

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 83			Issued on Date	27/04/2023
Assessment Reference	83 Hamblewood	Prop Type Ref	21809		
Property	1 Hickory Way, HEDGE END, SO30 0AW				
SAP Rating	87 B	DER	15.04	TER	19.59
Environmental	90 B	% DER<TER	23.23		
CO ₂ Emissions (t/year)	0.74	DFEE	47.99	TFEE	53.73
General Requirements Compliance	Pass	% DFEE<TFEE	10.69		
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) 19.59 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.04 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.0 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	1.34 (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: 3.90 (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 North East: 1.30 m², No overhang
Windows facing South East: 4.40 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											3.9000		
Infiltration rate											0.1950	(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)	=	0.1658	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.2113	0.2072	0.2030	0.1823	0.1782	0.1575	0.1575	0.1533	0.1658	0.1782	0.1865	0.1948 (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)			9.0000	1.3258	11.9318		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	13.2000	71.1400	0.2700	19.2078	150.0000	10670.9995 (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) =		44.1376		(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) =		17560.7994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							253.7688 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss					(33) + (36) =		50.9851 (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	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156 (39)
Average = Sum(39)m / 12 =												79.8156 (39)
HLP	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534 (40)
HLP (average)												1.1534 (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	18.9958	16.8719	13.7212	10.3878	7.7650	6.5556	7.0835	9.2074	12.3582	15.6915	18.3143	19.5238	(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	342.0331	339.9182	327.4695	307.5660	287.5149	268.1969	255.6835	261.4439	271.7194	291.8218	314.8287	331.9319	(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				
Northeast				1.3000	11.2829	0.4500	0.0000	0.7700	5.0824 (75)				
Southeast				4.4000	36.7938	0.4500	0.0000	0.7700	56.0959 (77)				
Northwest				3.3000	11.2829	0.4500	0.0000	0.7700	12.9015 (81)				
Solar gains	74.0798	132.1587	196.6921	270.3061	327.0401	335.3528	318.8723	274.9138	221.9276	150.3416	89.8183	62.6929	(83)
Total gains	416.1129	472.0769	524.1616	577.8721	614.5550	603.5496	574.5558	536.3577	493.6471	442.1635	404.6470	394.6248	(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	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	
alpha	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	
util living area	0.9981	0.9961	0.9901	0.9690	0.9033	0.7588	0.5907	0.6495	0.8775	0.9804	0.9962	0.9986	(86)
MIT	19.7701	19.9079	20.1444	20.4561	20.7491	20.9292	20.9842	20.9748	20.8424	20.4685	20.0533	19.7309	(87)
Th 2	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	(88)
util rest of house	0.9975	0.9947	0.9864	0.9564	0.8631	0.6675	0.4612	0.5193	0.8118	0.9702	0.9946	0.9981	(89)
MIT 2	18.8387	18.9760	19.2108	19.5153	19.7851	19.9243	19.9534	19.9502	19.8680	19.5314	19.1214	18.7996	(90)
Living area fraction	19.0393	19.1766	19.4118	19.7179	19.9926	20.1407	20.1754	20.1708	20.0778	19.7332	19.3220	19.0001	(91)
MIT	18.8893	19.0266	19.2618	19.5679	19.8426	19.9907	20.0254	20.0208	19.9278	19.5832	19.1720	18.8501	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9965	0.9930	0.9830	0.9503	0.8578	0.6707	0.4700	0.5278	0.8096	0.9652	0.9929	0.9973	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1164.4510	1127.5246	1018.5890	851.4618	649.9092	430.2590	273.3967	288.9974	465.1495	716.9963	963.5362	1169.3094	(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	557.8396	442.6959	374.4723	217.6495	91.3115	0.0000	0.0000	0.0000	0.0000	215.9333	404.4805	577.1519	(98)
Space heating													2881.5346 (98)
Space heating per m2													(98) / (4) = 41.6407 (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	3184.0162 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	557.8396	442.6959	374.4723	217.6495	91.3115	0.0000	0.0000	0.0000	0.0000	215.9333	404.4805	577.1519 (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)	616.3973	489.1668	413.7816	240.4967	100.8967	0.0000	0.0000	0.0000	0.0000	238.6004	446.9398	637.7369 (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	89.7803	89.7230	89.5960	89.3039	88.6467	87.3000	87.3000	87.3000	87.3000	89.2700	89.6538	87.3000 (216)
Fuel for water heating, kWh/month	173.9075	152.6250	158.7500	140.3218	136.7387	121.4582	114.1757	128.7033	129.5534	145.6915	156.4645	168.8385 (219)
Water heating fuel used	1727.2281 (219)											
Annual totals kWh/year												
Space heating fuel - main system	3184.0162 (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)												335.4724 (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												4872.8110 (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	3184.0162	0.2160	687.7475 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1727.2281	0.2160	373.0813 (264)
Space and water heating			1060.8288 (265)
Pumps and fans	120.1040	0.5190	62.3340 (267)
Energy for lighting	335.4724	0.5190	174.1102 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total CO2, kg/year			1040.8819 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0400 (273)

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

DER	15.0400	ZC1
Total Floor Area	69.2000	TFA
Assumed number of occupants	2.2265	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	16.7346	ZC2
CO2 emissions from cooking, equation (L16)	2.4919	ZC3
Total CO2 emissions	34.2665	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	34.2665	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 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)			9.0000	1.3258	11.9318		(27)
ground			34.6000	0.1300	4.4980		(28a)
external	84.3400	13.2000	71.1400	0.1800	12.8052		(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) =	38.3530		(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) =	47.1920 (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	80.5204	80.3458	80.1746	79.3704	79.2200	78.5196	78.5196	78.3899	78.7894	79.2200	79.5243	79.8425 (39)
Average = Sum(39)m / 12 =												79.3697 (39)
HLP	1.1636	1.1611	1.1586	1.1470	1.1448	1.1347	1.1347	1.1328	1.1386	1.1448	1.1492	1.1538 (40)
HLP (average)												1.1470 (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	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	18.9958	16.8719	13.7212	10.3878	7.7650	6.5556	7.0835	9.2074	12.3582	15.6915	18.3143	19.5238	(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	353.7030	350.9990	337.9645	317.4769	296.8380	276.9339	264.4267	270.7728	281.6389	302.3255	325.9144	343.6053	(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					
Northeast					1.3000	11.2829	0.6300	0.7000	0.7700		4.4827 (75)					
Southeast					4.4000	36.7938	0.6300	0.7000	0.7700		49.4766 (77)					
Northwest					3.3000	11.2829	0.6300	0.7000	0.7700		11.3791 (81)					
Solar gains					65.3383	116.5640	173.4824	238.4100	288.4494	295.7812	281.2454	242.4740	195.7402	132.6013	79.2197	55.2952 (83)
Total gains					419.0414	467.5630	511.4469	555.8869	585.2874	572.7150	545.6721	513.2468	477.3791	434.9268	405.1342	398.9004 (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	59.6812	59.8109	59.9387	60.5459	60.6609	61.2020	61.2020	61.3032	60.9924	60.6609	60.4287	60.1879	
alpha	4.9787	4.9874	4.9959	5.0364	5.0441	5.0801	5.0801	5.0869	5.0662	5.0441	5.0286	5.0125	
util living area	0.9979	0.9960	0.9907	0.9721	0.9143	0.7765	0.6088	0.6633	0.8843	0.9808	0.9959	0.9984	(86)
MIT	19.7457	19.8787	20.1113	20.4297	20.7261	20.9213	20.9820	20.9726	20.8348	20.4603	20.0473	19.7209	(87)
Th 2	19.9492	19.9513	19.9533	19.9627	19.9644	19.9726	19.9726	19.9741	19.9695	19.9644	19.9609	19.9571	(88)
util rest of house	0.9972	0.9946	0.9872	0.9608	0.8776	0.6880	0.4789	0.5342	0.8216	0.9709	0.9942	0.9978	(89)
MIT 2	18.2793	18.4748	18.8147	19.2786	19.6837	19.9171	19.9656	19.9622	19.8296	19.3285	18.7284	18.2487	(90)
Living area fraction	18.5950	18.7771	19.0938	19.5265	19.9082	20.1333	20.1845	20.1797	20.0460	19.5722	19.0123	18.5657	(92)
Temperature adjustment	18.5950	18.7771	19.0938	19.5265	19.9082	20.1333	20.1845	20.1797	20.0460	19.5722	19.0123	18.5657	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	417.2961	463.9837	502.8624	530.6345	512.2315	402.7944	276.6468	288.3560	394.8860	419.9895	401.8772	397.5919	(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	1151.0393	1114.9669	1009.7060	843.4263	650.2511	434.4745	281.4505	296.2920	468.4815	710.7780	947.3210	1146.9963	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	545.9050	437.4607	377.0917	225.2101	102.6866	0.0000	0.0000	0.0000	0.0000	216.3467	392.7196	557.5568	(98)
Space heating												2854.9771	(98)
Space heating per m2												41.2569	(99)

8c. Space cooling requirement

Not applicable

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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													3056.7207 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	545.9050	437.4607	377.0917	225.2101	102.6866	0.0000	0.0000	0.0000	0.0000	216.3467	392.7196	557.5568	(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)	584.4807	468.3733	403.7384	241.1243	109.9428	0.0000	0.0000	0.0000	0.0000	231.6345	420.4706	596.9559	(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	87.5474	87.3676	86.9541	86.0091	84.1358	80.3000	80.3000	80.3000	80.3000	85.7908	87.0620	87.6384	(216)
Fuel for water heating, kWh/month	218.0127	190.8316	199.4922	178.8834	177.0469	163.3817	156.5321	174.4966	176.4238	188.0359	197.7939	212.6719	(219)
Water heating fuel used												2233.6028	(219)
Annual totals kWh/year													
Space heating fuel - main system												3056.7207	(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)												335.4724	(232)
Total delivered energy for all uses												5700.7959	(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	3056.7207	0.2160	660.2517 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2233.6028	0.2160	482.4582 (264)
Space and water heating			1142.7099 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.4724	0.5190	174.1102 (268)
Total CO2, kg/m2/year			1355.7451 (272)
Emissions per m2 for space and water heating			16.5131 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5160 (272b)
Emissions per m2 for pumps and fans			0.5625 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.5131 * 1.00) + 2.5160 + 0.5625, rounded to 2 d.p.			19.5900 (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					3.9000
Infiltration rate					0.3095 (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) =	0.2630 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3354	0.3288	0.3222	0.2893	0.2828	0.2499	0.2499	0.2433	0.2630	0.2828	0.2959	0.3091 (22b)
	0.5562	0.5541	0.5519	0.5419	0.5400	0.5312	0.5312	0.5296	0.5346	0.5400	0.5438	0.5478 (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)			9.0000	1.3258	11.9318		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	13.2000	71.1400	0.2700	19.2078	150.0000	10670.9995 (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) =		44.1376		(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) = 17560.7994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 253.7688 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.8475 (36)
Total fabric heat loss (33) + (36) = 50.9851 (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	32.0733	31.9474	31.8239	31.2442	31.1357	30.6308	30.6308	30.5373	30.8253	31.1357	31.3552	31.5846 (38)
Heat transfer coeff	83.0584	82.9325	82.8091	82.2293	82.1208	81.6159	81.6159	81.5224	81.8104	82.1208	82.3403	82.5697 (39)
Average = Sum(39)m / 12 =												82.2288 (39)
HLP	1.2003	1.1984	1.1967	1.1883	1.1867	1.1794	1.1794	1.1781	1.1822	1.1867	1.1899	1.1932 (40)
HLP (average)												1.1883 (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 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)
	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	18.9958	16.8719	13.7212	10.3878	7.7650	6.5556	7.0835	9.2074	12.3582	15.6915	18.3143	19.5238	(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	311.3893	310.0077	299.0772	281.2355	262.5237	245.0896	234.1749	237.8842	247.4289	265.3977	285.9949	302.0145	(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
Northeast				1.3000	11.2829		0.4500		0.0000		0.7700		5.0824 (75)
Southeast				4.4000	36.7938		0.4500		0.0000		0.7700		56.0959 (77)
Northwest				3.3000	11.2829		0.4500		0.0000		0.7700		12.9015 (81)
Solar gains	74.0798	132.1587	196.6921	270.3061	327.0401	335.3528	318.8723	274.9138	221.9276	150.3416	89.8183	62.6929	(83)
Total gains	385.4691	442.1665	495.7693	551.5416	589.5638	580.4424	553.0472	512.7979	469.3565	415.7393	375.8132	364.7074	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.7298	58.8189	58.9066	59.3219	59.4003	59.7678	59.7678	59.8363	59.6257	59.4003	59.2420	59.0774	
alpha	4.9153	4.9213	4.9271	4.9548	4.9600	4.9845	4.9845	4.9891	4.9750	4.9600	4.9495	4.9385	
util living area	0.9987	0.9971	0.9924	0.9753	0.9197	0.7861	0.6207	0.6826	0.8993	0.9854	0.9973	0.9990	(86)
MIT	19.6680	19.8109	20.0574	20.3912	20.7048	20.9119	20.9789	20.9667	20.8101	20.4079	19.9750	19.6388	(87)
Th 2	19.9198	19.9212	19.9227	19.9294	19.9306	19.9365	19.9365	19.9376	19.9342	19.9306	19.9281	19.9254	(88)
util rest of house	0.9982	0.9960	0.9895	0.9648	0.8836	0.6958	0.4850	0.5480	0.8395	0.9774	0.9961	0.9986	(89)
MIT 2	18.7068	18.8505	19.0968	19.4302	19.7242	19.8943	19.9310	19.9277	19.8232	19.4511	19.0200	18.6821	(90)
Living area fraction									fLA = Living area / (4) =			0.2153	(91)
MIT	18.9138	19.0573	19.3037	19.6371	19.9353	20.1134	20.1566	20.1514	20.0357	19.6571	19.2257	18.8881	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9138	19.0573	19.3037	19.6371	19.9353	20.1134	20.1566	20.1514	20.0357	19.6571	19.2257	18.8881	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9949	0.9873	0.9612	0.8838	0.7126	0.5146	0.5773	0.8465	0.9746	0.9950	0.9981	(94)
Ext temp.	384.5317	439.9045	489.4633	530.1262	521.0517	413.6254	284.6101	296.0167	397.3002	405.1696	373.9473	364.0316	(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	1213.7977	1174.0984	1060.2582	882.9039	676.2916	449.9796	290.2789	305.8261	485.6035	743.7780	998.4305	1212.7928	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	616.9740	493.3783	424.6714	254.0000	115.4985	0.0000	0.0000	0.0000	0.0000	251.9247	449.6279	631.4784	(98)
												3237.5531	(98)
												46.7854	(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	767.1894	603.9576	619.5702	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8300	0.9003	0.8707	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	636.7596	543.7548	539.4767	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	761.8678	728.2353	682.7514	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	90.0779	137.2535	106.5964	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												333.9278 (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	22.5195	34.3134	26.6491	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												83.4820 (107)
Space cooling per m2												1.2064 (108)
Energy for space heating												46.7854 (99)
Energy for space cooling												1.2064 (108)
Total												47.9918 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)			9.0000	1.3258	11.9318		(27)
ground			34.6000	0.1300	4.4980		(28a)
external	84.3400	13.2000	71.1400	0.1800	12.8052		(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) =	38.3530		(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) =	47.1920 (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	80.5204	80.3458	80.1746	79.3704	79.2200	78.5196	78.5196	78.3899	78.7894	79.2200	79.5243	79.8425 (39)
Average = Sum(39)m / 12 =												79.3697 (39)
HLP	1.1636	1.1611	1.1586	1.1470	1.1448	1.1347	1.1347	1.1328	1.1386	1.1448	1.1492	1.1538 (40)
HLP (average)												1.1470 (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										Total = Sum(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	18.9958	16.8719	13.7212	10.3878	7.7650	6.5556	7.0835	9.2074	12.3582	15.6915	18.3143	19.5238	(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	311.3893	310.0077	299.0772	281.2355	262.5237	245.0896	234.1749	237.8842	247.4289	265.3977	285.9949	302.0145	(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	
Northeast				1.3000	11.2829		0.6300	0.7000		0.7700	4.4827 (75)	
Southeast				4.4000	36.7938		0.6300	0.7000		0.7700	49.4766 (77)	
Northwest				3.3000	11.2829		0.6300	0.7000		0.7700	11.3791 (81)	
Solar gains	65.3383	116.5640	173.4824	238.4100	288.4494	295.7812	281.2454	242.4740	195.7402	132.6013	79.2197	55.2952 (83)
Total gains	376.7277	426.5717	472.5596	519.6455	550.9731	540.8707	515.4203	480.3581	443.1691	397.9990	365.2147	357.3097 (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	59.6812	59.8109	59.9387	60.5459	60.6609	61.2020	61.2020	61.3032	60.9924	60.6609	60.4287	60.1879		
alpha	4.9787	4.9874	4.9959	5.0364	5.0441	5.0801	5.0801	5.0869	5.0662	5.0441	5.0286	5.0125		
util living area	0.9987	0.9973	0.9934	0.9787	0.9296	0.8034	0.6386	0.6980	0.9076	0.9867	0.9974	0.9990	(86)	
MIT	19.6889	19.8242	20.0608	20.3865	20.6950	20.9074	20.9777	20.9655	20.8077	20.4142	19.9940	19.6649	(87)	
Th 2	19.9492	19.9513	19.9533	19.9627	19.9644	19.9726	19.9726	19.9741	19.9695	19.9644	19.9609	19.9571	(88)	
util rest of house	0.9983	0.9964	0.9908	0.9696	0.8975	0.7176	0.5052	0.5670	0.8524	0.9795	0.9964	0.9987	(89)	
MIT 2	18.7525	18.8890	19.1262	19.4546	19.7468	19.9267	19.9666	19.9635	19.8543	19.4862	19.0665	18.7348	(90)	
Living area fraction									fLA = Living area / (4) =			0.2153	(91)	
MIT	18.9541	19.0904	19.3274	19.6552	19.9509	20.1379	20.1843	20.1793	20.0596	19.6860	19.2662	18.9351	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9541	19.0904	19.3274	19.6552	19.9509	20.1379	20.1843	20.1793	20.0596	19.6860	19.2662	18.9351	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9977	0.9953	0.9888	0.9662	0.8970	0.7331	0.5343	0.5954	0.8583	0.9768	0.9953	0.9982	(94)
Useful gains	375.8551	424.5846	467.2610	502.0767	494.2127	396.5384	275.3755	285.9992	380.3806	388.7830	363.5153	356.6758	(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	1179.9537	1140.1375	1028.4324	853.6458	653.6386	434.8341	281.4365	296.2550	469.5500	719.7956	967.5128	1176.4885	(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	598.2494	480.8515	417.5115	253.1298	118.6129	0.0000	0.0000	0.0000	0.0000	246.2734	434.8782	609.9406	(98)
Space heating												3159.4474	(98)
Space heating per m2											(98) / (4) =	45.6568	(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	738.0842	581.0450	595.7633	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8223	0.8957	0.8669	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	606.9625	520.4168	516.4821	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	715.6152	684.2557	644.8348	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	78.2300	121.8962	95.4944	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												295.6206 (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	19.5575	30.4740	23.8736	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												73.9051 (107)
Space cooling per m2												1.0680 (108)
Energy for space heating												45.6568 (99)
Energy for space cooling												1.0680 (108)
Total												46.7247 (109)
Target Fabric Energy Efficiency (TFEE)												53.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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											3.9000		
Infiltration rate											0.1950	(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) =		0.1658	(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)	
	0.1948	0.1823	0.1823	0.1658	0.1699	0.1616	0.1616	0.1575	0.1575	0.1699	0.1658	0.1699 (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)			9.0000	1.3258	11.9318		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	13.2000	71.1400	0.2700	19.2078	150.0000	10670.9995 (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) =		44.1376		(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) =	17560.7994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							253.7688 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss						(33) + (36) =	50.9851 (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	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156 (39)
Average = Sum(39)m / 12 =												79.8156 (39)
HLP	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534 (40)
HLP (average)												1.1534 (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)
								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)
RHI water heating demand												1535 (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	47.4896	42.1798	34.3030	25.9695	19.4125	16.3889	17.7088	23.0185	30.8954	39.2288	45.7858	48.8095 (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	505.4984	501.1965	481.5047	451.2428	420.4936	393.0043	377.0359	384.9834	402.5020	432.9627	466.6677	491.9422 (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			
Northeast				1.3000	14.6130	0.4500	0.0000			0.7700			6.5824 (75)
Southeast				4.4000	45.0642	0.4500	0.0000			0.7700			68.7048 (77)
Northwest				3.3000	14.6130	0.4500	0.0000			0.7700			16.7093 (81)
Solar gains	91.9966	140.2146	213.7909	296.7755	338.8791	384.7463	351.4191	315.5423	253.1954	172.5041	111.2880	73.6347 (83)	
Total gains	597.4950	641.4110	695.2956	748.0183	759.3727	777.7505	728.4550	700.5257	655.6974	605.4669	577.9557	565.5769 (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	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159
alpha	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744
util living area	0.9866	0.9800	0.9575	0.8915	0.7493	0.5139	0.3602	0.3632	0.6473	0.8943	0.9718	0.9891 (86)
MIT	20.1426	20.2378	20.4588	20.7278	20.9175	20.9901	20.9987	20.9987	20.9698	20.7736	20.4262	20.1130 (87)
Th 2	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575 (88)
util rest of house												
	0.9821	0.9733	0.9432	0.8557	0.6765	0.4135	0.2472	0.2457	0.5420	0.8497	0.9605	0.9853 (89)
MIT 2	19.2080	19.3010	19.5144	19.7609	19.9124	19.9545	19.9573	19.9573	19.9462	19.8064	19.4865	19.1791 (90)
Living area fraction									fLA = Living area / (4) =			0.2153 (91)
MIT	19.4092	19.5027	19.7178	19.9690	20.1288	20.1775	20.1815	20.1815	20.1666	20.0147	19.6888	19.3802 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2592	19.3527	19.5678	19.8190	19.9788	20.0275	20.0315	20.0315	20.0166	19.8647	19.5388	19.2302 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9781	0.9683	0.9365	0.8502	0.6781	0.4204	0.2553	0.2541	0.5483	0.8450	0.9546	0.9818 (94)
Useful gains	584.3881	621.0628	651.1226	635.9547	514.9542	326.9931	185.9568	177.9845	359.5416	511.5908	551.7333	555.2592 (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												
	1090.2191	1065.7562	955.2134	775.7313	549.0370	329.4352	186.0930	178.1120	368.4777	619.7431	873.0895	1079.9199 (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												
	376.3382	298.8340	226.2435	100.6392	25.3576	0.0000	0.0000	0.0000	0.0000	80.4653	231.3765	390.3475 (98)
Space heating												
RHI space heating demand												1729.6018 (98)
												1730 (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											3.9000	
Infiltration rate											0.1950 (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) =	0.1658 (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												
	0.2113	0.2072	0.2030	0.1823	0.1782	0.1575	0.1575	0.1533	0.1658	0.1782	0.1865	0.1948 (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)			9.0000	1.3258	11.9318		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	13.2000	71.1400	0.2700	19.2078	150.0000	10670.9995 (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) =	44.1376		(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) =	17560.7994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							253.7688 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss						(33) + (36) =	50.9851 (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	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156 (39)
Average = Sum(39)m / 12 =												79.8156 (39)
HLP	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534 (40)
HLP (average)												1.1534 (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	47.4896	42.1798	34.3030	25.9695	19.4125	16.3889	17.7088	23.0185	30.8954	39.2288	45.7858	48.8095	(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	505.4984	501.1965	481.5047	451.2428	420.4936	393.0043	377.0359	384.9834	402.5020	432.9627	466.6677	491.9422	(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			
Northeast	1.3000				11.2829		0.4500		0.0000		0.7700		5.0824 (75)	
Southeast	4.4000				36.7938		0.4500		0.0000		0.7700		56.0959 (77)	
Northwest	3.3000				11.2829		0.4500		0.0000		0.7700		12.9015 (81)	
Solar gains	74.0798	132.1587	196.6921	270.3061	327.0401	335.3528	318.8723	274.9138	221.9276	150.3416	89.8183	62.6929	(83)	
Total gains	579.5782	633.3552	678.1968	721.5490	747.5337	728.3571	695.9082	659.8972	624.4296	583.3044	556.4860	554.6351	(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	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159
alpha	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744
util living area	0.9917	0.9858	0.9714	0.9306	0.8324	0.6622	0.4967	0.5434	0.7788	0.9438	0.9847	0.9933 (86)
MIT	19.9838	20.1145	20.3318	20.6055	20.8391	20.9618	20.9926	20.9885	20.9137	20.6253	20.2475	19.9412 (87)
Th 2	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575 (88)
util rest of house	0.9890	0.9813	0.9619	0.9070	0.7787	0.5702	0.3832	0.4269	0.6964	0.9196	0.9790	0.9912 (89)
MIT 2	19.0507	19.1796	19.3922	19.6517	19.8543	19.9409	19.9557	19.9544	19.9136	19.6754	19.3122	19.0085 (90)
Living area fraction												
MIT	19.2516	19.3809	19.5945	19.8571	20.0663	20.1607	20.1790	20.1771	20.1290	19.8799	19.5135	19.2093 (91)
Temperature adjustment												-0.1500
adjusted MIT	19.1016	19.2309	19.4445	19.7071	19.9163	20.0107	20.0290	20.0271	19.9790	19.7299	19.3635	19.0593 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9861	0.9771	0.9560	0.9002	0.7763	0.5752	0.3912	0.4349	0.6983	0.9130	0.9746	0.9886 (94)
Useful gains	571.5146	618.8762	648.3604	649.5117	580.2979	418.9296	272.2233	286.9984	436.0210	532.5513	542.3537	548.3319 (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												
	1181.4002	1143.8299	1033.1716	862.5725	655.7908	431.8618	273.6858	289.4987	469.2336	728.7084	978.8219	1186.0074 (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												
	453.7549	352.7689	286.2996	153.4038	56.1667	0.0000	0.0000	0.0000	0.0000	145.9408	314.2571	474.4306 (98)
Space heating												2237.0223 (98)
Space heating per m2												(98) / (4) = 32.3269 (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													2471.8479 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	453.7549	352.7689	286.2996	153.4038	56.1667	0.0000	0.0000	0.0000	0.0000	145.9408	314.2571	474.4306	(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)	501.3866	389.7999	316.3531	169.5069	62.0627	0.0000	0.0000	0.0000	0.0000	161.2606	347.2454	524.2327	(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	89.6587	89.5818	89.4122	89.0327	88.2885	87.3000	87.3000	87.3000	87.3000	88.9633	89.4877	89.7036	(216)
Water heating fuel used	174.1435	152.8657	159.0763	140.7493	137.2935	121.4582	114.1757	128.7033	129.5534	146.1937	156.7549	169.0481	(219)
Annual totals kWh/year												1730.0155	(219)
Space heating fuel - main system													
Space heating fuel - secondary												2471.8479	(211)
												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)													335.4724 (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												4163.4302	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2471.8479	3.4800	86.0203 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1730.0155	3.4800	60.2045 (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	335.4724	13.1900	44.2488 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-494.0096	13.1900	-65.1599 (252)
Total energy cost			261.1555 (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] =	0.9605 (257)
SAP value	86.6015	
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	2471.8479	0.2160	533.9191 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1730.0155	0.2160	373.6834 (264)
Space and water heating			907.6025 (265)
Pumps and fans	120.1040	0.5190	62.3340 (267)
Energy for lighting	335.4724	0.5190	174.1102 (268)
Energy saving/generation technologies			
PV Unit	-494.0096	0.5190	-256.3910 (269)
Total kg/year			887.6556 (272)
CO2 emissions per m2			12.8300 (273)
EI value			89.5844
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8861 = 3.927$, stars = 4
Water heating environmental impact	$0.216 / 0.8861 = 0.2438$, 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											3.9000	
Infiltration rate											0.1950 (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) =	0.1658 (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	0.1948	0.1823	0.1823	0.1658	0.1699	0.1616	0.1616	0.1575	0.1575	0.1699	0.1658	0.1699 (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)			9.0000	1.3258	11.9318		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	13.2000	71.1400	0.2700	19.2078	150.0000	10670.9995 (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) =	44.1376		(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) =	17560.7994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							253.7688 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss						(33) + (36) =	50.9851 (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	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156 (39)
Average = Sum(39)m / 12 =												79.8156 (39)
HLP	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534 (40)
HLP (average)												1.1534 (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 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)
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)												
Distribution loss (46)m = 0.15 x (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 (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)	
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												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
133.5928	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												
47.4896	42.1798	34.3030	25.9695	19.4125	16.3889	17.7088	23.0185	30.8954	39.2288	45.7858	48.8095 (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 (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												
505.4984	501.1965	481.5047	451.2428	420.4936	393.0043	377.0359	384.9834	402.5020	432.9627	466.6677	491.9422 (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			
Northeast	1.3000				14.6130		0.4500		0.0000		0.7700		6.5824 (75)	
Southeast	4.4000				45.0642		0.4500		0.0000		0.7700		68.7048 (77)	
Northwest	3.3000				14.6130		0.4500		0.0000		0.7700		16.7093 (81)	
Solar gains	91.9966	140.2146	213.7909	296.7755	338.8791	384.7463	351.4191	315.5423	253.1954	172.5041	111.2880	73.6347	(83)	
Total gains	597.4950	641.4110	695.2956	748.0183	759.3727	777.7505	728.4550	700.5257	655.6974	605.4669	577.9557	565.5769	(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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159
util living area	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744
0.9866	0.9800	0.9575	0.8915	0.7493	0.5139	0.3602	0.3632	0.6473	0.8943	0.9718	0.9891 (86)	
MIT	20.1426	20.2378	20.4588	20.7278	20.9175	20.9901	20.9987	20.9987	20.9698	20.7736	20.4262	20.1130 (87)
Th 2	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575 (88)
util rest of house												
0.9821	0.9733	0.9432	0.8557	0.6765	0.4135	0.2472	0.2457	0.5420	0.8497	0.9605	0.9853 (89)	
MIT 2	19.2080	19.3010	19.5144	19.7609	19.9124	19.9545	19.9573	19.9573	19.9462	19.8064	19.4865	19.1791 (90)
Living area fraction												
MIT	19.4092	19.5027	19.7178	19.9690	20.1288	20.1775	20.1815	20.1815	20.1666	20.0147	19.6888	19.3802 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2592	19.3527	19.5678	19.8190	19.9788	20.0275	20.0315	20.0315	20.0166	19.8647	19.5388	19.2302 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9781	0.9683	0.9365	0.8502	0.6781	0.4204	0.2553	0.2541	0.5483	0.8450	0.9546	0.9818 (94)
Ext temp.	584.3881	621.0628	651.1226	635.9547	514.9542	326.9931	185.9568	177.9845	359.5416	511.5908	551.7333	555.2592 (95)
Heat loss rate W	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)
Month fracti	1090.2191	1065.7562	955.2134	775.7313	549.0370	329.4352	186.0930	178.1120	368.4777	619.7431	873.0895	1079.9199 (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	376.3382	298.8340	226.2435	100.6392	25.3576	0.0000	0.0000	0.0000	0.0000	80.4653	231.3765	390.3475 (98)
Space heating per m2												1729.6018 (98)
(98) / (4) =												24.9942 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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												1911.1623	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	376.3382	298.8340	226.2435	100.6392	25.3576	0.0000	0.0000	0.0000	0.0000	80.4653	231.3765	390.3475	(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)	415.8433	330.2033	249.9929	111.2035	28.0195	0.0000	0.0000	0.0000	0.0000	88.9119	255.6647	431.3232	(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	89.5376	89.4694	89.2374	88.6969	87.8373	87.3000	87.3000	87.3000	87.3000	88.4960	89.2650	89.5813	(216)
Water heating fuel used	174.3789	153.0576	159.3880	141.2822	137.9987	121.4582	114.1757	128.7033	129.5534	146.9657	157.1459	169.2789	(219)
Annual totals kWh/year												1733.3865	(219)
Space heating fuel - main system												1911.1623	(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)												335.4724	(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												3545.9858	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1911.1623	9.7400	186.1472 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1733.3865	9.7400	168.8318 (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	335.4724	36.8500	123.6216 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-554.1393	36.8500	-204.2003 (252)
Total energy cost			422.6586 (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	1911.1623	0.2160	412.8110 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1733.3865	0.2160	374.4115 (264)
Space and water heating			787.2225 (265)
Pumps and fans	120.1040	0.5190	62.3340 (267)
Energy for lighting	335.4724	0.5190	174.1102 (268)
Energy saving/generation technologies			
PV Unit	-554.1393	0.5190	-287.5983 (269)
Total kg/year			736.0684 (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	1911.1623	1.2200	2331.6180 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1733.3865	1.2200	2114.7315 (264)
Space and water heating			4446.3494 (265)
Pumps and fans	120.1040	3.0700	368.7192 (267)
Energy for lighting	335.4724	3.0700	1029.9004 (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			4143.7614 (272)
Primary energy kWh/m2/year			59.8809 (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 (24.2%)

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	£168	£186	-£18
Mains gas	£459	£367	£92
Space heating	£334	£334	£0
Water heating	£169	£95	£73
Lighting	£124	£124	£0
Generated (PV)	-£204	-£204	£0
Total cost of fuels	£423	£349	£74
Total cost of uses	£423	£349	£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	60 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											3.9000	
Infiltration rate											0.1950 (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) =	0.1658 (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												
	0.2113	0.2072	0.2030	0.1823	0.1782	0.1575	0.1575	0.1533	0.1658	0.1782	0.1865	0.1948 (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)			9.0000	1.3258	11.9318		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	13.2000	71.1400	0.2700	19.2078	150.0000	10670.9995 (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) =		44.1376		(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) =		17560.7994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							253.7688 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss					(33) + (36) =		50.9851 (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	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156 (39)
Average = Sum(39)m / 12 =												79.8156 (39)
HLP	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534 (40)
HLP (average)												1.1534 (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 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												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)
												-820.2625 (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	47.4896	42.1798	34.3030	25.9695	19.4125	16.3889	17.7088	23.0185	30.8954	39.2288	45.7858	48.8095	(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	505.4984	501.1965	481.5047	451.2428	420.4936	393.0043	377.0359	384.9834	402.5020	432.9627	466.6677	491.9422	(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
Northeast				1.3000	11.2829		0.4500		0.0000		0.7700		5.0824 (75)
Southeast				4.4000	36.7938		0.4500		0.0000		0.7700		56.0959 (77)
Northwest				3.3000	11.2829		0.4500		0.0000		0.7700		12.9015 (81)
Solar gains	74.0798	132.1587	196.6921	270.3061	327.0401	335.3528	318.8723	274.9138	221.9276	150.3416	89.8183		62.6929 (83)
Total gains	579.5782	633.3552	678.1968	721.5490	747.5337	728.3571	695.9082	659.8972	624.4296	583.3044	556.4860		554.6351 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	
util living area	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	
	0.9917	0.9858	0.9714	0.9306	0.8324	0.6622	0.4967	0.5434	0.7788	0.9438	0.9847	0.9933	(86)
MIT	19.9838	20.1145	20.3318	20.6055	20.8391	20.9618	20.9926	20.9885	20.9137	20.6253	20.2475	19.9412	(87)
Th 2	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	(88)
util rest of house	0.9890	0.9813	0.9619	0.9070	0.7787	0.5702	0.3832	0.4269	0.6964	0.9196	0.9790	0.9912	(89)
MIT 2	19.0507	19.1796	19.3922	19.6517	19.8543	19.9409	19.9557	19.9544	19.9136	19.6754	19.3122	19.0085	(90)
Living area fraction									fLA = Living area / (4) =			0.2153	(91)
MIT	19.2516	19.3809	19.5945	19.8571	20.0663	20.1607	20.1790	20.1771	20.1290	19.8799	19.5135	19.2093	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1016	19.2309	19.4445	19.7071	19.9163	20.0107	20.0290	20.0271	19.9790	19.7299	19.3635	19.0593	(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	0.9861	0.9771	0.9560	0.9002	0.7763	0.5752	0.3912	0.4349	0.6983	0.9130	0.9746	0.9886	(94)
Useful gains	571.5146	618.8762	648.3604	649.5117	580.2979	418.9296	272.2233	286.9984	436.0210	532.5513	542.3537	548.3319	(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	1181.4002	1143.8299	1033.1716	862.5725	655.7908	431.8618	273.6858	289.4987	469.2336	728.7084	978.8219	1186.0074	(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	453.7549	352.7689	286.2996	153.4038	56.1667	0.0000	0.0000	0.0000	0.0000	145.9408	314.2571	474.4306	(98)
Space heating												2237.0223	(98)
Space heating per m2											(98) / (4) =	32.3269	(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													2471.8479	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	453.7549	352.7689	286.2996	153.4038	56.1667	0.0000	0.0000	0.0000	0.0000	145.9408	314.2571	474.4306	(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)	501.3866	389.7999	316.3531	169.5069	62.0627	0.0000	0.0000	0.0000	0.0000	161.2606	347.2454	524.2327	(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	89.7571	89.7888	89.8192	89.8919	90.0317	87.3000	87.3000	87.3000	87.3000	89.3468	89.6363	89.7848	(216)	
Fuel for water heating, kWh/month	147.4522	108.3073	83.0932	38.6193	10.3176	0.0000	0.0000	20.0294	44.4400	88.7753	125.0193	146.7258	(219)	
Water heating fuel used												812.7795	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2471.8479	(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)													335.4724	(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													3296.1941	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2471.8479	3.4800	86.0203	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	812.7795	3.4800	28.2847	(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	335.4724	13.1900	44.2488	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-494.0096	13.1900	-65.1599	(252)
Total energy cost			235.8307	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.8673	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	87.9008	
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	2471.8479	0.2160	533.9191	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	812.7795	0.2160	175.5604	(264)
Space and water heating			709.4795	(265)
Pumps and fans	170.1040	0.5190	88.2840	(267)
Energy for lighting	335.4724	0.5190	174.1102	(268)
Energy saving/generation technologies				
PV Unit	-494.0096	0.5190	-256.3910	(269)
Total kg/year			715.4827	(272)
CO2 emissions per m2			10.3400	(273)
EI value			91.6047	
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											3.9000	
Infiltration rate											0.1950 (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) =	0.1658 (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	0.1948	0.1823	0.1823	0.1658	0.1699	0.1616	0.1616	0.1575	0.1575	0.1699	0.1658	0.1699 (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)			9.0000	1.3258	11.9318		(27)
ground			34.6000	0.1200	4.1520	75.0000	2594.9999 (28a)
external	84.3400	13.2000	71.1400	0.2700	19.2078	150.0000	10670.9995 (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) =		44.1376		(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) =		17560.7994 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							253.7688 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8475 (36)
Total fabric heat loss					(33) + (36) =		50.9851 (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	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156	79.8156 (39)
Average = Sum(39)m / 12 =												79.8156 (39)
HLP	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534	1.1534 (40)
HLP (average)												1.1534 (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	47.4896	42.1798	34.3030	25.9695	19.4125	16.3889	17.7088	23.0185	30.8954	39.2288	45.7858	48.8095 (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	505.4984	501.1965	481.5047	451.2428	420.4936	393.0043	377.0359	384.9834	402.5020	432.9627	466.6677	491.9422 (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			
Northeast				1.3000	14.6130	0.4500	0.0000	0.7700	6.5824 (75)			
Southeast				4.4000	45.0642	0.4500	0.0000	0.7700	68.7048 (77)			
Northwest				3.3000	14.6130	0.4500	0.0000	0.7700	16.7093 (81)			
Solar gains	91.9966	140.2146	213.7909	296.7755	338.8791	384.7463	351.4191	315.5423	253.1954	172.5041	111.2880	73.6347 (83)
Total gains	597.4950	641.4110	695.2956	748.0183	759.3727	777.7505	728.4550	700.5257	655.6974	605.4669	577.9557	565.5769 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159	61.1159
util living area	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744	5.0744
	0.9866	0.9800	0.9575	0.8915	0.7493	0.5139	0.3602	0.3632	0.6473	0.8943	0.9718	0.9891 (86)
MIT	20.1426	20.2378	20.4588	20.7278	20.9175	20.9901	20.9987	20.9987	20.9698	20.7736	20.4262	20.1130 (87)
Th 2	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575	19.9575 (88)
util rest of house	0.9821	0.9733	0.9432	0.8557	0.6765	0.4135	0.2472	0.2457	0.5420	0.8497	0.9605	0.9853 (89)
MIT 2	19.2080	19.3010	19.5144	19.7609	19.9124	19.9545	19.9573	19.9573	19.9462	19.8064	19.4865	19.1791 (90)
Living area fraction	19.4092	19.5027	19.7178	19.9690	20.1288	20.1775	20.1815	20.1815	20.1666	20.0147	19.6888	19.3802 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2592	19.3527	19.5678	19.8190	19.9788	20.0275	20.0315	20.0315	20.0166	19.8647	19.5388	19.2302 (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	0.9781	0.9683	0.9365	0.8502	0.6781	0.4204	0.2553	0.2541	0.5483	0.8450	0.9546	0.9818	(94)
Useful gains	584.3881	621.0628	651.1226	635.9547	514.9542	326.9931	185.9568	177.9845	359.5416	511.5908	551.7333	555.2592	(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	1090.2191	1065.7562	955.2134	775.7313	549.0370	329.4352	186.0930	178.1120	368.4777	619.7431	873.0895	1079.9199	(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	376.3382	298.8340	226.2435	100.6392	25.3576	0.0000	0.0000	0.0000	0.0000	80.4653	231.3765	390.3475	(98)
Space heating												1729.6018	(98)
Space heating per m2											(98) / (4) =	24.9942	(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													1911.1623 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	376.3382	298.8340	226.2435	100.6392	25.3576	0.0000	0.0000	0.0000	0.0000	80.4653	231.3765	390.3475	(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)	415.8433	330.2033	249.9929	111.2035	28.0195	0.0000	0.0000	0.0000	0.0000	88.9119	255.6647	431.3232	(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	89.6638	89.6911	89.6911	89.6826	89.3198	87.3000	87.3000	87.3000	87.3000	88.9204	89.4598	89.6802	(216)
(217)m	143.2206	108.7311	82.3202	37.1350	16.0025	0.0000	0.0000	13.5202	39.3999	85.0888	120.1574	144.6194	(219)
Fuel for water heating, kWh/month												790.1954	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												1911.1623	(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)													335.4724 (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												2652.7948	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1911.1623	9.7400	186.1472	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	790.1954	9.7400	76.9650	(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	335.4724	36.8500	123.6216	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-554.1393	36.8500	-204.2003	(252)
Total energy cost			349.2168	(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	1911.1623	0.2160	412.8110	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	790.1954	0.2160	170.6822	(264)
Space and water heating			583.4932	(265)

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Pumps and fans	170.1040	0.5190	88.2840 (267)
Energy for lighting	335.4724	0.5190	174.1102 (268)
Energy saving/generation technologies			
PV Unit	-554.1393	0.5190	-287.5983 (269)
Total kg/year			558.2891 (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	1911.1623	1.2200	2331.6180 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	790.1954	1.2200	964.0384 (264)
Space and water heating			3295.6563 (265)
Pumps and fans	170.1040	3.0700	522.2192 (267)
Energy for lighting	335.4724	3.0700	1029.9004 (268)
Energy saving/generation technologies			
PV Unit	-554.1393	3.0700	-1701.2076 (269)
Primary energy kWh/year			3146.5683 (272)
Primary energy kWh/m2/year			45.4706 (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	253.8 (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	50.99 (P7)
Summer heat loss coefficient	281.63 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South East	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
North East	1.3000	106.0502	0.4500	0.0000	0.9000	55.8354
South East	4.4000	127.3119	0.4500	0.0000	0.9000	226.8697
North West	3.3000	106.0502	0.4500	0.0000	0.9000	141.7361

total: 424.4413

	Jun	Jul	Aug	
Solar gains	457	424	373	(P4)
Internal gains	390	374	382	
Total summer gains	847	798	755	(P5)

Summer gain/loss ratio	3.01	2.84	2.68	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 253.8)	0.22	0.22	0.22	
Threshold temperature	18.63	20.36	20.20	(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 83	Issued on Date	27/04/2023
Assessment Reference	83 Hamblewood	Prop Type Ref	21809
Property	1 Hickory Way, HEDGE END, SO30 0AW		
SAP Rating	87 B	DER	15.04
Environmental	90 B	% DER<TER	23.23
CO ₂ Emissions (t/year)	0.74	DFEE	47.99
General Requirements Compliance	Pass	% DFEE<TFEE	10.69
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
Client	Y128-0001		

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)	19.59	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.04	kgCO ₂ /m ²	Pass
	-4.55 (-23.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.73	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.99	kWh/m ² /yr	
	-5.7 (-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	1.34 (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	3.90 (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 North East

1.30 m², No overhang

Windows facing South East

4.40 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

3.90 (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.