) =				
MIT	17.9743	18.3603	18.8669	19.4237	19.8256	20.0393	20.1023	20.0925	19.9380	19.3646	18.5469	17.9046	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.9743	18.3603	18.8669	19.4237	19.8256	20.0393	20.1023	20.0925	19.9380	19.3646	18.5469	17.9046	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9795	0.9513	0.9004	0.8064	0.6684	0.5013	0.3553	0.4054	0.6401	0.8683	0.9621	0.9843	(94)
Useful gains	1388.7249	1886.8856	2263.9426	2443.1481	2255.0854	1682.1106	1141.2069	1184.7592	1656.1949	1770.5135	1459.1332	1261.7560	(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	4689.0797	4608.3581	4227.3688	3570.8536	2753.3081	1831.1651	1179.0565	1241.6063	1970.3226	2969.8428	3889.6401	4670.4104	(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	2455.4639	1828.8295	1460.7891	811.9479	370.6777	0.0000	0.0000	0.0000	0.0000	892.3010	1749.9650	2536.0389	(98)
Space heating												12106.0130	(98)
Space heating per m2												(98) / (4) =	37.0986 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	3164.5615	2491.2506	2555.4995	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8261	0.8800	0.8513	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2614.3314	2192.3965	2175.4859	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3955.9962	3792.0523	3479.0330	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	965.9986	1190.1439	969.8390	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													3125.9816 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 1.0000 (105)
	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	241.4997	297.5360	242.4598	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													0.0000 (107)
Space cooling per m2													781.4954 (107)
Energy for space heating													2.3949 (108)
Energy for space cooling													37.0986 (99)
Total													2.3949 (108)
Dwelling Fabric Energy Efficiency (DFEE)													39.4935 (109)
													39.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	158.0200 (1b)	x 2.7800 (2b)	= 439.2956 (1b) - (3b)
First floor	168.3000 (1c)	x 2.2000 (2c)	= 370.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	326.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 809.5556 (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					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.0494 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2994 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2545 (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	0.3245	0.3181	0.3118	0.2799	0.2736	0.2418	0.2418	0.2354	0.2545	0.2736	0.2863	0.2990 (22b)
Effective ac	0.5526	0.5506	0.5486	0.5392	0.5374	0.5292	0.5292	0.5277	0.5324	0.5374	0.5410	0.5447 (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 Semi-glazed door			7.0000	1.2000	8.4000		(26a)
TER Opening Type (Uw = 1.40)			62.8400	1.3258	83.3106		(27)
TER Room Window (Uw = 1.70)			11.7600	1.5918	18.7191		(27a)
Ground Floor			133.9200	0.1300	17.4096		(28a)
Floor Over Garage			24.1000	0.1300	3.1330		(28b)
Cavity Walls	235.8900	67.5200	168.3700	0.1800	30.3066		(29a)
Sheltered Garage	23.3800		23.3800	0.1800	4.2084		(29a)
Dormer Walls	10.1400	2.3200	7.8200	0.1800	1.4076		(29a)
Ashlar Walls	5.3400		5.3400	0.1800	0.9612		(29a)
FF Plane	131.4700	7.1600	124.3100	0.1300	16.1603		(30)
FF Sloped	44.8200		44.8200	0.1300	5.8266		(30)
GF Plane	2.9800		2.9800	0.1300	0.3874		(30)
GF Sloped	16.0300	4.6000	11.4300	0.1300	1.4859		(30)
Total net area of external elements Aum(A, m ²)			628.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	191.7163		(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)							32.5361 (36)
Total fabric heat loss						(33) + (36) =	224.2524 (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	147.6411	147.0949	146.5596	144.0452	143.5748	141.3848	141.3848	140.9793	142.2284	143.5748	144.5265	145.5214 (38)
Heat transfer coeff	371.8935	371.3473	370.8120	368.2976	367.8272	365.6372	365.6372	365.2317	366.4808	367.8272	368.7789	369.7738 (39)
Average = Sum(39)m / 12 =												368.2954 (39)
HLP	1.1397	1.1380	1.1363	1.1286	1.1272	1.1205	1.1205	1.1192	1.1231	1.1272	1.1301	1.1332 (40)
HLP (average)												1.1286 (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												3.1661 (42)
Average daily hot water use (litres/day)												109.3960 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	120.3356	115.9597	111.5839	107.2080	102.8322	98.4564	98.4564	102.8322	107.2080	111.5839	115.9597	120.3356 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	178.4542	156.0772	161.0576	140.4140	134.7305	116.2622	107.7340	123.6264	125.1029	145.7953	159.1470	172.8233 (45)
Energy content (annual)	Total = Sum (45)m =											1721.2245 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	37.9215	33.1664	34.2247	29.8380	28.6302	24.7057	22.8935	26.2706	26.5844	30.9815	33.8187	36.7250 (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	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	158.3073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.7250	37.9480	30.8614	23.3640	17.4649	14.7446	15.9321	20.7091	27.7957	35.2930	41.1922	43.9125	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	479.2448	484.2178	471.6859	445.0068	411.3293	379.6772	358.5317	353.5586	366.0906	392.7696	426.4471	458.0992	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	38.8307	(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)	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	(71)
Water heating gains (Table 5)	50.9698	49.3548	46.0010	41.4416	38.4815	34.3135	30.7708	35.3100	36.9227	41.6418	46.9705	49.3615	(72)
Total internal gains	643.4318	642.0128	619.0405	580.3047	537.7679	499.2275	475.7267	480.0699	501.3012	540.1967	585.1020	621.8654	(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			16.2500	10.6334	0.6300	0.7000	0.7700	52.8077 (74)					
East			7.5100	19.6403	0.6300	0.7000	0.7700	45.0774 (76)					
South			36.3100	46.7521	0.6300	0.7000	0.7700	518.7987 (78)					
West			2.7700	19.6403	0.6300	0.7000	0.7700	16.6264 (80)					
North			2.3600	15.2954	0.6300	0.7000	1.0000	14.3270 (82)					
East			5.3500	25.9287	0.6300	0.7000	1.0000	56.0108 (82)					
South			1.8100	47.0123	0.6300	0.7000	1.0000	33.7731 (82)					
West			2.2400	26.6072	0.6300	0.7000	1.0000	23.3375 (82)					
Solar gains	760.7586	1318.0036	1862.3863	2406.8700	2786.7541	2806.6312	2689.2288	2399.6564	2049.9556	1472.5730	915.2424	648.4465	(83)
Total gains	1404.1904	1960.0163	2481.4268	2987.1747	3324.5220	3305.8587	3164.9556	2879.7263	2551.2568	2012.7697	1500.3443	1270.3119	(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	60.9344	61.0240	61.1121	61.5293	61.6080	61.9770	61.9770	62.0459	61.8344	61.6080	61.4491	61.2837	
alpha	5.0623	5.0683	5.0741	5.1020	5.1072	5.1318	5.1318	5.1364	5.1223	5.1072	5.0966	5.0856	
util living area	0.9996	0.9976	0.9893	0.9531	0.8480	0.6679	0.5004	0.5676	0.8329	0.9818	0.9986	0.9998	(86)
MIT	19.6139	19.8395	20.1569	20.5350	20.8261	20.9618	20.9928	20.9868	20.8832	20.4656	19.9521	19.5732	(87)
Th 2	19.9686	19.9699	19.9713	19.9775	19.9787	19.9841	19.9841	19.9851	19.9820	19.9787	19.9763	19.9738	(88)
util rest of house	0.9994	0.9968	0.9853	0.9358	0.7975	0.5779	0.3890	0.4503	0.7591	0.9724	0.9981	0.9997	(89)
MIT 2	18.6930	18.9193	19.2355	19.6064	19.8649	19.9673	19.9824	19.9815	19.9187	19.5473	19.0372	18.6566	(90)
Living area fraction	18.7578	18.9840	19.3002	19.6717	19.9324	20.0372	20.0534	20.0522	19.9865	19.6119	19.1016	18.7210	(91)
MIT	18.7578	18.9840	19.3002	19.6717	19.9324	20.0372	20.0534	20.0522	19.9865	19.6119	19.1016	18.7210	(92)
Temperature adjustment	18.7578	18.9840	19.3002	19.6717	19.9324	20.0372	20.0534	20.0522	19.9865	19.6119	19.1016	18.7210	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1403.0308	1951.5226	2436.4792	2776.3307	2642.5882	1927.0655	1255.8723	1320.0228	1937.4884	1947.8245	1496.3399	1269.6765	(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	5376.7507	5230.0639	4746.4817	3967.1956	3028.1102	1988.0549	1262.6926	1333.8928	2157.2784	3314.8158	4425.9229	5369.4975	(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	2956.4476	2203.1797	1718.6419	857.4227	286.8283	0.0000	0.0000	0.0000	0.0000	1017.0415	2109.2998	3050.2668	(98)
Space heating													14199.1283 (98)
Space heating per m2													(98) / (4) = 43.5129 (99)

8c. Space cooling requirement



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

 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	3436.9899	2705.7155	2775.7607	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8850	0.9391	0.9116	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3041.5770	2540.8184	2530.5222	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3900.5549	3738.8709	3431.3359	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	618.4641	891.3511	670.2054	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													(104)
Cooled fraction									FC = cooled area / (4) =				2180.0207 (104)
Intermittency factor (Table 10b)												1.0000	(105)
	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	154.6160	222.8378	167.5514	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													(107)
Space cooling per m2													545.0052 (108)
Energy for space heating													1.6702 (108)
Energy for space cooling													43.5129 (99)
Total													1.6702 (108)
Target Fabric Energy Efficiency (TFEE)													45.1831 (109)
													52.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	158.0200 (1b)	x 2.7800 (2b)	= 439.2956 (1b) - (3b)
First floor	168.3000 (1c)	x 2.2000 (2c)	= 370.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	326.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 809.5556 (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																6 * 10 =	60.0000 (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) =					60.0000 / (5) =	0.0741 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3241 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2755 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)					
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)					
Adj infilt rate	0.3168	0.3030	0.3030	0.2824	0.2824	0.2548	0.2548	0.2411	0.2617	0.2893	0.2755	0.2962 (22b)					
Effective ac	0.5502	0.5459	0.5459	0.5399	0.5399	0.5325	0.5325	0.5291	0.5342	0.5418	0.5379	0.5439 (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
1.2 Window (Uw = 1.20)			63.9600	1.1450	73.2366		(27)
Half Glazed Door			7.0000	1.2000	8.4000		(26a)
Rooflight (Uw = 1.20)			11.9600	1.1450	13.6947		(27a)
Ground Floor			133.9200	0.1300	17.4096	110.0000	14731.2000 (28a)
Floor Over Garage			24.1000	0.1400	3.3740		(28b)
Cavity Walls	235.8900	68.6000	167.2900	0.1800	30.1122	60.0000	10037.4000 (29a)
Sheltered Garage	23.3800		23.3800	0.1524	3.5627	60.0000	1402.8000 (29a)
Dormer Walls	10.1400	2.3600	7.7800	0.1800	1.4004	18.0000	140.0400 (29a)
Ashlar Walls	5.3400		5.3400	0.1000	0.5340	18.0000	96.1200 (29a)
FF Plane	131.4700	7.2800	124.1900	0.1100	13.6609	9.0000	1117.7100 (30)
FF Sloped	44.8200		44.8200	0.1400	6.2748	9.0000	403.3800 (30)
GF Plane	2.9800		2.9800	0.1000	0.2980	9.0000	26.8200 (30)
GF Sloped	16.0300	4.6800	11.3500	0.1400	1.5890	9.0000	102.1500 (30)
Total net area of external elements Aum(A, m ²)			628.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	173.5469		(33)
Internal Wall			475.8000			9.0000	4282.2000 (32c)
Internal Floor			144.2000			18.0000	2595.6000 (32d)
GF Internal Ceiling			144.2000			18.0000	2595.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	37531.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							115.0129 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7237 (36)
Total fabric heat loss						(33) + (36) =	195.2707 (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	146.9846	145.8440	145.8440	144.2282	144.2282	142.2513	142.2513	141.3388	142.7265	144.7542	143.7150	145.2928 (38)
Heat transfer coeff	342.2553	341.1147	341.1147	339.4989	339.4989	337.5219	337.5219	336.6095	337.9972	340.0248	338.9857	340.5634 (39)
Average = Sum(39)m / 12 =												339.3922 (39)
HLP	Jan 1.0488	Feb 1.0453	Mar 1.0453	Apr 1.0404	May 1.0404	Jun 1.0343	Jul 1.0343	Aug 1.0315	Sep 1.0358	Oct 1.0420	Nov 1.0388	Dec 1.0436 (40)
HLP (average)												1.0401 (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	3.1661 (42)
Average daily hot water use (litres/day)	109.3960 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.3356	115.9597	111.5839	107.2080	102.8322	98.4564	98.4564	102.8322	107.2080	111.5839	115.9597	120.3356	(44)
Energy conte	178.4542	156.0772	161.0576	140.4140	134.7305	116.2622	107.7340	123.6264	125.1029	145.7953	159.1470	172.8233	(45)
Energy content (annual)	Total = Sum (45)m =												1721.2245 (45)
Distribution loss (46)m = 0.15 x (45)m	26.7681	23.4116	24.1586	21.0621	20.2096	17.4393	16.1601	18.5440	18.7654	21.8693	23.8720	25.9235	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(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	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	104.9161	93.0647	99.1317	90.7974	90.3779	82.7669	81.4016	86.6858	85.7064	94.0570	97.0261	103.0438	(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	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.8126	94.8700	77.1534	58.4101	43.6622	36.8615	39.8302	51.7728	69.4893	88.2326	102.9805	109.7812	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	715.2907	722.7132	704.0088	664.1893	613.9244	566.6824	535.1219	527.6994	546.4038	586.2233	636.4882	683.7302	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	(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)	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	(71)
Water heating gains (Table 5)	141.0162	138.4892	133.2415	126.1074	121.4757	114.9540	109.4108	116.5132	119.0367	126.4207	134.7585	138.4997	(72)
Total internal gains	1086.6054	1079.5583	1037.8897	972.1928	902.5483	841.9839	807.8488	819.4713	858.4158	924.3625	997.7131	1055.4971	(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	16.5300	12.7650	0.6300	0.7000	0.7700	64.4862	(74)
East	7.6400	23.8018	0.6300	0.7000	0.7700	55.5743	(76)
South	36.9700	54.2217	0.6300	0.7000	0.7700	612.6246	(78)
West	2.8200	23.8018	0.6300	0.7000	0.7700	20.5130	(80)
North	2.4000	18.1686	0.6300	0.7000	1.0000	17.3067	(82)
East	5.4400	31.5957	0.6300	0.7000	1.0000	69.5233	(82)
South	1.8400	55.6527	0.6300	0.7000	1.0000	40.6430	(82)
West	2.2800	32.5082	0.6300	0.7000	1.0000	28.9831	(82)

Solar gains	909.6543	1378.4137	1921.3508	2561.7568	2890.4437	3087.4047	2925.4765	2663.1601	2264.4313	1632.8050	1051.2878	779.7889	(83)
Total gains	1996.2597	2457.9720	2959.2405	3533.9496	3792.9920	3929.3886	3733.3252	3482.6314	3122.8470	2557.1675	2049.0010	1835.2859	(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	30.4605	30.5624	30.5624	30.7079	30.7079	30.8877	30.8877	30.9714	30.8443	30.6604	30.7543	30.6119	
alpha	3.0307	3.0375	3.0375	3.0472	3.0472	3.0592	3.0592	3.0648	3.0563	3.0440	3.0503	3.0408	
util living area	0.9710	0.9469	0.8961	0.7891	0.6475	0.4530	0.3266	0.3563	0.6032	0.8449	0.9496	0.9766	(86)
MIT	19.4947	19.7318	20.0840	20.4763	20.7308	20.8689	20.9005	20.8972	20.8027	20.4413	19.8980	19.4464	(87)
Th 2	20.0428	20.0457	20.0457	20.0498	20.0498	20.0548	20.0548	20.0571	20.0536	20.0485	20.0511	20.0471	(88)
util rest of house	0.9663	0.9385	0.8798	0.7579	0.5979	0.3849	0.2464	0.2723	0.5355	0.8138	0.9400	0.9727	(89)
MIT 2	18.0194	18.3622	18.8624	19.4043	19.7323	19.8925	19.9203	19.9207	19.8268	19.3697	18.6098	17.9528	(90)
Living area fraction	fLA = Living area / (4) =												0.0703 (91)
MIT	18.1231	18.4585	18.9483	19.4797	19.8025	19.9611	19.9892	19.9894	19.8954	19.4451	18.7004	18.0578	(92)
Temperature adjustment													0.0000
adjusted MIT	18.1231	18.4585	18.9483	19.4797	19.8025	19.9611	19.9892	19.9894	19.8954	19.4451	18.7004	18.0578	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9532	0.9204	0.8572	0.7368	0.5839	0.3779	0.2407	0.2660	0.5233	0.7904	0.9220	0.9613	(94)
Useful gains	1902.7364	2262.2391	2536.6154	2603.9082	2214.8335	1484.9903	898.5450	926.5287	1634.1504	2021.1523	1889.2278	1764.1929	(95)
Ext temp.	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000	(96)
Heat loss rate W													
Month fracti	4594.1231	4488.5494	4075.7475	3388.0908	2513.1280	1539.4756	907.6540	938.9344	1789.8367	2837.5281	3762.8671	4549.1682	(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	2002.3917	1496.0805	1145.1143	564.6115	221.9311	0.0000	0.0000	0.0000	0.0000	607.3836	1349.0202	2072.0217	(98)
RHI space heating demand												9458.5546	(98)
												9459	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	158.0200 (1b)	x 2.7800 (2b)	= 439.2956 (1b) - (3b)
First floor	168.3000 (1c)	x 2.2000 (2c)	= 370.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	326.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 809.5556 (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																6 * 10 =	60.0000 (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) =							
Pressure test										60.0000 / (5) =							0.0741 (8)
Measured/design AP50										Yes							5.0000
Infiltration rate																	0.3241 (18)
Number of sides sheltered																	2 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.8500 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.2755 (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 (22)					
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 (22a)					
	0.3513	0.3444	0.3375	0.3030	0.2962	0.2617	0.2617	0.2548	0.2755	0.2962	0.3099	0.3237 (22b)					
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524 (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
1.2 Window (Uw = 1.20)			63.9600	1.1450	73.2366		(27)
Half Glazed Door			7.0000	1.2000	8.4000		(26a)
Rooflight (Uw = 1.20)			11.9600	1.1450	13.6947		(27a)
Ground Floor			133.9200	0.1300	17.4096	110.0000	14731.2000 (28a)
Floor Over Garage			24.1000	0.1400	3.3740		(28b)
Cavity Walls	235.8900	68.6000	167.2900	0.1800	30.1122	60.0000	10037.4000 (29a)
Sheltered Garage	23.3800		23.3800	0.1524	3.5627	60.0000	1402.8000 (29a)
Dormer Walls	10.1400	2.3600	7.7800	0.1800	1.4004	18.0000	140.0400 (29a)
Ashlar Walls	5.3400		5.3400	0.1000	0.5340	18.0000	96.1200 (29a)
FF Plane	131.4700	7.2800	124.1900	0.1100	13.6609	9.0000	1117.7100 (30)
FF Sloped	44.8200		44.8200	0.1400	6.2748	9.0000	403.3800 (30)
GF Plane	2.9800		2.9800	0.1000	0.2980	9.0000	26.8200 (30)
GF Sloped	16.0300	4.6800	11.3500	0.1400	1.5890	9.0000	102.1500 (30)
Total net area of external elements Aum(A, m ²)			628.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	173.5469		(33)
Internal Wall			475.8000			9.0000	4282.2000 (32c)
Internal Floor			144.2000			18.0000	2595.6000 (32d)
GF Internal Ceiling			144.2000			18.0000	2595.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	37531.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							115.0129 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7237 (36)
Total fabric heat loss						(33) + (36) =	195.2707 (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	150.0578	149.4178	148.7905	145.8440	145.2928	142.7265	142.7265	142.2513	143.7150	145.2928	146.4080	147.5739 (38)
Heat transfer coeff	345.3284	344.6885	344.0612	341.1147	340.5634	337.9972	337.9972	337.5219	338.9857	340.5634	341.6787	342.8446 (39)
Average = Sum(39)m / 12 =												341.1121 (39)
HLP	Jan 1.0583	Feb 1.0563	Mar 1.0544	Apr 1.0453	May 1.0436	Jun 1.0358	Jul 1.0358	Aug 1.0343	Sep 1.0388	Oct 1.0436	Nov 1.0471	Dec 1.0506 (40)
HLP (average)												1.0453 (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	3.1661 (42)
Average daily hot water use (litres/day)	109.3960 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.3356	115.9597	111.5839	107.2080	102.8322	98.4564	98.4564	102.8322	107.2080	111.5839	115.9597	120.3356	(44)
Energy conte	178.4542	156.0772	161.0576	140.4140	134.7305	116.2622	107.7340	123.6264	125.1029	145.7953	159.1470	172.8233	(45)
Energy content (annual)	Total = Sum (45)m =												1721.2245 (45)
Distribution loss (46)m = 0.15 x (45)m	26.7681	23.4116	24.1586	21.0621	20.2096	17.4393	16.1601	18.5440	18.7654	21.8693	23.8720	25.9235	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(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	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(64)
Total per year (kWh/year) = Sum (64)m =													2392.0599 (64)
Heat gains from water heating, kWh/month	104.9161	93.0647	99.1317	90.7974	90.3779	82.7669	81.4016	86.6858	85.7064	94.0570	97.0261	103.0438	(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	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.8126	94.8700	77.1534	58.4101	43.6622	36.8615	39.8302	51.7728	69.4893	88.2326	102.9805	109.7812	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	715.2907	722.7132	704.0088	664.1893	613.9244	566.6824	535.1219	527.6994	546.4038	586.2233	636.4882	683.7302	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	(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)	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	(71)
Water heating gains (Table 5)	141.0162	138.4892	133.2415	126.1074	121.4757	114.9540	109.4108	116.5132	119.0367	126.4207	134.7585	138.4997	(72)
Total internal gains	1086.6054	1079.5583	1037.8897	972.1928	902.5483	841.9839	807.8488	819.4713	858.4158	924.3625	997.7131	1055.4971	(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					16.5300	10.6334		0.6300	0.7000		0.7700		53.7176 (74)		
East					7.6400	19.6403		0.6300	0.7000		0.7700		45.8577 (76)		
South					36.9700	46.7521		0.6300	0.7000		0.7700		528.2288 (78)		
West					2.8200	19.6403		0.6300	0.7000		0.7700		16.9265 (80)		
North					2.4000	15.2954		0.6300	0.7000		1.0000		14.5698 (82)		
East					5.4400	25.9287		0.6300	0.7000		1.0000		56.9531 (82)		
South					1.8400	47.0123		0.6300	0.7000		1.0000		34.3329 (82)		
West					2.2800	26.6072		0.6300	0.7000		1.0000		23.7546 (82)		

Solar gains	774.3411	1341.4887	1895.4589	2449.4417	2835.9060	2856.0771	2736.6294	2442.0462	2086.3005	1498.7811	931.5743	660.0294 (83)			
Total gains	1860.9465	2421.0470	2933.3486	3421.6345	3738.4543	3698.0610	3544.4782	3261.5175	2944.7163	2423.1437	1929.2874	1715.5265 (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	30.1895	30.2455	30.3007	30.5624	30.6119	30.8443	30.8443	30.8877	30.7543	30.6119	30.5120	30.4082	
alpha	3.0126	3.0164	3.0200	3.0375	3.0408	3.0563	3.0563	3.0592	3.0503	3.0408	3.0341	3.0272	
util living area	0.9773	0.9521	0.9060	0.8178	0.6871	0.5318	0.4019	0.4490	0.6609	0.8730	0.9604	0.9819	(86)
MIT	19.3791	19.6514	20.0054	20.3936	20.6782	20.8351	20.8875	20.8775	20.7584	20.3555	19.7836	19.3263	(87)
Th 2	20.0351	20.0367	20.0383	20.0457	20.0471	20.0536	20.0536	20.0548	20.0511	20.0471	20.0443	20.0413	(88)
util rest of house	0.9736	0.9446	0.8915	0.7904	0.6421	0.4668	0.3218	0.3660	0.5982	0.8471	0.9529	0.9789	(89)
MIT 2	17.8464	18.2399	18.7456	19.2898	19.6649	19.8577	19.9094	19.9031	19.7757	19.2526	18.4406	17.7742	(90)
Living area fraction	17.9541	18.3392	18.8341	19.3674	19.7362	19.9264	19.9782	19.9716	19.8448	19.3302	18.5350	17.8833	(92)
MIT	17.9541	18.3392	18.8341	19.3674	19.7362	19.9264	19.9782	19.9716	19.8448	19.3302	18.5350	17.8833	(93)
Temperature adjustment													0.0000
adjusted MIT	17.9541	18.3392	18.8341	19.3674	19.7362	19.9264	19.9782	19.9716	19.8448	19.3302	18.5350	17.8833	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9623	0.9272	0.8691	0.7681	0.6260	0.4576	0.3152	0.3583	0.5832	0.8234	0.9368	0.9693	(94)
Useful gains	1790.8209	2244.7866	2549.4234	2628.1998	2340.3264	1692.1024	1117.2973	1168.6665	1717.5001	1995.2843	1807.4273	1662.8325	(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	4715.1648	4632.3243	4243.6934	3570.5977	2736.8252	1800.2970	1141.8215	1205.4907	1947.3976	2973.1754	3907.1010	4691.2523	(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	2175.7119	1604.4254	1260.5368	678.5265	294.9951	0.0000	0.0000	0.0000	0.0000	727.5510	1511.7650	2253.1443	(98)
Space heating												10506.6560	(98)
Space heating per m2												32.1974	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4204.3442	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	2175.7119	1604.4254	1260.5368	678.5265	294.9951	0.0000	0.0000	0.0000	0.0000	727.5510	1511.7650	2253.1443	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	870.6330	642.0270	504.4165	271.5192	118.0453	0.0000	0.0000	0.0000	0.0000	291.1369	604.9480	901.6184	(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	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)	
Fuel for water heating, kWh/month	134.4542	118.5257	124.5190	111.6797	109.4835	97.8866	94.0657	103.1419	102.9355	115.8026	122.3782	131.2384	(219)	
Water heating fuel used												1366.1107	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4204.3442	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump												30.0000	(230c)	
Total electricity for the above, kWh/year												30.0000	(231)	
Electricity for lighting (calculated in Appendix L)												754.5372	(232)	
Total delivered energy for all uses												6354.9921	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4204.3442	13.1900	554.5530 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1366.1107	13.1900	180.1900 (247)
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)
Energy for lighting	754.5372	13.1900	99.5235 (250)
Additional standing charges			0.0000 (251)
Total energy cost			838.2235 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9481 (257)
SAP value		86.7738
SAP rating (Section 12)		87 (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	4204.3442	0.5190	2182.0546 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1366.1107	0.5190	709.0115 (264)
Space and water heating			2891.0661 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	754.5372	0.5190	391.6048 (268)
Total kg/year			3298.2409 (272)
CO2 emissions per m2			10.1100 (273)
EI value			88.0975
EI rating			88 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.4990 = 5.661$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.4990 = 0.2227$, stars = 4
Water heating energy efficiency	$13.19 / 1.7510 = 7.533$, stars = 2
Water heating environmental impact	$0.519 / 1.7510 = 0.2964$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	158.0200 (1b)	x 2.7800 (2b)	= 439.2956 (1b) - (3b)
First floor	168.3000 (1c)	x 2.2000 (2c)	= 370.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	326.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 809.5556 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.0741 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3241 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)
Adj infilt rate	0.3168	0.3030	0.3030	0.2824	0.2824	0.2548	0.2548	0.2411	0.2617	0.2893	0.2755	0.2962 (22b)
Effective ac	0.5502	0.5459	0.5459	0.5399	0.5399	0.5325	0.5325	0.5291	0.5342	0.5418	0.5379	0.5439 (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
1.2 Window (Uw = 1.20)			63.9600	1.1450	73.2366		(27)
Half Glazed Door			7.0000	1.2000	8.4000		(26a)
Rooflight (Uw = 1.20)			11.9600	1.1450	13.6947		(27a)
Ground Floor			133.9200	0.1300	17.4096	110.0000	14731.2000 (28a)
Floor Over Garage			24.1000	0.1400	3.3740		(28b)
Cavity Walls	235.8900	68.6000	167.2900	0.1800	30.1122	60.0000	10037.4000 (29a)
Sheltered Garage	23.3800		23.3800	0.1524	3.5627	60.0000	1402.8000 (29a)
Dormer Walls	10.1400	2.3600	7.7800	0.1800	1.4004	18.0000	140.0400 (29a)
Ashlar Walls	5.3400		5.3400	0.1000	0.5340	18.0000	96.1200 (29a)
FF Plane	131.4700	7.2800	124.1900	0.1100	13.6609	9.0000	1117.7100 (30)
FF Sloped	44.8200		44.8200	0.1400	6.2748	9.0000	403.3800 (30)
GF Plane	2.9800		2.9800	0.1000	0.2980	9.0000	26.8200 (30)
GF Sloped	16.0300	4.6800	11.3500	0.1400	1.5890	9.0000	102.1500 (30)
Total net area of external elements Aum(A, m ²)			628.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	173.5469		(33)
Internal Wall			475.8000			9.0000	4282.2000 (32c)
Internal Floor			144.2000			18.0000	2595.6000 (32d)
GF Internal Ceiling			144.2000			18.0000	2595.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	37531.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							115.0129 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7237 (36)
Total fabric heat loss						(33) + (36) =	195.2707 (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	146.9846	145.8440	145.8440	144.2282	144.2282	142.2513	142.2513	141.3388	142.7265	144.7542	143.7150	145.2928 (38)
Heat transfer coeff	342.2553	341.1147	341.1147	339.4989	339.4989	337.5219	337.5219	336.6095	337.9972	340.0248	338.9857	340.5634 (39)
Average = Sum(39)m / 12 =												339.3922 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0488	1.0453	1.0453	1.0404	1.0404	1.0343	1.0343	1.0315	1.0358	1.0420	1.0388	1.0436 (40)
HLP (average)												1.0401 (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	3.1661 (42)
Average daily hot water use (litres/day)	109.3960 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.3356	115.9597	111.5839	107.2080	102.8322	98.4564	98.4564	102.8322	107.2080	111.5839	115.9597	120.3356	(44)
Energy conte	178.4542	156.0772	161.0576	140.4140	134.7305	116.2622	107.7340	123.6264	125.1029	145.7953	159.1470	172.8233	(45)
Energy content (annual)	Total = Sum (45)m =												1721.2245 (45)
Distribution loss (46)m = 0.15 x (45)m	26.7681	23.4116	24.1586	21.0621	20.2096	17.4393	16.1601	18.5440	18.7654	21.8693	23.8720	25.9235	(46)
Water storage loss:													
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(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	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(64)
Total per year (kWh/year) = Sum (64)m =													2392.0599 (64)
Heat gains from water heating, kWh/month	104.9161	93.0647	99.1317	90.7974	90.3779	82.7669	81.4016	86.6858	85.7064	94.0570	97.0261	103.0438	(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	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.8126	94.8700	77.1534	58.4101	43.6622	36.8615	39.8302	51.7728	69.4893	88.2326	102.9805	109.7812	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	715.2907	722.7132	704.0088	664.1893	613.9244	566.6824	535.1219	527.6994	546.4038	586.2233	636.4882	683.7302	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	(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)	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	(71)
Water heating gains (Table 5)	141.0162	138.4892	133.2415	126.1074	121.4757	114.9540	109.4108	116.5132	119.0367	126.4207	134.7585	138.4997	(72)
Total internal gains	1086.6054	1079.5583	1037.8897	972.1928	902.5483	841.9839	807.8488	819.4713	858.4158	924.3625	997.7131	1055.4971	(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				16.5300	12.7650		0.6300		0.7000		0.7700		64.4862 (74)
East				7.6400	23.8018		0.6300		0.7000		0.7700		55.5743 (76)
South				36.9700	54.2217		0.6300		0.7000		0.7700		612.6246 (78)
West				2.8200	23.8018		0.6300		0.7000		0.7700		20.5130 (80)
North				2.4000	18.1686		0.6300		0.7000		1.0000		17.3067 (82)
East				5.4400	31.5957		0.6300		0.7000		1.0000		69.5233 (82)
South				1.8400	55.6527		0.6300		0.7000		1.0000		40.6430 (82)
West				2.2800	32.5082		0.6300		0.7000		1.0000		28.9831 (82)
Solar gains	909.6543	1378.4137	1921.3508	2561.7568	2890.4437	3087.4047	2925.4765	2663.1601	2264.4313	1632.8050	1051.2878		779.7889 (83)
Total gains	1996.2597	2457.9720	2959.2405	3533.9496	3792.9920	3929.3886	3733.3252	3482.6314	3122.8470	2557.1675	2049.0010		1835.2859 (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	30.4605	30.5624	30.5624	30.7079	30.7079	30.8877	30.8877	30.9714	30.8443	30.6604	30.7543	30.6119	
alpha	3.0307	3.0375	3.0375	3.0472	3.0472	3.0592	3.0592	3.0648	3.0563	3.0440	3.0503	3.0408	
util living area	0.9710	0.9469	0.8961	0.7891	0.6475	0.4530	0.3266	0.3563	0.6032	0.8449	0.9496	0.9766	(86)
MIT	19.4947	19.7318	20.0840	20.4763	20.7308	20.8689	20.9005	20.8972	20.8027	20.4413	19.8980	19.4464	(87)
Th 2	20.0428	20.0457	20.0457	20.0498	20.0498	20.0548	20.0548	20.0571	20.0536	20.0485	20.0511	20.0471	(88)
util rest of house	0.9663	0.9385	0.8798	0.7579	0.5979	0.3849	0.2464	0.2723	0.5355	0.8138	0.9400	0.9727	(89)
MIT 2	18.0194	18.3622	18.8624	19.4043	19.7323	19.8925	19.9203	19.9207	19.8268	19.3697	18.6098	17.9528	(90)
Living area fraction	18.1231	18.4585	18.9483	19.4797	19.8025	19.9611	19.9892	19.9894	19.8954	19.4451	18.7004	18.0578	(91)
MIT	18.1231	18.4585	18.9483	19.4797	19.8025	19.9611	19.9892	19.9894	19.8954	19.4451	18.7004	18.0578	(92)
Temperature adjustment													0.0000
adjusted MIT	18.1231	18.4585	18.9483	19.4797	19.8025	19.9611	19.9892	19.9894	19.8954	19.4451	18.7004	18.0578	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9532	0.9204	0.8572	0.7368	0.5839	0.3779	0.2407	0.2660	0.5233	0.7904	0.9220	0.9613	(94)
Useful gains	1902.7364	2262.2391	2536.6154	2603.9082	2214.8335	1484.9903	898.5450	926.5287	1634.1504	2021.1523	1889.2278	1764.1929	(95)
Ext temp.	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000	(96)
Heat loss rate W	4594.1231	4488.5494	4075.7475	3388.0908	2513.1280	1539.4756	907.6540	938.9344	1789.8367	2837.5281	3762.8671	4549.1682	(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	2002.3917	1496.0805	1145.1143	564.6115	221.9311	0.0000	0.0000	0.0000	0.0000	607.3836	1349.0202	2072.0217	(98)
Space heating												9458.5546	(98)
Space heating per m2											(98) / (4) =	28.9855	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													249.9000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3784.9358	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	2002.3917	1496.0805	1145.1143	564.6115	221.9311	0.0000	0.0000	0.0000	0.0000	607.3836	1349.0202	2072.0217	(98)	
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)	
Space heating fuel (main heating system)	801.2772	598.6717	458.2290	225.9350	88.8080	0.0000	0.0000	0.0000	0.0000	243.0507	539.8240	829.1403	(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	235.4292	207.5385	218.0327	195.5511	191.7056	171.3994	164.7091	180.6014	180.2400	202.7704	214.2841	229.7984	(64)	
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(216)	
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)	
Fuel for water heating, kWh/month	134.4542	118.5257	124.5190	111.6797	109.4835	97.8866	94.0657	103.1419	102.9355	115.8026	122.3782	131.2384	(219)	
Water heating fuel used												1366.1107	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3784.9358	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump												30.0000	(230c)	
Total electricity for the above, kWh/year												30.0000	(231)	
Electricity for lighting (calculated in Appendix L)												754.5372	(232)	
Total delivered energy for all uses												5935.5838	(238)	

10a. Fuel costs - using BEDF prices (509)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3784.9358	20.4300	773.2624	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1366.1107	20.4300	279.0964	(247)
Pumps and fans for heating	30.0000	20.4300	6.1290	(249)
Energy for lighting	754.5372	20.4300	154.1520	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1212.6398	(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	3784.9358	0.5190	1964.3817	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1366.1107	0.5190	709.0115	(264)
Space and water heating			2673.3932	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	754.5372	0.5190	391.6048	(268)
Total kg/year			3080.5680	(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	3784.9358	3.0700	11619.7529	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1366.1107	3.0700	4193.9599	(264)
Space and water heating			15813.7129	(265)
Pumps and fans	30.0000	3.0700	92.1000	(267)
Energy for lighting	754.5372	3.0700	2316.4293	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

18222.2422 (272)
55.8416 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(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	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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
N Solar water heating	+ 1.0	-£ 106	-268 kg (8.7%)
U Solar photovoltaic panels	+ 3.6	-£ 380	-966 kg (34.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£106	0.82 kg/m ²	B 88 B 89
Solar photovoltaic panels	£380	2.96 kg/m ²	B 91 A 92
Total Savings	£486	3.78 kg/m ²	

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 509 TEST (30 Nov 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£1213	£1107	£106
Space heating	£779	£780	-£0
Water heating	£279	£173	£106
Lighting	£154	£154	£0
Generated (PV)	-£0	-£380	£380
Total cost of fuels	£1213	£727	£486
Total cost of uses	£1212	£727	£486
Delivered energy	18 kWh/m ²	11 kWh/m ²	7 kWh/m ²
Carbon dioxide emissions	3.1 tonnes	1.8 tonnes	1.2 tonnes
CO2 emissions per m ²	9 kg/m ²	6 kg/m ²	4 kg/m ²
Primary energy	56 kWh/m ²	33 kWh/m ²	22 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	158.0200 (1b)	x 2.7800 (2b)	= 439.2956 (1b) - (3b)
First floor	168.3000 (1c)	x 2.2000 (2c)	= 370.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	326.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 809.5556 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.0741 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3241 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2755 (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	0.3513	0.3444	0.3375	0.3030	0.2962	0.2617	0.2617	0.2548	0.2755	0.2962	0.3099	0.3237 (22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524 (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
1.2 Window (Uw = 1.20)			63.9600	1.1450	73.2366		(27)
Half Glazed Door			7.0000	1.2000	8.4000		(26a)
Rooflight (Uw = 1.20)			11.9600	1.1450	13.6947		(27a)
Ground Floor			133.9200	0.1300	17.4096	110.0000	14731.2000 (28a)
Floor Over Garage			24.1000	0.1400	3.3740		(28b)
Cavity Walls	235.8900	68.6000	167.2900	0.1800	30.1122	60.0000	10037.4000 (29a)
Sheltered Garage	23.3800		23.3800	0.1524	3.5627	60.0000	1402.8000 (29a)
Dormer Walls	10.1400	2.3600	7.7800	0.1800	1.4004	18.0000	140.0400 (29a)
Ashlar Walls	5.3400		5.3400	0.1000	0.5340	18.0000	96.1200 (29a)
FF Plane	131.4700	7.2800	124.1900	0.1100	13.6609	9.0000	1117.7100 (30)
FF Sloped	44.8200		44.8200	0.1400	6.2748	9.0000	403.3800 (30)
GF Plane	2.9800		2.9800	0.1000	0.2980	9.0000	26.8200 (30)
GF Sloped	16.0300	4.6800	11.3500	0.1400	1.5890	9.0000	102.1500 (30)
Total net area of external elements Aum(A, m ²)			628.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	173.5469		(33)
Internal Wall			475.8000			9.0000	4282.2000 (32c)
Internal Floor			144.2000			18.0000	2595.6000 (32d)
GF Internal Ceiling			144.2000			18.0000	2595.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	37531.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							115.0129 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7237 (36)
Total fabric heat loss						(33) + (36) =	195.2707 (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	150.0578	149.4178	148.7905	145.8440	145.2928	142.7265	142.7265	142.2513	143.7150	145.2928	146.4080	147.5739 (38)
Heat transfer coeff	345.3284	344.6885	344.0612	341.1147	340.5634	337.9972	337.9972	337.5219	338.9857	340.5634	341.6787	342.8446 (39)
Average = Sum(39)m / 12 =												341.1121 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0583	1.0563	1.0544	1.0453	1.0436	1.0358	1.0358	1.0343	1.0388	1.0436	1.0471	1.0506 (40)
HLP (average)												1.0453 (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	3.1661 (42)
Average daily hot water use (litres/day)	109.3960 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.3356	115.9597	111.5839	107.2080	102.8322	98.4564	98.4564	102.8322	107.2080	111.5839	115.9597	120.3356	(44)
Energy content (annual)	178.4542	156.0772	161.0576	140.4140	134.7305	116.2622	107.7340	123.6264	125.1029	145.7953	159.1470	172.8233	(45)
Distribution loss (46)m = 0.15 x (45)m	26.7681	23.4116	24.1586	21.0621	20.2096	17.4393	16.1601	18.5440	18.7654	21.8693	23.8720	25.9235	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7830	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	235.4292	207.5385	216.6370	188.7975	178.9113	158.7926	151.6821	168.5050	174.8371	201.3746	214.2841	229.7984	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.0537	(H8)
Utilisation factor												0.6129	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												109.3960	(H14)
Volume ratio Veff/V												0.6856	(H15)
Solar storage volume factor												0.9245	(H16)
Solar input												-903.5899	(H17)
Solar input	-26.2023	-43.7241	-74.4672	-99.8007	-123.2954	-121.2190	-119.6170	-104.5100	-81.8523	-55.8955	-31.0797	-21.9269	(63)
Solar input (sum of months) = Sum(63)m =												-903.5899	(63)
Output from w/h	209.2269	163.8144	142.1698	88.9968	55.6159	37.5737	32.0651	63.9950	92.9849	145.4792	183.2044	207.8715	(64)
Total per year (kWh/year) = Sum(64)m =												1422.9975	(64)
Heat gains from water heating, kWh/month	104.9161	93.0647	98.0151	85.3945	80.1425	72.6815	70.9801	77.0087	81.3841	92.9404	97.0261	103.0438	(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	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.8126	94.8700	77.1534	58.4101	43.6622	36.8615	39.8302	51.7728	69.4893	88.2326	102.9805	109.7812	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	715.2907	722.7132	704.0088	664.1893	613.9244	566.6824	535.1219	527.6994	546.4038	586.2233	636.4882	683.7302	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	(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)	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	(71)
Water heating gains (Table 5)	141.0162	138.4892	131.7407	118.6034	107.7184	100.9466	95.4033	103.5063	113.0335	124.9199	134.7585	138.4997	(72)
Total internal gains	1086.6054	1079.5583	1036.3889	964.6888	888.7910	827.9765	793.8413	806.4644	852.4126	922.8617	997.7131	1055.4971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	16.5300	10.6334	0.6300	0.7000	0.7700	53.7176 (74)
East	7.6400	19.6403	0.6300	0.7000	0.7700	45.8577 (76)
South	36.9700	46.7521	0.6300	0.7000	0.7700	528.2288 (78)
West	2.8200	19.6403	0.6300	0.7000	0.7700	16.9265 (80)
North	2.4000	15.2954	0.6300	0.7000	1.0000	14.5698 (82)
East	5.4400	25.9287	0.6300	0.7000	1.0000	56.9531 (82)
South	1.8400	47.0123	0.6300	0.7000	1.0000	34.3329 (82)
West	2.2800	26.6072	0.6300	0.7000	1.0000	23.7546 (82)

Solar gains	774.3411	1341.4887	1895.4589	2449.4417	2835.9060	2856.0771	2736.6294	2442.0462	2086.3005	1498.7811	931.5743	660.0294	(83)
Total gains	1860.9465	2421.0470	2931.8478	3414.1305	3724.6969	3684.0535	3530.4707	3248.5106	2938.7131	2421.6429	1929.2874	1715.5265	(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	30.1895	30.2455	30.3007	30.5624	30.6119	30.8443	30.8443	30.8877	30.7543	30.6119	30.5120	30.4082	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

alpha	3.0126	3.0164	3.0200	3.0375	3.0408	3.0563	3.0563	3.0592	3.0503	3.0408	3.0341	3.0272
util living area	0.9773	0.9521	0.9061	0.8185	0.6886	0.5333	0.4033	0.4505	0.6617	0.8732	0.9604	0.9819 (86)
MIT	19.3791	19.6514	20.0050	20.3921	20.6767	20.8344	20.8873	20.8772	20.7578	20.3552	19.7836	19.3263 (87)
Th 2	20.0351	20.0367	20.0383	20.0457	20.0471	20.0536	20.0536	20.0548	20.0511	20.0471	20.0443	20.0413 (88)
util rest of house	0.9736	0.9446	0.8916	0.7912	0.6436	0.4683	0.3230	0.3673	0.5991	0.8473	0.9529	0.9789 (89)
MIT 2	17.8464	18.2399	18.7450	19.2879	19.6632	19.8571	19.9093	19.9029	19.7751	19.2522	18.4406	17.7742 (90)
Living area fraction									fLA = Living area / (4) =			0.0703 (91)
MIT	17.9541	18.3392	18.8336	19.3656	19.7344	19.9258	19.9780	19.9714	19.8442	19.3297	18.5350	17.8833 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9541	18.3392	18.8336	19.3656	19.7344	19.9258	19.9780	19.9714	19.8442	19.3297	18.5350	17.8833 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9623	0.9272	0.8692	0.7688	0.6275	0.4590	0.3164	0.3596	0.5841	0.8236	0.9368	0.9693 (94)
Useful gains	1790.8209	2244.7866	2548.4696	2624.9453	2337.1928	1690.9781	1116.9904	1168.2183	1716.4168	1994.4784	1807.4273	1662.8325 (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	4715.1648	4632.3243	4243.5010	3569.9588	2736.2390	1800.0960	1141.7662	1205.4100	1947.1965	2973.0145	3907.1010	4691.2523 (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	2175.7119	1604.4254	1261.1034	680.4097	296.8904	0.0000	0.0000	0.0000	0.0000	728.0309	1511.7650	2253.1443 (98)
Space heating												10511.4809 (98)
Space heating per m2										(98) / (4) =		32.2122 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4206.2749 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2175.7119	1604.4254	1261.1034	680.4097	296.8904	0.0000	0.0000	0.0000	0.0000	728.0309	1511.7650	2253.1443 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	870.6330	642.0270	504.6432	272.2728	118.8037	0.0000	0.0000	0.0000	0.0000	291.3289	604.9480	901.6184 (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	209.2269	163.8144	142.1698	88.9968	55.6159	37.5737	32.0651	63.9950	92.9849	145.4792	183.2044	207.8715 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)
Fuel for water heating, kWh/month	119.4900	93.5548	81.1935	50.8263	31.7624	21.4584	18.3125	36.5477	53.1039	83.0835	104.6285	118.7159 (219)
Water heating fuel used												812.6771 (219)
Annual totals kWh/year												
Space heating fuel - main system												4206.2749 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												754.5372 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)
Total delivered energy for all uses												4126.2498 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4206.2749	13.1900	554.8077 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	812.6771	13.1900	107.1921 (247)
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	754.5372	13.1900	99.5235 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			544.2523 (255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.6156 (257)
SAP value		91.4123
SAP rating (Section 12)		91 (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	4206.2749	0.5190	2183.0567	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	812.6771	0.5190	421.7794	(264)
Space and water heating			2604.8361	(265)
Pumps and fans	80.0000	0.5190	41.5200	(267)
Energy for lighting	754.5372	0.5190	391.6048	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			2141.5236	(272)
CO2 emissions per m2			6.5600	(273)
EI value			92.2718	
EI rating			92	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	158.0200 (1b)	x 2.7800 (2b)	= 439.2956 (1b) - (3b)
First floor	168.3000 (1c)	x 2.2000 (2c)	= 370.2600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	326.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 809.5556 (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												6 * 10 =	60.0000 (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) =						60.0000 / (5) =		0.0741 (8)
Pressure test												Yes		
Measured/design AP50														5.0000
Infiltration rate														0.3241 (18)
Number of sides sheltered														2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =		0.2755 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000	(22)	
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750	(22a)	
Adj infilt rate	0.3168	0.3030	0.3030	0.2824	0.2824	0.2548	0.2548	0.2411	0.2617	0.2893	0.2755	0.2962	(22b)	
Effective ac	0.5502	0.5459	0.5459	0.5399	0.5399	0.5325	0.5325	0.5291	0.5342	0.5418	0.5379	0.5439	(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
1.2 Window (Uw = 1.20)			63.9600	1.1450	73.2366		(27)
Half Glazed Door			7.0000	1.2000	8.4000		(26a)
Rooflight (Uw = 1.20)			11.9600	1.1450	13.6947		(27a)
Ground Floor			133.9200	0.1300	17.4096	110.0000	14731.2000 (28a)
Floor Over Garage			24.1000	0.1400	3.3740		(28b)
Cavity Walls	235.8900	68.6000	167.2900	0.1800	30.1122	60.0000	10037.4000 (29a)
Sheltered Garage	23.3800		23.3800	0.1524	3.5627	60.0000	1402.8000 (29a)
Dormer Walls	10.1400	2.3600	7.7800	0.1800	1.4004	18.0000	140.0400 (29a)
Ashlar Walls	5.3400		5.3400	0.1000	0.5340	18.0000	96.1200 (29a)
FF Plane	131.4700	7.2800	124.1900	0.1100	13.6609	9.0000	1117.7100 (30)
FF Sloped	44.8200		44.8200	0.1400	6.2748	9.0000	403.3800 (30)
GF Plane	2.9800		2.9800	0.1000	0.2980	9.0000	26.8200 (30)
GF Sloped	16.0300	4.6800	11.3500	0.1400	1.5890	9.0000	102.1500 (30)
Total net area of external elements Aum(A, m ²)			628.0700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	173.5469		(33)
Internal Wall			475.8000			9.0000	4282.2000 (32c)
Internal Floor			144.2000			18.0000	2595.6000 (32d)
GF Internal Ceiling			144.2000			18.0000	2595.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	37531.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							115.0129 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.7237 (36)
Total fabric heat loss						(33) + (36) =	195.2707 (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	146.9846	145.8440	145.8440	144.2282	144.2282	142.2513	142.2513	141.3388	142.7265	144.7542	143.7150	145.2928 (38)
Heat transfer coeff	342.2553	341.1147	341.1147	339.4989	339.4989	337.5219	337.5219	336.6095	337.9972	340.0248	338.9857	340.5634 (39)
Average = Sum(39)m / 12 =												339.3922 (39)
HLP	Jan 1.0488	Feb 1.0453	Mar 1.0453	Apr 1.0404	May 1.0404	Jun 1.0343	Jul 1.0343	Aug 1.0315	Sep 1.0358	Oct 1.0420	Nov 1.0388	Dec 1.0436 (40)
HLP (average)												1.0401 (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	3.1661 (42)
Average daily hot water use (litres/day)	109.3960 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.3356	115.9597	111.5839	107.2080	102.8322	98.4564	98.4564	102.8322	107.2080	111.5839	115.9597	120.3356	(44)
Energy content (annual)	178.4542	156.0772	161.0576	140.4140	134.7305	116.2622	107.7340	123.6264	125.1029	145.7953	159.1470	172.8233	(45)
Distribution loss (46)m = 0.15 x (45)m	26.7681	23.4116	24.1586	21.0621	20.2096	17.4393	16.1601	18.5440	18.7654	21.8693	23.8720	25.9235	(46)
Water storage loss:													
Store volume												250.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7800	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.0875	(55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	235.4292	207.5385	216.6370	188.7975	178.9113	158.7926	151.6821	168.5050	174.8371	201.3746	214.2841	229.7984	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1162.7634	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1953.4426	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1349	(H8)
Utilisation factor												0.5857	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												109.3960	(H14)
Volume ratio Veff/V												0.6856	(H15)
Solar storage volume factor												0.9245	(H16)
Solar input												-930.0478	(H17)
Solar input	-29.8945	-43.6328	-73.1392	-100.6288	-120.6333	-125.5692	-122.6256	-109.6694	-85.9261	-59.1072	-34.0675	-25.1542	(63)
Output from w/h	205.5347	163.9057	143.4977	88.1687	58.2780	33.2235	29.0565	58.8356	88.9111	142.2674	180.2167	204.6442	(64)
Heat gains from water heating, kWh/month	104.9161	93.0647	98.0151	85.3945	80.1425	72.6815	70.9801	77.0087	81.3841	92.9404	97.0261	103.0438	(65)
Total per year (kWh/year) = Sum(64)m =												1396.5397	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	189.9688	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.8126	94.8700	77.1534	58.4101	43.6622	36.8615	39.8302	51.7728	69.4893	88.2326	102.9805	109.7812	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	715.2907	722.7132	704.0088	664.1893	613.9244	566.6824	535.1219	527.6994	546.4038	586.2233	636.4882	683.7302	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	57.1630	(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)	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	-126.6458	(71)
Water heating gains (Table 5)	141.0162	138.4892	131.7407	118.6034	107.7184	100.9466	95.4033	103.5063	113.0335	124.9199	134.7585	138.4997	(72)
Total internal gains	1086.6054	1079.5583	1036.3889	964.6888	888.7910	827.9765	793.8413	806.4644	852.4126	922.8617	997.7131	1055.4971	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W	
North	16.5300	12.7650	0.6300	0.7000	0.7700	64.4862	(74)
East	7.6400	23.8018	0.6300	0.7000	0.7700	55.5743	(76)
South	36.9700	54.2217	0.6300	0.7000	0.7700	612.6246	(78)
West	2.8200	23.8018	0.6300	0.7000	0.7700	20.5130	(80)
North	2.4000	18.1686	0.6300	0.7000	1.0000	17.3067	(82)
East	5.4400	31.5957	0.6300	0.7000	1.0000	69.5233	(82)
South	1.8400	55.6527	0.6300	0.7000	1.0000	40.6430	(82)
West	2.2800	32.5082	0.6300	0.7000	1.0000	28.9831	(82)

Solar gains	909.6543	1378.4137	1921.3508	2561.7568	2890.4437	3087.4047	2925.4765	2663.1601	2264.4313	1632.8050	1051.2878	779.7889	(83)
Total gains	1996.2597	2457.9720	2957.7397	3526.4456	3779.2347	3915.3811	3719.3178	3469.6245	3116.8438	2555.6667	2049.0010	1835.2859	(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	30.4605	30.5624	30.5624	30.7079	30.7079	30.8877	30.8877	30.9714	30.8443	30.6604	30.7543	30.6119		

FULL SAP CALCULATION PRINTOUT

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

alpha	3.0307	3.0375	3.0375	3.0472	3.0472	3.0592	3.0592	3.0648	3.0563	3.0440	3.0503	3.0408
util living area	0.9710	0.9469	0.8962	0.7898	0.6491	0.4544	0.3278	0.3575	0.6040	0.8450	0.9496	0.9766 (86)
MIT	19.4947	19.7318	20.0836	20.4750	20.7296	20.8686	20.9004	20.8971	20.8023	20.4410	19.8980	19.4464 (87)
Th 2	20.0428	20.0457	20.0457	20.0498	20.0498	20.0548	20.0548	20.0571	20.0536	20.0485	20.0511	20.0471 (88)
util rest of house	0.9663	0.9385	0.8800	0.7587	0.5994	0.3862	0.2473	0.2732	0.5363	0.8140	0.9400	0.9727 (89)
MIT 2	18.0194	18.3622	18.8619	19.4027	19.7309	19.8922	19.9202	19.9207	19.8264	19.3693	18.6098	17.9528 (90)
Living area fraction									fLA = Living area / (4) =			0.0703 (91)
MIT	18.1231	18.4585	18.9478	19.4781	19.8011	19.9608	19.9891	19.9893	19.8950	19.4446	18.7004	18.0578 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1231	18.4585	18.9478	19.4781	19.8011	19.9608	19.9891	19.9893	19.8950	19.4446	18.7004	18.0578 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9532	0.9204	0.8573	0.7376	0.5854	0.3791	0.2416	0.2670	0.5241	0.7906	0.9220	0.9613 (94)
Useful gains	1902.7364	2262.2391	2535.7030	2601.0541	2212.3371	1484.4107	898.4299	926.3753	1633.3946	2020.4425	1889.2278	1764.1929 (95)
Ext temp.	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000 (96)
Heat loss rate W	4594.1231	4488.5494	4075.5648	3387.5380	2512.6682	1539.3730	907.6328	938.9063	1789.6990	2837.3877	3762.8671	4549.1682 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	2002.3917	1496.0805	1145.6572	566.2684	223.4464	0.0000	0.0000	0.0000	0.0000	607.8072	1349.0202	2072.0217 (98)
Space heating												9462.6933 (98)
Space heating per m2										(98) / (4) =		28.9982 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3786.5919 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2002.3917	1496.0805	1145.6572	566.2684	223.4464	0.0000	0.0000	0.0000	0.0000	607.8072	1349.0202	2072.0217 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	801.2772	598.6717	458.4462	226.5980	89.4143	0.0000	0.0000	0.0000	0.0000	243.2202	539.8240	829.1403 (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	205.5347	163.9057	143.4977	88.1687	58.2780	33.2235	29.0565	58.8356	88.9111	142.2674	180.2167	204.6442 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (217)
Fuel for water heating, kWh/month	117.3813	93.6069	81.9519	50.3533	33.2827	18.9740	16.5942	33.6011	50.7773	81.2492	102.9221	116.8728 (219)
Water heating fuel used												797.5669 (219)
Annual totals kWh/year												
Space heating fuel - main system												3786.5919 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												754.5372 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1163 * 0.80) =									-1860.4215			-1860.4215 (233)
Total delivered energy for all uses												3558.2746 (238)

10a. Fuel costs - using BEDF prices (509)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3786.5919	20.4300	773.6007 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	797.5669	20.4300	162.9429 (247)
Pumps and fans for heating	30.0000	20.4300	6.1290 (249)
Pump for solar water heating	50.0000	20.4300	10.2150 (249)
Energy for lighting	754.5372	20.4300	154.1520 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1860.4215	20.4300	-380.0841 (252)
Total energy cost			726.9555 (255)

FULL SAP CALCULATION PRINTOUT

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

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	3786.5919	0.5190	1965.2412 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	797.5669	0.5190	413.9372 (264)
Space and water heating			2379.1785 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	754.5372	0.5190	391.6048 (268)
Energy saving/generation technologies			
PV Unit	-1860.4215	0.5190	-965.5587 (269)
Total kg/year			1846.7445 (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	3786.5919	3.0700	11624.8373 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	797.5669	3.0700	2448.5304 (264)
Space and water heating			14073.3677 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	754.5372	3.0700	2316.4293 (268)
Energy saving/generation technologies			
PV Unit	-1860.4215	3.0700	-5711.4940 (269)
Primary energy kWh/year			10923.9031 (272)
Primary energy kWh/m2/year			33.4760 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	115.0 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	2137.23 (P1)
Transmission heat loss coefficient	195.27 (37)
Summer heat loss coefficient	2332.50 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	0.850	0.90	1.000	0.765 (P8)
North	0.850	1.00	1.000	0.850 (P8)
East	0.850	0.90	1.000	0.765 (P8)
East	0.850	1.00	1.000	0.850 (P8)
East	1.000	1.00	1.000	1.000 (P8)
South	0.850	0.90	1.000	0.765 (P8)
South	0.850	1.00	1.000	0.850 (P8)
West	0.850	0.90	1.000	0.765 (P8)
West	1.000	1.00	1.000	1.000 (P8)
West	0.850	1.00	1.000	0.850 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	16.5300	81.1852	0.6300	0.7000	0.7650	407.4667
East	7.6400	117.5071	0.6300	0.7000	0.7650	272.5837
South	36.9700	112.2060	0.6300	0.7000	0.7650	1259.5287
West	2.8200	117.5071	0.6300	0.7000	0.7650	100.6134
North	2.4000	145.8913	0.6300	0.7000	0.8500	118.1247
East	5.4400	176.6135	0.6300	0.7000	0.8500	381.8825
South	1.8400	190.8804	0.6300	0.7000	0.8500	118.4893
West	2.2800	190.5387	0.6300	0.7000	1.0000	153.1747

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

total:				2811.8636
	Jun	Jul	Aug	
Solar gains	2968	2812	2560	(P3)
Internal gains	839	805	816	
Total summer gains	3807	3617	3377	(P5)
Summer gain/loss ratio	1.63	1.55	1.45	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 115.0)	1.19	1.19	1.19	
Threshold temperature	18.83	20.65	20.44	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)



Property Reference	21 Derby Road	Issued on Date	03/01/2023
Assessment Reference	2318N	Prop Type Ref	
Property	21, Derby Road, Reading, RG4 5HE		
SAP Rating	87 B	DER	10.76
Environmental	88 B	TER	18.56
CO ₂ Emissions (t/year)	3.08	% DER<TER	42.03
General Requirements Compliance	Pass	DFEE	39.49
		TFEE	51.96
		% DFEE<TFEE	23.99
Assessor Details	Mrs. Nikki Kells, Nikki Kells, Tel: 020 3723 1613, info@sapsuk.co.uk		Assessor ID
Client	Zoe Lewis Architects, Zoe Lewis Architects		

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	18.56	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.76	kgCO ₂ /m ²	Pass
	-7.80 (-42.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.96	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	39.49	kWh/m ² /yr	
	-12.5 (-24.0%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	Pass
Floor	0.13 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Air-to-water heat pump	
Secondary heating system	None	

5 Cylinder insulation

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)



Hot water storage	Nominal cylinder loss: 2.01 kWh/day Permitted by DBSCG 2.56	Pass
Primary pipework insulated	Yes	Pass

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	Cylinderstat	Pass
	Independent timer for DHW	Pass

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Slight	Pass
Based on:		
Overshading	Average	
Windows facing North	16.53 m ² , No overhang	
Windows facing East	7.64 m ² , No overhang	
Windows facing South	36.97 m ² , No overhang	
Windows facing West	2.82 m ² , No overhang	
Air change rate	8.00 ach	
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours	

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

10 Key features

External wall U-value	0.10	W/m ² K
Roof U-value	0.11	W/m ² K
Roof U-value	0.10	W/m ² K
Thermal bridging y-value	0.035	W/m ² K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.