

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 85			Issued on Date	27/04/2023
Assessment Reference	85 Hamblewood	Prop Type Ref	21809		
Property	3 Hickory Way, HEDGE END, SO30 0AW				
SAP Rating	87 B	DER	14.94	TER	19.49
Environmental	90 B	% DER<TER	23.35		
CO ₂ Emissions (t/year)	0.73	DFEE	47.31	TFEE	52.91
General Requirements Compliance	Pass	% DFEE<TFEE	10.58		
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk			Assessor ID	Y128-0001
Client					

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

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DWELLING AS BUILT

End-Terrace House, total floor area 69 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.49 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.94 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.89 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1600 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading:
Average
Windows facing South East: 4.40 m², No overhang
Windows facing South West: 0.65 m², No overhang
Windows facing North West: 3.30 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.9 m³/m²h
Photovoltaic array 0.60 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												3.8900
Infiltration rate												0.1945 (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) =	0.1653 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2108	0.2067	0.2025	0.1819	0.1777	0.1571	0.1571	0.1529	0.1653	0.1777	0.1860	0.1943 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			8.3500	1.3258	11.0701		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	12.5500	71.7900	0.2700	19.3833	150.0000	10768.4995 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			153.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.4514		(33)
party			40.4000	0.0000	0.0000	45.0000	1818.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17658.2994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							255.1777 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss						(33) + (36) =	50.2989 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293 (39)
Average = Sum(39)m / 12 =												79.1293 (39)
HLP	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435 (40)
HLP (average)												1.1435 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2265 (42)
Average daily hot water use (litres/day)	87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1370.1151 (45)
	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month												
	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (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												
	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)
								Total per year (kWh/year) = Sum(64)m =				1534.9792 (64)
Heat gains from water heating, kWh/month												
	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (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	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.3142	17.1547	13.9512	10.5619	7.8952	6.6654	7.2022	9.3617	12.5653	15.9545	18.6213	19.8510 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.4228	197.4506	192.3404	181.4615	167.7287	154.8219	146.1993	144.1714	149.2816	160.1606	173.8933	186.8002 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	342.3515	340.2010	327.6995	307.7401	287.6450	268.3067	255.8022	261.5982	271.9266	292.0848	315.1357	332.2592 (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			
Southeast	4.4000				36.7938		0.4500		0.0000		0.7700		56.0959 (77)	
Southwest	0.6500				36.7938		0.4500		0.0000		0.7700		8.2869 (79)	
Northwest	3.3000				11.2829		0.4500		0.0000		0.7700		12.9015 (81)	
Solar gains	77.2842	135.9290	197.3667	263.6259	312.6975	318.0963	303.4910	265.7103	220.1282	153.2996	93.3491	65.6342	(83)	
Total gains	419.6358	476.1300	525.0662	571.3661	600.3425	586.4030	559.2932	527.3086	492.0548	445.3844	408.4848	397.8934	(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	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882
alpha	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325
util living area												
	0.9981	0.9960	0.9901	0.9702	0.9091	0.7701	0.6007	0.6547	0.8772	0.9799	0.9961	0.9986 (86)
MIT	19.7933	19.9308	20.1611	20.4611	20.7459	20.9266	20.9837	20.9749	20.8471	20.4833	20.0735	19.7540 (87)
Th 2	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655 (88)
util rest of house												
	0.9974	0.9946	0.9864	0.9581	0.8706	0.6798	0.4706	0.5248	0.8115	0.9694	0.9945	0.9981 (89)
MIT 2	18.8679	19.0048	19.2334	19.5267	19.7898	19.9308	19.9613	19.9582	19.8788	19.5520	19.1476	18.8286 (90)
Living area fraction												
MIT	19.0671	19.2042	19.4332	19.7279	19.9957	20.1453	20.1814	20.1772	20.0873	19.7525	19.3469	19.0279 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.9171	19.0542	19.2832	19.5779	19.8457	19.9953	20.0314	20.0272	19.9373	19.6025	19.1969	18.8779 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9831	0.9522	0.8652	0.6827	0.4793	0.5331	0.8094	0.9644	0.9927	0.9973	(94)
Useful gains	418.1634	472.7191	516.1826	544.0497	519.3938	400.3609	268.0622	281.1080	398.2547	429.5086	405.5085	396.8209	(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													
	1156.6438	1120.0139	1011.5239	844.9373	644.5610	426.9227	271.5270	287.0142	461.9032	712.3605	957.2230	1161.4497	(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													
	549.4294	434.9821	368.5339	216.6391	93.1244	0.0000	0.0000	0.0000	0.0000	210.4418	397.2344	568.8838	(98)
Space heating												2839.2690	(98)
Space heating per m2												(98) / (4) =	41.0299 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	90.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	3137.3138 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	549.4294	434.9821	368.5339	216.6391	93.1244	0.0000	0.0000	0.0000	0.0000	210.4418	397.2344	568.8838 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	607.1043	480.6432	407.2198	239.3802	102.8999	0.0000	0.0000	0.0000	0.0000	232.5324	438.9330	628.6009 (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	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)
Efficiency of water heater (217)m	89.7718	89.7126	89.5856	89.3004	88.6621	87.3000	87.3000	87.3000	87.3000	89.2504	89.6425	87.3000 (216)
Fuel for water heating, kWh/month	173.9240	152.6427	158.7685	140.3273	136.7150	121.4582	114.1757	128.7033	129.5534	145.7234	156.4842	168.8531 (219)
Water heating fuel used												1727.3288 (219)
Annual totals kWh/year												
Space heating fuel - main system												3137.3138 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)												
mechanical ventilation fans (SFP = 0.2116)												45.1040 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												120.1040 (231)
Electricity for lighting (calculated in Appendix L)												341.0956 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 + 0.60 + 1029 + 1.00) =												-494.0096 (233)
Total delivered energy for all uses												4831.8325 (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	3137.3138	0.2160	677.6598 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1727.3288	0.2160	373.1030 (264)
Space and water heating			1050.7628 (265)
Pumps and fans	120.1040	0.5190	62.3340 (267)
Energy for lighting	341.0956	0.5190	177.0286 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total CO2, kg/year			1033.7344 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9400 (273)

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

DER		14.9400 ZC1
Total Floor Area	TFA	69.2000
Assumed number of occupants	N	2.2265
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.7346 ZC2
CO2 emissions from cooking, equation (L16)		2.4919 ZC3
Total CO2 emissions		34.1665 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		34.1665 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	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1145 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3645 (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) =	0.3098 (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	0.3950	0.3872	0.3795	0.3408	0.3330	0.2943	0.2943	0.2866	0.3098	0.3330	0.3485	0.3640 (22b)
Effective ac	0.5780	0.5750	0.5720	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5607	0.5663 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Semi-glazed door			2.1000	1.2000	2.5200		(26a)
TER Opening Type (Uw = 1.40)			8.3500	1.3258	11.0701		(27)
ground			34.6000	0.1300	4.4980		(28a)
external	84.3400	12.5500	71.7900	0.1800	12.9222		(29a)
cd	34.6000		34.6000	0.1300	4.4980		(30)
Total net area of external elements Aum(A, m ²)			153.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.6083		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8390 (36)
Total fabric heat loss						(33) + (36) =	46.4473 (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	33.3284	33.1537	32.9825	32.1784	32.0280	31.3276	31.3276	31.1979	31.5974	32.0280	32.3323	32.6505 (38)
Heat transfer coeff	79.7757	79.6010	79.4298	78.6257	78.4752	77.7749	77.7749	77.6452	78.0446	78.4752	78.7796	79.0978 (39)
Average = Sum(39)m / 12 =												78.6250 (39)
HLP	1.1528	1.1503	1.1478	1.1362	1.1340	1.1239	1.1239	1.1220	1.1278	1.1340	1.1384	1.1430 (40)
HLP (average)												1.1362 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2265 (42)
Average daily hot water use (litres/day)												87.0805 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (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)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	48.8128	42.4857	45.2628	42.0849	41.7127	38.6494	39.9377	41.7127	42.0849	45.2628	45.5204	48.8128 (61)
Total heat required for water heating calculated for each month	190.8644	166.7250	173.4666	153.8561	148.9598	131.1955	125.6953	140.1208	141.6683	161.3176	172.2033	186.3822 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	190.8644	166.7250	173.4666	153.8561	148.9598	131.1955	125.6953	140.1208	141.6683	161.3176	172.2033	186.3822 (64)
Heat gains from water heating, kWh/month	59.4354	51.9310	53.9435	47.6851	46.0878	40.4339	38.4988	43.1489	43.6327	49.9039	53.5022	57.9450 (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	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.3142	17.1547	13.9512	10.5619	7.8952	6.6654	7.2022	9.3617	12.5653	15.9545	18.6213	19.8510 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.4228	197.4506	192.3404	181.4615	167.7287	154.8219	146.1993	144.1714	149.2816	160.1606	173.8933	186.8002 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	79.8862	77.2783	72.5046	66.2294	61.9460	56.1582	51.7457	57.9958	60.6010	67.0752	74.3086	77.8831 (72)
Total internal gains	354.0214	351.2818	338.1945	317.6510	296.9681	277.0437	264.5455	270.9271	281.8461	302.5885	326.2214	343.9325 (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			
Southeast				4.4000	36.7938	0.6300	0.7000	0.7700	49.4766 (77)			
Southwest				0.6500	36.7938	0.6300	0.7000	0.7700	7.3090 (79)			
Northwest				3.3000	11.2829	0.6300	0.7000	0.7700	11.3791 (81)			
Solar gains	68.1647	119.8894	174.0774	232.5181	275.7992	280.5609	267.6791	234.3565	194.1531	135.2102	82.3339	57.8894 (83)
Total gains	422.1861	471.1712	512.2719	550.1690	572.7673	557.6047	532.2245	505.2837	475.9992	437.7987	408.5553	401.8219 (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	60.2384	60.3705	60.5007	61.1194	61.2366	61.7880	61.7880	61.8912	61.5745	61.2366	61.0000	60.7546
alpha	5.0159	5.0247	5.0334	5.0746	5.0824	5.1192	5.1192	5.1261	5.1050	5.0824	5.0667	5.0503
util living area	0.9979	0.9958	0.9905	0.9728	0.9185	0.7857	0.6173	0.6671	0.8832	0.9800	0.9957	0.9983 (86)
MIT	19.7643	19.8975	20.1252	20.4338	20.7227	20.9187	20.9814	20.9726	20.8390	20.4731	20.0640	19.7394 (87)
Th 2	19.9579	19.9600	19.9620	19.9714	19.9731	19.9814	19.9814	19.9829	19.9782	19.9731	19.9696	19.9658 (88)
util rest of house	0.9971	0.9944	0.9870	0.9618	0.8832	0.6985	0.4873	0.5386	0.8204	0.9697	0.9940	0.9978 (89)
MIT 2	18.3126	18.5085	18.8411	19.2911	19.6873	19.9233	19.9741	19.9708	19.8420	19.3531	18.7589	18.2818 (90)
Living area fraction	18.6252	18.8076	19.1176	19.5372	19.9103	20.1376	20.1910	20.1865	20.0567	19.5943	19.0399	18.5957 (92)
Temperature adjustment	18.6252	18.8076	19.1176	19.5372	19.9103	20.1376	20.1910	20.1865	20.0567	19.5943	19.0399	18.5957 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9957	0.9921	0.9830	0.9557	0.8806	0.7134	0.5154	0.5661	0.8262	0.9645	0.9917	0.9966 (94)
Ext temp.	420.3785	467.4490	503.5763	525.7782	504.3711	397.7814	274.2989	286.0602	393.2530	422.2752	405.1544	400.4691 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1142.8006	1107.0567	1002.2126	836.3552	644.3023	430.6888	279.2858	294.0065	464.8846	705.8275	940.6240	1138.6647 (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	537.4821	429.8164	370.9855	223.6154	104.1088	0.0000	0.0000	0.0000	0.0000	210.9629	385.5382	549.2176 (98)
Space heating per m2												2811.7268 (98)
										(98) / (4) =		40.6319 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3010.4142 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	537.4821	429.8164	370.9855	223.6154	104.1088	0.0000	0.0000	0.0000	0.0000	210.9629	385.5382	549.2176	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	575.4626	460.1888	397.2007	239.4170	111.4656	0.0000	0.0000	0.0000	0.0000	225.8704	412.7817	588.0274	(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	190.8644	166.7250	173.4666	153.8561	148.9598	131.1955	125.6953	140.1208	141.6683	161.3176	172.2033	186.3822	(64)
Efficiency of water heater (217)m	87.5155	87.3301	86.9169	85.9915	84.1686	80.3000	80.3000	80.3000	80.3000	85.7276	87.0206	87.6080	(216)
Fuel for water heating, kWh/month	218.0922	190.9136	199.5775	178.9201	176.9780	163.3817	156.5321	174.4966	176.4238	188.1746	197.8879	212.7456	(219)
Water heating fuel used												2234.1238	(219)
Annual totals kWh/year													
Space heating fuel - main system												3010.4142	(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)												341.0956	(232)
Total delivered energy for all uses												5660.6335	(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	3010.4142	0.2160	650.2495 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2234.1238	0.2160	482.5707 (264)
Space and water heating			1132.8202 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	341.0956	0.5190	177.0286 (268)
Total CO2, kg/m2/year			1348.7738 (272)
Emissions per m2 for space and water heating			16.3702 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5582 (272b)
Emissions per m2 for pumps and fans			0.5625 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3702 * 1.00) + 2.5582 + 0.5625, rounded to 2 d.p.			19.4900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1145 (8)
Pressure test					Yes
Measured/design AP50					3.8900
Infiltration rate					0.3090 (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) =	0.2626 (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	0.3348	0.3283	0.3217	0.2889	0.2823	0.2495	0.2495	0.2429	0.2626	0.2823	0.2954	0.3086 (22b)
Effective ac	0.5561	0.5539	0.5517	0.5417	0.5399	0.5311	0.5311	0.5295	0.5345	0.5399	0.5436	0.5476 (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
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			8.3500	1.3258	11.0701		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	12.5500	71.7900	0.2700	19.3833	150.0000	10768.4995 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			153.5400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.4514		(33)
party			40.4000	0.0000	0.0000	45.0000	1818.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17658.2994 (34)
255.1777 (35)
6.8475 (36)
(33) + (36) = 50.2989 (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	32.0628	31.9373	31.8143	31.2364	31.1283	30.6250	30.6250	30.5318	30.8188	31.1283	31.3470	31.5757 (38)
Heat transfer coeff	82.3617	82.2362	82.1131	81.5353	81.4272	80.9238	80.9238	80.8306	81.1177	81.4272	81.6459	81.8745 (39)
Average = Sum(39)m / 12 =												81.5348 (39)
HLP	1.1902	1.1884	1.1866	1.1783	1.1767	1.1694	1.1694	1.1681	1.1722	1.1767	1.1799	1.1832 (40)
HLP (average)												1.1782 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2265 (42)
Average daily hot water use (litres/day)												87.0805 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy conte	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Energy content (annual)										Total = Sum(45)m =		1370.1151 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	30.1860	26.4008	27.2433	23.7514	22.7900	19.6660	18.2235	20.9117	21.1615	24.6616	26.9201	29.2335 (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	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.3142	17.1547	13.9512	10.5619	7.8952	6.6654	7.2022	9.3617	12.5653	15.9545	18.6213	19.8510	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.4228	197.4506	192.3404	181.4615	167.7287	154.8219	146.1993	144.1714	149.2816	160.1606	173.8933	186.8002	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	(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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	(71)
Water heating gains (Table 5)	40.5725	39.2870	36.6173	32.9880	30.6317	27.3140	24.4939	28.1071	29.3909	33.1474	37.3890	39.2923	(72)
Total internal gains	311.7077	310.2905	299.3072	281.4096	262.6538	245.1994	234.2937	238.0385	247.6360	265.6607	286.3019	302.3418	(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
Southeast				4.4000	36.7938		0.4500		0.0000		0.7700		56.0959 (77)
Southwest				0.6500	36.7938		0.4500		0.0000		0.7700		8.2869 (79)
Northwest				3.3000	11.2829		0.4500		0.0000		0.7700		12.9015 (81)
Solar gains	77.2842	135.9290	197.3667	263.6259	312.6975	318.0963	303.4910	265.7103	220.1282	153.2996	93.3491	65.6342	(83)
Total gains	388.9920	446.2195	496.6738	545.0356	575.3513	563.2957	537.7847	503.7488	467.7643	418.9603	379.6510	367.9760	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.5554	59.6463	59.7357	60.1590	60.2389	60.6136	60.6136	60.6835	60.4687	60.2389	60.0775	59.9098	
alpha	4.9704	4.9764	4.9824	5.0106	5.0159	5.0409	5.0409	5.0456	5.0312	5.0159	5.0052	4.9940	
util living area	0.9987	0.9970	0.9925	0.9764	0.9251	0.7975	0.6316	0.6884	0.8993	0.9850	0.9972	0.9990	(86)
MIT	19.6915	19.8341	20.0744	20.3963	20.7010	20.9086	20.9782	20.9667	20.8150	20.4230	19.9955	19.6621	(87)
Th 2	19.9278	19.9293	19.9307	19.9374	19.9387	19.9445	19.9445	19.9456	19.9423	19.9387	19.9362	19.9335	(88)
util rest of house	0.9982	0.9960	0.9896	0.9664	0.8907	0.7088	0.4953	0.5542	0.8396	0.9768	0.9960	0.9986	(89)
MIT 2	18.7362	18.8796	19.1197	19.4416	19.7282	19.9003	19.9388	19.9357	19.8343	19.4720	19.0464	18.7113	(90)
Living area fraction									fLA = Living area / (4) =			0.2153	(91)
MIT	18.9419	19.0851	19.3253	19.6472	19.9377	20.1174	20.1626	20.1577	20.0455	19.6767	19.2508	18.9161	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9419	19.0851	19.3253	19.6472	19.9377	20.1174	20.1626	20.1577	20.0455	19.6767	19.2508	18.9161	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9948	0.9874	0.9628	0.8907	0.7251	0.5251	0.5834	0.8467	0.9740	0.9949	0.9981	(94)
Ext temp.	388.0393	443.9039	490.3991	524.7849	512.4569	408.4523	282.3914	293.8846	396.0469	408.0769	377.7309	367.2915	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1205.9307	1166.5304	1053.1250	876.2719	670.7701	446.4903	288.3010	303.7394	482.2842	739.0936	992.0610	1204.8706	(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	608.5113	485.6050	418.6681	253.0706	117.7850	0.0000	0.0000	0.0000	0.0000	246.2765	442.3177	623.1589	(98)
Space heating per m2												3195.3931	(98)
										(98) / (4) =		46.1762	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	760.6841	598.8364	614.3128	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8239	0.8970	0.8699	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	626.7268	537.1285	534.3733	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	741.9726	710.5539	672.3800	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	82.9770	129.0285	102.6770	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												314.6825 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	20.7442	32.2571	25.6693	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												78.6706 (107)
Space cooling per m2												1.1369 (108)
Energy for space heating												46.1762 (99)
Energy for space cooling												1.1369 (108)
Total												47.3131 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1145 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3645 (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) =	0.3098 (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	0.3950	0.3872	0.3795	0.3408	0.3330	0.2943	0.2943	0.2866	0.3098	0.3330	0.3485	0.3640 (22b)
Effective ac	0.5780	0.5750	0.5720	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5607	0.5663 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Semi-glazed door			2.1000	1.2000	2.5200		(26a)
TER Opening Type (Uw = 1.40)			8.3500	1.3258	11.0701		(27)
ground			34.6000	0.1300	4.4980		(28a)
external	84.3400	12.5500	71.7900	0.1800	12.9222		(29a)
cd	34.6000		34.6000	0.1300	4.4980		(30)
Total net area of external elements Aum(A, m ²)			153.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.6083		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8390 (36)
Total fabric heat loss						(33) + (36) =	46.4473 (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	33.3284	33.1537	32.9825	32.1784	32.0280	31.3276	31.3276	31.1979	31.5974	32.0280	32.3323	32.6505 (38)
Heat transfer coeff	79.7757	79.6010	79.4298	78.6257	78.4752	77.7749	77.7749	77.6452	78.0446	78.4752	78.7796	79.0978 (39)
Average = Sum(39)m / 12 =												78.6250 (39)
HLP	1.1528	1.1503	1.1478	1.1362	1.1340	1.1239	1.1239	1.1220	1.1278	1.1340	1.1384	1.1430 (40)
HLP (average)												1.1362 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2265 (42)
Average daily hot water use (litres/day)												87.0805 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m												1370.1151 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	30.1860	26.4008	27.2433	23.7514	22.7900	19.6660	18.2235	20.9117	21.1615	24.6616	26.9201	29.2335 (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	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	111.3273	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.3142	17.1547	13.9512	10.5619	7.8952	6.6654	7.2022	9.3617	12.5653	15.9545	18.6213	19.8510	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	195.4228	197.4506	192.3404	181.4615	167.7287	154.8219	146.1993	144.1714	149.2816	160.1606	173.8933	186.8002	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	34.1327	(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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	(71)
Water heating gains (Table 5)	40.5725	39.2870	36.6173	32.9880	30.6317	27.3140	24.4939	28.1071	29.3909	33.1474	37.3890	39.2923	(72)
Total internal gains	311.7077	310.2905	299.3072	281.4096	262.6538	245.1994	234.2937	238.0385	247.6360	265.6607	286.3019	302.3418	(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
Southeast	4.4000	36.7938	0.6300	0.7000	0.7700	49.4766 (77)
Southwest	0.6500	36.7938	0.6300	0.7000	0.7700	7.3090 (79)
Northwest	3.3000	11.2829	0.6300	0.7000	0.7700	11.3791 (81)

Solar gains	68.1647	119.8894	174.0774	232.5181	275.7992	280.5609	267.6791	234.3565	194.1531	135.2102	82.3339	57.8894	(83)
Total gains	379.8724	430.1799	473.3846	513.9277	538.4530	525.7604	501.9727	472.3950	441.7891	400.8709	368.6358	360.2312	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2384	60.3705	60.5007	61.1194	61.2366	61.7880	61.7880	61.8912	61.5745	61.2366	61.0000	60.7546	
alpha	5.0159	5.0247	5.0334	5.0746	5.0824	5.1192	5.1192	5.1261	5.1050	5.0824	5.0667	5.0503	
util living area	0.9987	0.9972	0.9933	0.9793	0.9337	0.8129	0.6480	0.7024	0.9068	0.9861	0.9973	0.9990	(86)
MIT	19.7074	19.8430	20.0747	20.3904	20.6909	20.9040	20.9769	20.9654	20.8121	20.4272	20.0107	19.6833	(87)
Th 2	19.9579	19.9600	19.9620	19.9714	19.9731	19.9814	19.9814	19.9829	19.9782	19.9731	19.9696	19.9658	(88)
util rest of house	0.9982	0.9963	0.9907	0.9706	0.9030	0.7289	0.5146	0.5722	0.8515	0.9787	0.9962	0.9987	(89)
MIT 2	18.7779	18.9147	19.1469	19.4656	19.7512	19.9332	19.9750	19.9721	19.8657	19.5059	19.0901	18.7601	(90)
Living area fraction									fLA = Living area / (4) =			0.2153	(91)
MIT	18.9780	19.1146	19.3467	19.6647	19.9536	20.1422	20.1907	20.1860	20.0695	19.7043	19.2884	18.9589	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9780	19.1146	19.3467	19.6647	19.9536	20.1422	20.1907	20.1860	20.0695	19.7043	19.2884	18.9589	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	378.9656	428.1059	468.0173	497.0597	485.8264	391.1143	272.9348	283.6398	378.8655	391.2561	366.8534	359.5738	(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	(95)
Heat loss rate W	1170.9510	1131.4953	1020.4108	846.3858	647.7003	431.0476	279.2675	293.9641	465.8845	714.4619	960.1943	1167.3946	(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	589.2372	472.6776	410.9807	251.5148	120.4342	0.0000	0.0000	0.0000	0.0000	240.4651	427.2055	601.0187	(98)
Space heating												3113.5337	(98)
Space heating per m2										(98) / (4) =		44.9933	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	731.0837	575.5340	590.1032	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8167	0.8924	0.8663	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	597.0586	513.6099	511.1846	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	698.1001	668.6958	635.7327	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	72.7499	115.3839	92.6637	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												280.7976 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	18.1875	28.8460	23.1659	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												70.1994 (107)
Space cooling per m2												1.0144 (108)
Energy for space heating												44.9933 (99)
Energy for space cooling												1.0144 (108)
Total												46.0077 (109)
Target Fabric Energy Efficiency (TFEE)												52.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												3.8900
Infiltration rate												0.1945 (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) =	0.1653 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.1943	0.1819	0.1819	0.1653	0.1695	0.1612	0.1612	0.1571	0.1571	0.1695	0.1653	0.1695 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			8.3500	1.3258	11.0701		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	12.5500	71.7900	0.2700	19.3833	150.0000	10768.4995 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			153.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.4514		(33)
party			40.4000	0.0000	0.0000	45.0000	1818.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17658.2994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							255.1777 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss						(33) + (36) =	50.2989 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293 (39)
Average = Sum(39)m / 12 =												79.1293 (39)
HLP	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435 (40)
HLP (average)												1.1435 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2265 (42)
Average daily hot water use (litres/day)	87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1370.1151 (45)
	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)
RHI water heating demand												1534.9792 (64)
Heat gains from water heating, kWh/month	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (65)
												1535 (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	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.2856	42.8868	34.8779	26.4048	19.7379	16.6636	18.0056	23.4044	31.4133	39.8864	46.5533	49.6276 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	506.2944	501.9035	482.0797	451.6781	420.8190	393.2790	377.3327	385.3692	403.0199	433.6203	467.4351	492.7603 (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	
Southeast				4.4000	45.0642	0.4500	0.0000	0.7700			68.7048 (77)	
Southwest				0.6500	45.0642	0.4500	0.0000	0.7700			10.1496 (79)	
Northwest				3.3000	14.6130	0.4500	0.0000	0.7700			16.7093 (81)	
Solar gains	95.5637	143.4393	213.1623	287.6865	322.4143	363.3920	332.9386	303.2551	249.5317	174.8698	115.1282	76.7832 (83)
Total gains	601.8581	645.3427	695.2419	739.3647	743.2333	756.6710	710.2714	688.6243	652.5515	608.4901	582.5633	569.5436 (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	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882
alpha	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325
util living area	0.9863	0.9795	0.9573	0.8941	0.7570	0.5232	0.3663	0.3663	0.6461	0.8915	0.9708	0.9888 (86)
MIT	20.1645	20.2583	20.4723	20.7307	20.9165	20.9898	20.9987	20.9987	20.9712	20.7837	20.4444	20.1344 (87)
Th 2	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655 (88)
util rest of house	0.9816	0.9727	0.9429	0.8588	0.6848	0.4221	0.2522	0.2487	0.5414	0.8462	0.9592	0.9850 (89)
MIT 2	19.2356	19.3273	19.5337	19.7707	19.9197	19.9624	19.9653	19.9653	19.9548	19.8218	19.5102	19.2064 (90)
Living area fraction									fLA = Living area / (4) =			0.2153 (91)
MIT	19.4356	19.5278	19.7358	19.9774	20.1343	20.1836	20.1878	20.1878	20.1737	20.0289	19.7114	19.4062 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2856	19.3778	19.5858	19.8274	19.9843	20.0336	20.0378	20.0378	20.0237	19.8789	19.5614	19.2562 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9776	0.9677	0.9363	0.8533	0.6863	0.4289	0.2603	0.2570	0.5477	0.8417	0.9534	0.9814 (94)
Useful gains	588.3761	624.4729	650.9451	630.8976	510.0573	324.5671	184.8535	176.9559	357.3761	512.1774	555.3960	558.9607 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W	1082.9352	1058.5730	948.4299	769.7232	544.7492	327.0898	184.9907	177.0795	365.8686	615.5415	867.3656	1072.6919 (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	367.9519	291.7153	221.3287	99.9544	25.8108	0.0000	0.0000	0.0000	0.0000	76.9029	224.6181	382.2160 (98)
Space heating												1690.4982 (98)
RHI space heating demand												1690 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												3.8900
Infiltration rate												0.1945 (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) =	0.1653 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2108	0.2067	0.2025	0.1819	0.1777	0.1571	0.1571	0.1529	0.1653	0.1777	0.1860	0.1943 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			8.3500	1.3258	11.0701		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	12.5500	71.7900	0.2700	19.3833	150.0000	10768.4995 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			153.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.4514		(33)
party			40.4000	0.0000	0.0000	45.0000	1818.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17658.2994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							255.1777 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss						(33) + (36) =	50.2989 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293 (39)
Average = Sum(39)m / 12 =												79.1293 (39)
HLP	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435 (40)
HLP (average)												1.1435 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2265 (42)
Average daily hot water use (litres/day) 87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1370.1151 (45)
	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month												
	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (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												
	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)
								Total per year (kWh/year) = Sum(64)m =				1534.9792 (64)
Heat gains from water heating, kWh/month												
	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (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	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.2856	42.8868	34.8779	26.4048	19.7379	16.6636	18.0056	23.4044	31.4133	39.8864	46.5533	49.6276 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	506.2944	501.9035	482.0797	451.6781	420.8190	393.2790	377.3327	385.3692	403.0199	433.6203	467.4351	492.7603 (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			
Southeast				4.4000	36.7938	0.4500	0.0000	0.7700	56.0959 (77)			
Southwest				0.6500	36.7938	0.4500	0.0000	0.7700	8.2869 (79)			
Northwest				3.3000	11.2829	0.4500	0.0000	0.7700	12.9015 (81)			
Solar gains	77.2842	135.9290	197.3667	263.6259	312.6975	318.0963	303.4910	265.7103	220.1282	153.2996	93.3491	65.6342 (83)
Total gains	583.5787	637.8325	679.4464	715.3041	733.5165	711.3753	680.8238	651.0795	623.1481	586.9199	560.7842	558.3946 (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	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	
alpha	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	
util living area													
	0.9915	0.9855	0.9711	0.9320	0.8383	0.6710	0.5033	0.5462	0.7771	0.9421	0.9843	0.9932 (86)	
MIT	20.0069	20.1372	20.3482	20.6112	20.8382	20.9611	20.9926	20.9888	20.9174	20.6390	20.2675	19.9642 (87)	
Th 2	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655 (88)	
util rest of house													
	0.9888	0.9808	0.9616	0.9087	0.7855	0.5791	0.3892	0.4300	0.6947	0.9174	0.9784	0.9910 (89)	
MIT 2	19.0797	19.2081	19.4145	19.6639	19.8613	19.9486	19.9637	19.9625	19.9237	19.6946	19.3380	19.0375 (90)	
Living area fraction									fLA = Living area / (4) =				0.2153 (91)
MIT	19.2794	19.4082	19.6155	19.8679	20.0717	20.1666	20.1853	20.1835	20.1377	19.8979	19.5381	19.2371 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	19.1294	19.2582	19.4655	19.7179	19.9217	20.0166	20.0353	20.0335	19.9877	19.7479	19.3881	19.0871 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9859	0.9767	0.9557	0.9020	0.7829	0.5839	0.3971	0.4379	0.6967	0.9109	0.9740	0.9885 (94)
Useful gains	575.3296	622.9499	649.3639	645.2291	574.2931	415.3698	270.3571	285.0821	434.1258	534.6245	546.2058	551.9618 (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												
	1173.4390	1136.1509	1025.9521	856.0122	650.5768	428.6108	271.8294	287.5177	465.8882	723.8695	972.3518	1178.0023 (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												
	444.9934	344.8711	280.1816	151.7638	56.7551	0.0000	0.0000	0.0000	0.0000	140.7983	306.8251	465.7742 (98)
Space heating												2191.9627 (98)
Space heating per m2												(98) / (4) = 31.6758 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2422.0582 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	444.9934	344.8711	280.1816	151.7638	56.7551	0.0000	0.0000	0.0000	0.0000	140.7983	306.8251	465.7742	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	491.7054	381.0730	309.5930	167.6949	62.7128	0.0000	0.0000	0.0000	0.0000	155.5782	339.0333	514.6676	(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													
Efficiency of water heater (217)m	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422	(64)
Fuel for water heating, kWh/month	89.6465	89.5669	89.3966	89.0242	88.2956	87.3000	87.3000	87.3000	87.3000	88.9347	89.4710	89.6925	(216)
Water heating fuel used	174.1671	152.8911	159.1040	140.7628	137.2824	121.4582	114.1757	128.7033	129.5534	146.2408	156.7841	169.0690	(219)
Annual totals kWh/year												1730.1918	(219)
Space heating fuel - main system													2422.0582 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)													
mechanical ventilation fans (SFP = 0.2116)													45.1040 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													120.1040 (231)
Electricity for lighting (calculated in Appendix L)													341.0956 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.60 + 1029 + 1.00) =										-494.0096			-494.0096 (233)
Total delivered energy for all uses													4119.4399 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2422.0582	3.4800	84.2876 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1730.1918	3.4800	60.2107 (247)
Mechanical ventilation fans	45.1040	13.1900	5.9492 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	341.0956	13.1900	44.9905 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-494.0096	13.1900	-65.1599 (252)
Total energy cost			260.1706 (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] =	0.9568 (257)
SAP value		86.6520
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	2422.0582	0.2160	523.1646 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1730.1918	0.2160	373.7214 (264)
Space and water heating			896.8860 (265)
Pumps and fans	120.1040	0.5190	62.3340 (267)
Energy for lighting	341.0956	0.5190	177.0286 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total kg/year			879.8576 (272)
CO2 emissions per m2			12.7100 (273)
EI value			89.6759
EI rating			90 (274)
EI band			B

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Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8860 = 3.928$, stars = 4
Water heating environmental impact	$0.216 / 0.8860 = 0.2438$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												3.8900
Infiltration rate												0.1945 (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) =	0.1653 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.1943	0.1819	0.1819	0.1653	0.1695	0.1612	0.1612	0.1571	0.1571	0.1695	0.1653	0.1695 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			8.3500	1.3258	11.0701		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	12.5500	71.7900	0.2700	19.3833	150.0000	10768.4995 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			153.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.4514		(33)
party			40.4000	0.0000	0.0000	45.0000	1818.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17658.2994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							255.1777 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss						(33) + (36) =	50.2989 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293 (39)
Average = Sum(39)m / 12 =												79.1293 (39)
HLP	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435 (40)
HLP (average)												1.1435 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2265 (42)
Average daily hot water use (litres/day)	87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

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

Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1370.1151 (45)
	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month												
	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (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												
	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (64)
								Total per year (kWh/year) = Sum(64)m =				1534.9792 (64)
Heat gains from water heating, kWh/month												
	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (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	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.2856	42.8868	34.8779	26.4048	19.7379	16.6636	18.0056	23.4044	31.4133	39.8864	46.5533	49.6276 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	506.2944	501.9035	482.0797	451.6781	420.8190	393.2790	377.3327	385.3692	403.0199	433.6203	467.4351	492.7603 (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		
Southeast				4.4000	45.0642	0.4500	0.0000	0.7700	68.7048 (77)			
Southwest				0.6500	45.0642	0.4500	0.0000	0.7700	10.1496 (79)			
Northwest				3.3000	14.6130	0.4500	0.0000	0.7700	16.7093 (81)			
Solar gains	95.5637	143.4393	213.1623	287.6865	322.4143	363.3920	332.9386	303.2551	249.5317	174.8698	115.1282	76.7832 (83)
Total gains	601.8581	645.3427	695.2419	739.3647	743.2333	756.6710	710.2714	688.6243	652.5515	608.4901	582.5633	569.5436 (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	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882
alpha	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325
util living area												
	0.9863	0.9795	0.9573	0.8941	0.7570	0.5232	0.3663	0.3663	0.6461	0.8915	0.9708	0.9888 (86)
MIT	20.1645	20.2583	20.4723	20.7307	20.9165	20.9898	20.9987	20.9987	20.9712	20.7837	20.4444	20.1344 (87)
Th 2	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655 (88)
util rest of house												
	0.9816	0.9727	0.9429	0.8588	0.6848	0.4221	0.2522	0.2487	0.5414	0.8462	0.9592	0.9850 (89)
MIT 2	19.2356	19.3273	19.5337	19.7707	19.9197	19.9624	19.9653	19.9653	19.9548	19.8218	19.5102	19.2064 (90)
Living area fraction												
MIT	19.4356	19.5278	19.7358	19.9774	20.1343	20.1836	20.1878	20.1878	20.1737	20.0289	19.7114	19.4062 (91)
Temperature adjustment												-0.1500
adjusted MIT	19.2856	19.3778	19.5858	19.8274	19.9843	20.0336	20.0378	20.0378	20.0237	19.8789	19.5614	19.2562 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9776	0.9677	0.9363	0.8533	0.6863	0.4289	0.2603	0.2570	0.5477	0.8417	0.9534	0.9814 (94)
Useful gains	588.3761	624.4729	650.9451	630.8976	510.0573	324.5671	184.8535	176.9559	357.3761	512.1774	555.3960	558.9607 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W												
	1082.9352	1058.5730	948.4299	769.7232	544.7492	327.0898	184.9907	177.0795	365.8686	615.5415	867.3656	1072.6919 (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												
	367.9519	291.7153	221.3287	99.9544	25.8108	0.0000	0.0000	0.0000	0.0000	76.9029	224.6181	382.2160 (98)
Space heating												1690.4982 (98)
Space heating per m2												(98) / (4) = 24.4292 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1867.9538 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	367.9519	291.7153	221.3287	99.9544	25.8108	0.0000	0.0000	0.0000	0.0000	76.9029	224.6181	382.2160	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	406.5767	322.3373	244.5621	110.4469	28.5202	0.0000	0.0000	0.0000	0.0000	84.9756	248.1968	422.3382	(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													
Efficiency of water heater (217)m	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422	(64)
Fuel for water heating, kWh/month	89.5224	89.4525	89.2205	88.6915	87.8453	87.3000	87.3000	87.3000	87.3000	88.4623	89.2425	89.5674	(216)
Water heating fuel used	174.4086	153.0866	159.4180	141.2907	137.9862	121.4582	114.1757	128.7033	129.5534	147.0217	157.1857	169.3051	(219)
Annual totals kWh/year												1733.5931	(219)
Space heating fuel - main system												1867.9538	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)													
mechanical ventilation fans (SFP = 0.2116)												45.1040	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												120.1040	(231)
Electricity for lighting (calculated in Appendix L)												341.0956	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1154 * 1.00) =										-554.1393		-554.1393	(233)
Total delivered energy for all uses												3508.6072	(238)

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1867.9538	9.7400	181.9387 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1733.5931	9.7400	168.8520 (247)
Mechanical ventilation fans	45.1040	36.8500	16.6208 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	341.0956	36.8500	125.6937 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-554.1393	36.8500	-204.2003 (252)
Total energy cost			420.5424 (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	1867.9538	0.2160	403.4780 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1733.5931	0.2160	374.4561 (264)
Space and water heating			777.9341 (265)
Pumps and fans	120.1040	0.5190	62.3340 (267)
Energy for lighting	341.0956	0.5190	177.0286 (268)
Energy saving/generation technologies			
PV Unit	-554.1393	0.5190	-287.5983 (269)
Total kg/year			729.6984 (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	1867.9538	1.2200	2278.9036 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1733.5931	1.2200	2114.9836 (264)
Space and water heating			4393.8872 (265)
Pumps and fans	120.1040	3.0700	368.7192 (267)
Energy for lighting	341.0956	3.0700	1047.1634 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-554.1393	3.0700	-1701.2076 (269)
Primary energy kWh/year			4108.5622 (272)
Primary energy kWh/m2/year			59.3723 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 90

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
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	+ 1.3	-£ 73	-178 kg (24.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£73 2.57 kg/m²	B 88	A 92
Total Savings	£73 2.57 kg/m²		

Potential energy efficiency rating:	B 88
Potential environmental impact rating:	A 92

Fuel prices for cost data on this page from database revision number 514 TEST (30 Mar 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£170	£188	-£18
Mains gas	£455	£363	£92
Space heating	£330	£330	£0
Water heating	£169	£95	£73
Lighting	£126	£126	£0
Generated (PV)	-£204	-£204	£0
Total cost of fuels	£421	£347	£74
Total cost of uses	£421	£347	£73
Delivered energy	51 kWh/m²	38 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	59 kWh/m²	45 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												3.8900
Infiltration rate												0.1945 (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) =	0.1653 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2108	0.2067	0.2025	0.1819	0.1777	0.1571	0.1571	0.1529	0.1653	0.1777	0.1860	0.1943 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			8.3500	1.3258	11.0701		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	12.5500	71.7900	0.2700	19.3833	150.0000	10768.4995 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			153.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.4514		(33)
party			40.4000	0.0000	0.0000	45.0000	1818.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17658.2994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							255.1777 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss						(33) + (36) =	50.2989 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293 (39)
Average = Sum(39)m / 12 =												79.1293 (39)
HLP	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435 (40)
HLP (average)												1.1435 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2265 (42)
Average daily hot water use (litres/day)	87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Distribution loss (46)m = 0.15 x (45)m	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Total = Sum (45)m =	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (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												1.3237 (H8)
Utilisation factor												0.5302 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.0805 (H14)
Volume ratio Veff/V												0.8613 (H15)
Solar storage volume factor												0.9701 (H16)
Solar input	-23.7860	-39.6920	-67.5999	-90.5973	-111.9253	-110.0404	-108.5861	-94.8723	-74.3040	-50.7409	-28.2136	-820.2625 (H17)
Solar input (sum of months) = Sum (63)m =												-19.9048 (63)
Output from w/h	132.3488	97.2478	74.6337	34.7156	9.2891	0.0000	0.0000	17.4857	38.7961	79.3179	112.0627	131.7374 (64)
Total per year (kWh/year) = Sum (64)m =												727.6348 (64)
Heat gains from water heating, kWh/month	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (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	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.2856	42.8868	34.8779	26.4048	19.7379	16.6636	18.0056	23.4044	31.4133	39.8864	46.5533	49.6276 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	506.2944	501.9035	482.0797	451.6781	420.8190	393.2790	377.3327	385.3692	403.0199	433.6203	467.4351	492.7603 (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
Southeast				4.4000	36.7938		0.4500		0.0000		0.7700		56.0959 (77)
Southwest				0.6500	36.7938		0.4500		0.0000		0.7700		8.2869 (79)
Northwest				3.3000	11.2829		0.4500		0.0000		0.7700		12.9015 (81)
Solar gains	77.2842	135.9290	197.3667	263.6259	312.6975	318.0963	303.4910	265.7103	220.1282	153.2996	93.3491	65.6342	(83)
Total gains	583.5787	637.8325	679.4464	715.3041	733.5165	711.3753	680.8238	651.0795	623.1481	586.9199	560.7842	558.3946	(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	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882
alpha	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325
util living area	0.9915	0.9855	0.9711	0.9320	0.8383	0.6710	0.5033	0.5462	0.7771	0.9421	0.9843	0.9932 (86)
MIT	20.0069	20.1372	20.3482	20.6112	20.8382	20.9611	20.9926	20.9888	20.9174	20.6390	20.2675	19.9642 (87)
Th 2	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655 (88)
util rest of house	0.9888	0.9808	0.9616	0.9087	0.7855	0.5791	0.3892	0.4300	0.6947	0.9174	0.9784	0.9910 (89)
MIT 2	19.0797	19.2081	19.4145	19.6639	19.8613	19.9486	19.9637	19.9625	19.9237	19.6946	19.3380	19.0375 (90)
Living area fraction	19.2794	19.4082	19.6155	19.8679	20.0717	20.1666	20.1853	20.1835	20.1377	19.8979	19.5381	19.2371 (91)
Temperature adjustment												-0.1500
adjusted MIT	19.1294	19.2582	19.4655	19.7179	19.9217	20.0166	20.0353	20.0335	19.9877	19.7479	19.3881	19.0871 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9859	0.9767	0.9557	0.9020	0.7829	0.5839	0.3971	0.4379	0.6967	0.9109	0.9740	0.9885	(94)
Useful gains	575.3296	622.9499	649.3639	645.2291	574.2931	415.3698	270.3571	285.0821	434.1258	534.6245	546.2058	551.9618	(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	1173.4390	1136.1509	1025.9521	856.0122	650.5768	428.6108	271.8294	287.5177	465.8882	723.8695	972.3518	1178.0023	(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	444.9934	344.8711	280.1816	151.7638	56.7551	0.0000	0.0000	0.0000	0.0000	140.7983	306.8251	465.7742	(98)
Space heating												2191.9627	(98)
Space heating per m2											(98) / (4) =	31.6758	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2422.0582	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	444.9934	344.8711	280.1816	151.7638	56.7551	0.0000	0.0000	0.0000	0.0000	140.7983	306.8251	465.7742	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	491.7054	381.0730	309.5930	167.6949	62.7128	0.0000	0.0000	0.0000	0.0000	155.5782	339.0333	514.6676	(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	132.3488	97.2478	74.6337	34.7156	9.2891	0.0000	0.0000	17.4857	38.7961	79.3179	112.0627	131.7374	(64)	
Efficiency of water heater	89.7459	89.7762	89.8076	89.8866	90.0358	87.3000	87.3000	87.3000	87.3000	89.3202	89.6212	87.3000	(216)	
(217)m	89.7459	89.7762	89.8076	89.8866	90.0358	87.3000	87.3000	87.3000	87.3000	89.3202	89.6212	87.3000	(217)	
Fuel for water heating, kWh/month	147.4706	108.3225	83.1040	38.6216	10.3171	0.0000	0.0000	20.0294	44.4400	88.8017	125.0405	146.7426	(219)	
Water heating fuel used												812.8900	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2422.0582	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)														
mechanical ventilation fans (SFP = 0.2116)													45.1040	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													170.1040	(231)
Electricity for lighting (calculated in Appendix L)													341.0956	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1029 * 1.00) =													-494.0096	(233)
Total delivered energy for all uses													3252.1381	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2422.0582	3.4800	84.2876	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	812.8900	3.4800	28.2886	(247)
Mechanical ventilation fans	45.1040	13.1900	5.9492	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	341.0956	13.1900	44.9905	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-494.0096	13.1900	-65.1599	(252)
Total energy cost			234.8435	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.8637	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	87.9514	
SAP rating (Section 12)		88	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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	2422.0582	0.2160	523.1646	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	812.8900	0.2160	175.5842	(264)
Space and water heating			698.7488	(265)
Pumps and fans	170.1040	0.5190	88.2840	(267)
Energy for lighting	341.0956	0.5190	177.0286	(268)
Energy saving/generation technologies				
PV Unit	-494.0096	0.5190	-256.3910	(269)
Total kg/year			707.6704	(272)
CO2 emissions per m2			10.2300	(273)
EI value			91.6963	
EI rating			92	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.6000 (1b)	x 2.4500 (2b)	= 84.7700 (1b) - (3b)
First floor	34.6000 (1c)	x 2.6000 (2c)	= 89.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.7300 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour	
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =												0.0000 / (5) =	0.0000 (8)
Pressure test											Yes		
Measured/design AP50											3.8900		
Infiltration rate											0.1945	(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) =		0.1653	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)	
Adj infilt rate	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)	
	0.1943	0.1819	0.1819	0.1653	0.1695	0.1612	0.1612	0.1571	0.1571	0.1695	0.1653	0.1695 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			8.3500	1.3258	11.0701		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	12.5500	71.7900	0.2700	19.3833	150.0000	10768.4995 (29a)
cd	34.6000		34.6000	0.1100	3.8060	9.0000	311.4000 (30)
Total net area of external elements Aum(A, m ²)			153.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.4514		(33)
party			40.4000	0.0000	0.0000	45.0000	1818.0001 (32)
stud			136.8000			9.0000	1231.2000 (32c)
internal			34.6000			18.0000	622.8000 (32d)
internal			34.6000			9.0000	311.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17658.2994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							255.1777 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss						(33) + (36) =	50.2989 (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	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305	28.8305 (38)
Heat transfer coeff	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293	79.1293 (39)
Average = Sum(39)m / 12 =												79.1293 (39)
HLP	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435	1.1435 (40)
HLP (average)												1.1435 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2265 (42)
Average daily hot water use (litres/day)	87.0805 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	95.7885	92.3053	88.8221	85.3389	81.8557	78.3724	78.3724	81.8557	85.3389	88.8221	92.3053	95.7885 (44)
Energy content (annual)	142.0516	124.2393	128.2038	111.7712	107.2471	92.5461	85.7576	98.4081	99.5834	116.0548	126.6829	137.5694 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1370.1151 (45)
	21.3077	18.6359	19.2306	16.7657	16.0871	13.8819	12.8636	14.7612	14.9375	17.4082	19.0024	20.6354 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0831	12.7005	14.0299	13.5417	13.9673	13.4869	13.9179	13.9499	13.5168	14.0040	13.5934	14.0728 (61)
Total heat required for water heating calculated for each month	156.1348	136.9398	142.2336	125.3129	121.2143	106.0330	99.6754	112.3579	113.1001	130.0588	140.2763	151.6422 (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												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4788 (H8)
Utilisation factor												0.4915 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.0805 (H14)
Volume ratio Veff/V												0.8613 (H15)
Solar storage volume factor												0.9701 (H16)
Solar input	-27.7177	-39.4176	-68.3998	-92.0092	-106.9209	-116.2989	-110.2691	-100.5548	-78.7040	-54.3974	-32.7837	-849.4204 (H17)
Solar input (sum of months) = Sum (63)m =												-21.9473 (63)
Output from w/h	128.4171	97.5221	73.8339	33.3037	14.2934	0.0000	0.0000	11.8032	34.3961	75.6614	107.4926	129.6950 (64)
Total per year (kWh/year) = Sum (64)m =												706.4185 (64)
Heat gains from water heating, kWh/month	50.7529	44.4847	46.1352	40.5493	39.1515	34.1433	31.9939	36.2081	36.4907	42.0892	45.5204	49.2600 (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	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928	133.5928 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.2856	42.8868	34.8779	26.4048	19.7379	16.6636	18.0056	23.4044	31.4133	39.8864	46.5533	49.6276 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.6757	294.7024	287.0753	270.8380	250.3414	231.0774	218.2079	215.1812	222.8084	239.0456	259.5423	278.8062 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858	50.5858 (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)	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619	-89.0619 (71)
Water heating gains (Table 5)	68.2163	66.1974	62.0097	56.3185	52.6229	47.4212	43.0025	48.6669	50.6815	56.5715	63.2228	66.2097 (72)
Total internal gains	506.2944	501.9035	482.0797	451.6781	420.8190	393.2790	377.3327	385.3692	403.0199	433.6203	467.4351	492.7603 (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	
Southeast				4.4000	45.0642	0.4500		0.0000	0.7700		68.7048 (77)	
Southwest				0.6500	45.0642	0.4500		0.0000	0.7700		10.1496 (79)	
Northwest				3.3000	14.6130	0.4500		0.0000	0.7700		16.7093 (81)	
Solar gains	95.5637	143.4393	213.1623	287.6865	322.4143	363.3920	332.9386	303.2551	249.5317	174.8698	115.1282	76.7832 (83)
Total gains	601.8581	645.3427	695.2419	739.3647	743.2333	756.6710	710.2714	688.6243	652.5515	608.4901	582.5633	569.5436 (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	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882	61.9882
alpha	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325	5.1325
util living area	0.9863	0.9795	0.9573	0.8941	0.7570	0.5232	0.3663	0.3663	0.6461	0.8915	0.9708	0.9888 (86)
MIT	20.1645	20.2583	20.4723	20.7307	20.9165	20.9898	20.9987	20.9987	20.9712	20.7837	20.4444	20.1344 (87)
Th 2	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655	19.9655 (88)
util rest of house	0.9816	0.9727	0.9429	0.8588	0.6848	0.4221	0.2522	0.2487	0.5414	0.8462	0.9592	0.9850 (89)
MIT 2	19.2356	19.3273	19.5337	19.7707	19.9197	19.9624	19.9653	19.9653	19.9548	19.8218	19.5102	19.2064 (90)
Living area fraction	19.4356	19.5278	19.7358	19.9774	20.1343	20.1836	20.1878	20.1878	20.1737	20.0289	19.7114	19.4062 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2856	19.3778	19.5858	19.8274	19.9843	20.0336	20.0378	20.0378	20.0237	19.8789	19.5614	19.2562 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9776	0.9677	0.9363	0.8533	0.6863	0.4289	0.2603	0.2570	0.5477	0.8417	0.9534	0.9814	(94)
Useful gains	588.3761	624.4729	650.9451	630.8976	510.0573	324.5671	184.8535	176.9559	357.3761	512.1774	555.3960	558.9607	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1082.9352	1058.5730	948.4299	769.7232	544.7492	327.0898	184.9907	177.0795	365.8686	615.5415	867.3656	1072.6919	(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	367.9519	291.7153	221.3287	99.9544	25.8108	0.0000	0.0000	0.0000	0.0000	76.9029	224.6181	382.2160	(98)
Space heating												1690.4982	(98)
Space heating per m2											(98) / (4) =	24.4292	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1867.9538	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	367.9519	291.7153	221.3287	99.9544	25.8108	0.0000	0.0000	0.0000	0.0000	76.9029	224.6181	382.2160	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	406.5767	322.3373	244.5621	110.4469	28.5202	0.0000	0.0000	0.0000	0.0000	84.9756	248.1968	422.3382	(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	128.4171	97.5221	73.8339	33.3037	14.2934	0.0000	0.0000	11.8032	34.3961	75.6614	107.4926	129.6950	(64)	
Efficiency of water heater	89.6498	89.6764	89.6777	89.6785	89.3329	87.3000	87.3000	87.3000	87.3000	88.8842	89.4389	89.6673	(216)	
(217)m	89.6498	89.6764	89.6777	89.6785	89.3329	87.3000	87.3000	87.3000	87.3000	88.8842	89.4389	89.6673	(217)	
Fuel for water heating, kWh/month	143.2430	108.7489	82.3325	37.1368	16.0002	0.0000	0.0000	13.5202	39.3999	85.1235	120.1856	144.6402	(219)	
Water heating fuel used												790.3307	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1867.9538	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.1360, total flow = 29.0000, SFP = 0.2116)														
mechanical ventilation fans (SFP = 0.2116)													45.1040	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													170.1040	(231)
Electricity for lighting (calculated in Appendix L)													341.0956	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1154 * 1.00) =										-554.1393			-554.1393	(233)
Total delivered energy for all uses													2615.3448	(238)

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1867.9538	9.7400	181.9387	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	790.3307	9.7400	76.9782	(247)
Mechanical ventilation fans	45.1040	36.8500	16.6208	(249)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	341.0956	36.8500	125.6937	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-554.1393	36.8500	-204.2003	(252)
Total energy cost			347.0936	(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	1867.9538	0.2160	403.4780	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	790.3307	0.2160	170.7114	(264)
Space and water heating			574.1895	(265)

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Pumps and fans	170.1040	0.5190	88.2840 (267)
Energy for lighting	341.0956	0.5190	177.0286 (268)
Energy saving/generation technologies			
PV Unit	-554.1393	0.5190	-287.5983 (269)
Total kg/year			551.9037 (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	1867.9538	1.2200	2278.9036 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	790.3307	1.2200	964.2035 (264)
Space and water heating			3243.1071 (265)
Pumps and fans	170.1040	3.0700	522.2192 (267)
Energy for lighting	341.0956	3.0700	1047.1634 (268)
Energy saving/generation technologies			
PV Unit	-554.1393	3.0700	-1701.2076 (269)
Primary energy kWh/year			3111.2821 (272)
Primary energy kWh/m2/year			44.9607 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	255.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	230.64 (P1)
Transmission heat loss coefficient	50.30 (P7)
Summer heat loss coefficient	280.94 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (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
South East	4.4000	127.3119	0.4500	0.0000	0.9000	226.8697
South West	0.6500	127.3119	0.4500	0.0000	0.9000	33.5148
North West	3.3000	106.0502	0.4500	0.0000	0.9000	141.7361

total: 402.1207

	Jun	Jul	Aug	
Solar gains	432	402	358	(P4)
Internal gains	390	374	382	
Total summer gains	822	776	741	(P5)

Summer gain/loss ratio	2.93	2.76	2.64	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 255.2)	0.21	0.21	0.21	
Threshold temperature	18.54	20.28	20.15	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 85	Issued on Date	27/04/2023
Assessment Reference	85 Hamblewood	Prop Type Ref	21809
Property	3 Hickory Way, HEDGE END, SO30 0AW		
SAP Rating	87 B	DER	14.94
Environmental	90 B	TER	19.49
CO ₂ Emissions (t/year)	0.73	% DER<TER	23.35
General Requirements Compliance	Pass	DfEE	47.31
		TFEE	52.91
		% DfEE<TFEE	10.58
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.49	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.94	kgCO ₂ /m ²	Pass
	-4.55 (-23.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.91	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.31	kWh/m ² /yr	
	-5.6 (-10.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.40 (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	3.89 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing South East

4.40 m², No overhang

Windows facing South West

0.65 m², No overhang

Windows facing North West

3.30 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

3.89 (measured in this dwelling)

Maximum

10.0

Pass

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.11	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.00	W/m ² K
Air permeability	3.9	m ³ /m ² h
Photovoltaic array	0.60	kW

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