

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Atkins End/Semi (ASHP + PV)				Issued on Date	15/12/2022
Assessment Reference	Atkins End/Semi (ASHP + PV)	Prop Type Ref	Atkins			
Property	2 Bed, WC, B, 2 Storey					
SAP Rating	93 A	DER	9.37	TER	27.11	
Environmental	94 A	% DER<TER	65.44			
CO ₂ Emissions (t/year)	0.47	DFEE	41.87	TFEE	50.85	
General Requirements Compliance	Pass	% DFEE<TFEE	17.65			
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk				Assessor ID	Q920-0001
Client						

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 71 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 27.11 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.37 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM 8kW VWL 85/3 A 230v

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.56 kWh/day
Permitted by DBSCG 2.24 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 3.90 m², No overhang
Windows facing South West: 6.80 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Window U-value 0.90 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.20 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.4600 (1b)	x 2.3100 (2b)	= 81.9126 (1b) - (3b)
First floor	35.4600 (1c)	x 2.6100 (2c)	= 92.5506 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.4632 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.0100		
Infiltration rate															0.2005 (18)		
Number of sides sheltered															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1855 (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																	
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			7.3700	1.1450	8.4389		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm Wht + Wht Topsheet			35.4600	0.1100	3.9006	75.0000	2659.5000 (28a)					
100mm Knauf Supafil 34	82.9000	12.8500	70.0500	0.2500	17.5125	52.8000	3698.6400 (29a)					
FP McCann System	35.4600		35.4600	0.1800	6.3828	9.0000	319.1400 (30)					
Total net area of external elements Aum(A, m2)			153.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.7996		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			65.7000			9.0000	591.3000 (32c)					
Timber 1F			69.5700			9.0000	626.1300 (32c)					
Internal Floor			35.4600			12.6000	446.7960 (32d)					
Internal Ceiling			35.4600			9.0000	319.1400 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10456.1460 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4358 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1111 (36)					
Total fabric heat loss						(33) + (36) =	46.9107 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 28.7864	Feb 28.7864	Mar 28.7864	Apr 28.7864	May 28.7864	Jun 28.7864	Jul 28.7864	Aug 28.7864	Sep 28.7864	Oct 28.7864	Nov 28.7864	Dec 28.7864 (38)
Heat transfer coeff	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972 (39)
Average = Sum(39)m / 12 =												75.6972 (39)
HLP	Jan 1.0674	Feb 1.0674	Mar 1.0674	Apr 1.0674	May 1.0674	Jun 1.0674	Jul 1.0674	Aug 1.0674	Sep 1.0674	Oct 1.0674	Nov 1.0674	Dec 1.0674 (40)
HLP (average)												1.0674 (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												2.2683 (42)
Average daily hot water use (litres/day)												88.0710 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use												
	96.8781	93.3552	89.8324	86.3096	82.7867	79.2639	79.2639	82.7867	86.3096	89.8324	93.3552	96.8781 (44)
Energy conte	143.6674	125.6524	129.6620	113.0425	108.4670	93.5987	86.7330	99.5274	100.7161	117.3749	128.1238	139.1342 (45)
Energy content (annual)	Total = Sum (45)m = 1385.6994 (45)											
Distribution loss (46)m = 0.15 x (45)m	21.5501	18.8479	19.4493	16.9564	16.2700	14.0398	13.0100	14.9291	15.1074	17.6062	19.2186	20.8701 (46)
Water storage loss:												
Store volume	200.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.5600 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.8424 (55)											
Total storage loss												
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (56)
If cylinder contains dedicated solar storage												
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	193.0442	170.2508	179.0388	160.8265	157.8438	141.3827	136.1098	148.9042	148.5001	166.7517	175.9078	188.5110 (62)
WWHRS	-46.2092	-40.6549	-41.4954	-34.1633	-31.7328	-26.1861	-22.1768	-26.8460	-27.6226	-34.1312	-39.5146	-44.6584 eq.(G10)
Total of WWHRS savings												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-415.3914
Solar input (sum of months) = Sum (63)m = 0.0000 (63)												
Output from w/h	146.8350	129.5959	137.5434	126.6632	126.1110	115.1967	113.9330	122.0581	120.8775	132.6205	136.3932	143.8526 (64)
Total per year (kWh/year) = Sum (64)m = 1551.6800 (64)												
Heat gains from water heating, kWh/month												
	87.2708	77.4581	82.6141	75.8138	75.5667	69.3488	68.3402	72.5943	71.7153	78.5286	80.8284	85.7636 (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	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	18.7721	16.6732	13.5596	10.2655	7.6735	6.4783	7.0001	9.0990	12.2126	15.5067	18.0986	19.2938 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	199.4347	201.5042	196.2891	185.1868	171.1721	158.0003	149.2007	147.1312	152.3463	163.4486	177.4633	190.6351 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413 (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)												
	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301 (71)
Water heating gains (Table 5)												
	117.2995	115.2651	111.0404	105.2970	101.5682	96.3178	91.8551	97.5730	99.6046	105.5492	112.2616	115.2736 (72)
Total internal gains	392.5301	390.4663	377.9128	357.7730	337.4376	317.8201	305.0796	310.8269	321.1872	341.5282	364.8473	382.2263 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Access factor Table 6d	Gains W
Northeast	3.9000	11.2829	0.4600	0.0000	0.7700	15.5860 (75)
Southwest	3.4700	36.7938	0.4600	0.0000	0.7700	45.2223 (79)
Southwest	3.3300	36.7938	0.4300	0.0000	0.7700	40.5675 (79)
Solar gains						
	101.3759	177.8577	257.1038	341.6132	403.6733	410.0081
Total gains						
	493.9060	568.3239	635.0167	699.3862	741.1109	727.8283

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698
alpha	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580
util living area	0.9782	0.9635	0.9345	0.8720	0.7601	0.6036	0.4595	0.5040	0.7184	0.8991	0.9642	0.9817 (86)
Weekday	17.9445	18.2617	18.7396	19.2933	19.7296	19.9534	20.0132	20.0059	19.8710	19.3221	18.5223	17.8551
Weekend	19.9879	20.1303	20.3466	20.6034	20.8177	20.9415	20.9831	20.9763	20.8885	20.6111	20.2453	19.9479
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.4380	19.6547	19.9916	20.3807	20.7187	20.9102	20.9739	20.9634	20.8260	20.3998	19.8215	19.3762 (87)
Th 2	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276 (88)
util rest of house												
	0.9740	0.9566	0.9217	0.8468	0.7136	0.5298	0.3655	0.4082	0.6510	0.8736	0.9562	0.9782 (89)
Weekday	17.9445	18.2617	18.7396	19.2933	19.7296	19.9534	20.0132	20.0059	19.8710	19.3221	18.5223	17.8551
Weekend	17.9445	18.2617	18.7396	19.2933	19.7296	19.9534	20.0132	20.0059	19.8710	19.3221	18.5223	17.8551
MIT 2	17.9445	18.2617	18.7396	19.2933	19.7296	19.9534	20.0132	20.0059	19.8710	19.3221	18.5223	17.8551 (90)
Living area fraction												
MIT	18.1892	18.4899	18.9448	19.4715	19.8916	20.1102	20.1706	20.1628	20.0275	19.4987	18.7352	18.1043 (91)
Temperature adjustment	0.0000											
adjusted MIT	18.1892	18.4899	18.9448	19.4715	19.8916	20.1102	20.1706	20.1628	20.0275	19.4987	18.7352	18.1043 (92)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9627	0.9419	0.9040	0.8299	0.7065	0.5364	0.3798	0.4221	0.6510	0.8567	0.9417	0.9681	(94)
Useful gains	475.5074	535.3170	574.0436	580.4257	523.5648	390.4309	264.5074	276.3060	395.3574	464.1767	458.8202	453.4195	(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	1051.3762	1028.7176	942.0337	800.2329	620.0844	417.1055	270.2836	284.8314	448.6913	673.6032	880.7480	1052.5171	(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	428.4464	331.5652	273.7847	158.2611	71.8105	0.0000	0.0000	0.0000	0.0000	155.8134	303.7879	445.7286	(98)
Space heating												2169.1979	(98)
Space heating per m2												30.5865	(99)

(98) / (4) = 30.5865 (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 %)	222.0383	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	976.9479	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	428.4464	331.5652	273.7847	158.2611	71.8105	0.0000	0.0000	0.0000	0.0000	155.8134	303.7879	445.7286	(98)
Space heating efficiency (main heating system 1)	222.0383	222.0383	222.0383	222.0383	222.0383	0.0000	0.0000	0.0000	0.0000	222.0383	222.0383	222.0383	(210)
Space heating fuel (main heating system)	192.9606	149.3280	123.3052	71.2765	32.3415	0.0000	0.0000	0.0000	0.0000	70.1741	136.8178	200.7441	(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	146.8350	129.5959	137.5434	126.6632	126.1110	115.1967	113.9330	122.0581	120.8775	132.6205	136.3932	143.8526	(64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)
Fuel for water heating, kWh/month	86.2315	76.1075	80.7748	74.3852	74.0609	67.6513	66.9092	71.6808	70.9875	77.8838	80.0994	84.4800	(219)
Water heating fuel used												911.2520	(219)
Annual totals kWh/year												976.9479	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)		
mechanical ventilation fans (SFP = 0.2282)	48.5654	(230a)
Total electricity for the above, kWh/year	48.5654	(231)
Electricity for lighting (calculated in Appendix L)	331.5208	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =	-988.0192	-988.0192	(233)
Total delivered energy for all uses		1280.2669	(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	976.9479	0.5190	507.0359	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	911.2520	0.5190	472.9398	(264)
Space and water heating			979.9758	(265)
Pumps and fans	48.5654	0.5190	25.2054	(267)
Energy for lighting	331.5208	0.5190	172.0593	(268)
Energy saving/generation technologies				
PV Unit	-988.0192	0.5190	-512.7820	(269)
Total CO2, kg/year			664.4585	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.3700	(273)

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

DER	9.3700	ZC1
Total Floor Area	70.9200	
Assumed number of occupants	2.2683	
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	
CO2 emissions from appliances, equation (L14)	16.6640	ZC2
CO2 emissions from cooking, equation (L16)	2.4455	ZC3
Total CO2 emissions	28.4795	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	28.4795	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.4600 (1b)	x 2.3100 (2b)	= 81.9126 (1b) - (3b)
First floor	35.4600 (1c)	x 2.6100 (2c)	= 92.5506 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.4632 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1720 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4220 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3903 (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	0.4976	0.4879	0.4781	0.4293	0.4196	0.3708	0.3708	0.3610	0.3903	0.4196	0.4391	0.4586 (22b)
Effective ac	0.6238	0.6190	0.6143	0.5922	0.5880	0.5687	0.5687	0.5652	0.5762	0.5880	0.5964	0.6052 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			10.7000	1.3258	14.1856		(27)					
150mm Wht + Wht Topsheet			35.4600	0.1300	4.6098		(28a)					
100mm Knauf Supafil 34	82.9000	12.8500	70.0500	0.1800	12.6090		(29a)					
FP McCann System	35.4600		35.4600	0.1300	4.6098		(30)					
Total net area of external elements Aum(A, m2)			153.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	38.1642		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4435 (36)					
Total fabric heat loss						(33) + (36) =	46.6077 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.9154	Feb 35.6386	Mar 35.3672	Apr 34.0927	May 33.8543	Jun 32.7442	Jul 32.7442	Aug 32.5387	Sep 33.1718	Oct 33.8543	Nov 34.3367	Dec 34.8410 (38)
Heat transfer coeff	82.5231	82.2463	81.9749	80.7004	80.4620	79.3519	79.3519	79.1464	79.7795	80.4620	80.9444	81.4487 (39)
Average = Sum(39)m / 12 =												80.6993 (39)
HLP	Jan 1.1636	Feb 1.1597	Mar 1.1559	Apr 1.1379	May 1.1345	Jun 1.1189	Jul 1.1189	Aug 1.1160	Sep 1.1249	Oct 1.1345	Nov 1.1413	Dec 1.1485 (40)
HLP (average)												1.1379 (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												2.2683 (42)
Average daily hot water use (litres/day)												88.0710 (43)
Daily hot water use	Jan 96.8781	Feb 93.3552	Mar 89.8324	Apr 86.3096	May 82.7867	Jun 79.2639	Jul 79.2639	Aug 82.7867	Sep 86.3096	Oct 89.8324	Nov 93.3552	Dec 96.8781 (44)
Energy conte	143.6674	125.6524	129.6620	113.0425	108.4670	93.5987	86.7330	99.5274	100.7161	117.3749	128.1238	139.1342 (45)
Energy content (annual)										Total = Sum(45)m =		1385.6994 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.5501	18.8479	19.4493	16.9564	16.2700	14.0398	13.0100	14.9291	15.1074	17.6062	19.2186	20.8701 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	194.5935	171.6502	180.5881	162.3258	159.3930	142.8820	137.6591	150.4535	149.9994	168.3009	177.4071	190.0603 (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	194.5935	171.6502	180.5881	162.3258	159.3930	142.8820	137.6591	150.4535	149.9994	168.3009	177.4071	190.0603 (64)
Heat gains from water heating, kWh/month	88.5103	78.5776	83.8535	77.0133	76.8061	70.5482	69.5796	73.8337	72.9147	79.7680	82.0278	87.0030 (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	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7721	16.6732	13.5596	10.2655	7.6735	6.4783	7.0001	9.0990	12.2126	15.5067	18.0986	19.2938	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.4347	201.5042	196.2891	185.1868	171.1721	158.0003	149.2007	147.1312	152.3463	163.4486	177.4633	190.6351	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	(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)	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	(71)
Water heating gains (Table 5)	118.9654	116.9310	112.7063	106.9629	103.2340	97.9836	93.5209	99.2389	101.2705	107.2151	113.9275	116.9395	(72)
Total internal gains	397.1959	395.1321	382.5787	362.4389	342.1035	322.4860	309.7455	315.4928	325.8531	346.1941	369.5132	386.8922	(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					3.9000	11.2829	0.6300	0.7000			0.7700	13.4480 (75)
Southwest					6.8000	36.7938	0.6300	0.7000			0.7700	76.4638 (79)
Solar gains	89.9118	157.6200	227.5274	301.8048	356.1988	361.6075	345.3054	303.5044	253.0580	177.4027	108.5071	76.4194 (83)
Total gains	487.1078	552.7521	610.1061	664.2437	698.3022	684.0935	655.0509	618.9971	578.9111	523.5968	478.0203	463.3116 (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	59.6803	59.8811	60.0794	61.0282	61.2090	62.0653	62.0653	62.2265	61.7327	61.2090	60.8443	60.4675
alpha	4.9787	4.9921	5.0053	5.0685	5.0806	5.1377	5.1377	5.1484	5.1155	5.0806	5.0563	5.0312
util living area	0.9963	0.9925	0.9824	0.9498	0.8630	0.6931	0.5230	0.5718	0.8147	0.9633	0.9924	0.9972 (86)
MIT	19.8206	19.9748	20.2205	20.5414	20.8066	20.9551	20.9912	20.9865	20.8951	20.5586	20.1369	19.7994 (87)
Th 2	19.9492	19.9524	19.9555	19.9700	19.9727	19.9854	19.9854	19.9878	19.9805	19.9727	19.9672	19.9615 (88)
util rest of house	0.9951	0.9900	0.9763	0.9316	0.8149	0.6026	0.4076	0.4542	0.7379	0.9463	0.9894	0.9962 (89)
MIT 2	18.3885	18.6150	18.9724	19.4363	19.7848	19.9559	19.9822	19.9823	19.8988	19.4696	18.8626	18.3663 (90)
Living area fraction	18.6231	18.8378	19.1769	19.6173	19.9523	20.1196	20.1476	20.1468	20.0621	fLA = Living area / (4) =		0.1638 (91)
MIT	18.6231	18.8378	19.1769	19.6173	19.9523	20.1196	20.1476	20.1468	20.0621	19.6480	19.0714	18.6011 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6231	18.8378	19.1769	19.6173	19.9523	20.1196	20.1476	20.1468	20.0621	19.6480	19.0714	18.6011 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9862	0.9701	0.9238	0.8138	0.6153	0.4265	0.4734	0.7449	0.9392	0.9856	0.9943	(94)
Useful gains	483.6215	545.1517	591.8381	613.6019	568.2767	420.9447	279.4000	293.0158	431.2380	491.7561	471.1250	460.6836	(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	1181.9887	1146.3297	1039.1874	864.8933	663.9923	437.9913	281.5065	296.5493	475.6498	728.0194	969.0192	1172.9518	(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	519.5852	403.9917	332.8279	180.9298	71.2124	0.0000	0.0000	0.0000	0.0000	175.7799	358.4838	529.9276	(98)
Space heating												2572.7382	(98)
Space heating per m ²												36.2766	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2751.5917 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	519.5852	403.9917	332.8279	180.9298	71.2124	0.0000	0.0000	0.0000	0.0000	175.7799	358.4838	529.9276	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	555.7061	432.0766	355.9657	193.5079	76.1630	0.0000	0.0000	0.0000	0.0000	187.9999	383.4051	566.7675	(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	194.5935	171.6502	180.5881	162.3258	159.3930	142.8820	137.6591	150.4535	149.9994	168.3009	177.4071	190.0603	(64)
Efficiency of water heater (217)m	87.3102	87.0207	86.4240	85.1037	82.8240	79.8000	79.8000	79.8000	79.8000	84.9298	86.6535	87.4062	(216)
Fuel for water heating, kWh/month	222.8760	197.2522	208.9560	190.7389	192.4480	179.0502	172.5051	188.5382	187.9691	198.1646	204.7316	217.4448	(219)
Water heating fuel used												2360.6746	(219)
Annual totals kWh/year													
Space heating fuel - main system												2751.5917	(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)												331.5208	(232)
Total delivered energy for all uses												5518.7871	(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	2751.5917	0.2160	594.3438 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2360.6746	0.2160	509.9057 (264)
Space and water heating			1104.2495 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	331.5208	0.5190	172.0593 (268)
Total CO2, kg/m2/year			1315.2338 (272)
Emissions per m2 for space and water heating			15.5704 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.4261 (272b)
Emissions per m2 for pumps and fans			0.5489 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5704 * 1.55) + 2.4261 + 0.5489, rounded to 2 d.p.			27.1100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.4600 (1b)	x 2.3100 (2b)	= 81.9126 (1b) - (3b)
First floor	35.4600 (1c)	x 2.6100 (2c)	= 92.5506 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.4632 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1720 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3725 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3445 (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	0.4393	0.4307	0.4220	0.3790	0.3704	0.3273	0.3273	0.3187	0.3445	0.3704	0.3876	0.4048 (22b)
Effective ac	0.5965	0.5927	0.5891	0.5718	0.5686	0.5536	0.5536	0.5508	0.5593	0.5686	0.5751	0.5819 (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
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			7.3700	1.1450	8.4389		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
150mm Wht + Wht Topsheet			35.4600	0.1100	3.9006	75.0000	2659.5000 (28a)
100mm Knauf Supafil 34	82.9000	12.8500	70.0500	0.2500	17.5125	52.8000	3698.6400 (29a)
FP McCann System	35.4600		35.4600	0.1800	6.3828	9.0000	319.1400 (30)
Total net area of external elements Aum(A, m ²)			153.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7996		(33)
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)
Timber GF			65.7000			9.0000	591.3000 (32c)
Timber 1F			69.5700			9.0000	626.1300 (32c)
Internal Floor			35.4600			12.6000	446.7960 (32d)
Internal Ceiling			35.4600			9.0000	319.1400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 10456.1460 (34)
147.4358 (35)
4.1111 (36)
(33) + (36) = 46.9107 (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	34.3409	34.1252	33.9138	32.9208	32.7350	31.8701	31.8701	31.7099	32.2032	32.7350	33.1108	33.5038 (38)
Heat transfer coeff	81.2516	81.0359	80.8245	79.8315	79.6457	78.7808	78.7808	78.6207	79.1140	79.6457	80.0216	80.4145 (39)
Average = Sum(39)m / 12 =												79.8306 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1457	1.1426	1.1397	1.1257	1.1230	1.1108	1.1108	1.1086	1.1155	1.1230	1.1283	1.1339 (40)
HLP (average)												1.1256 (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
Average daily hot water use (litres/day)
2.2683 (42)
88.0710 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.8781	93.3552	89.8324	86.3096	82.7867	79.2639	79.2639	82.7867	86.3096	89.8324	93.3552	96.8781 (44)
Energy conte	143.6674	125.6524	129.6620	113.0425	108.4670	93.5987	86.7330	99.5274	100.7161	117.3749	128.1238	139.1342 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1385.6994 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.5293	26.7011	27.5532	24.0215	23.0492	19.8897	18.4308	21.1496	21.4022	24.9422	27.2263	29.5660 (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	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7721	16.6732	13.5596	10.2655	7.6735	6.4783	7.0001	9.0990	12.2126	15.5067	18.0986	19.2938	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.4347	201.5042	196.2891	185.1868	171.1721	158.0003	149.2007	147.1312	152.3463	163.4486	177.4633	190.6351	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	(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)	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	(71)
Water heating gains (Table 5)	41.0340	39.7338	37.0338	33.3632	30.9801	27.6246	24.7725	28.4268	29.7252	33.5244	37.8143	39.7393	(72)
Total internal gains	316.2646	314.9350	303.9063	285.8392	266.8496	249.1270	237.9971	241.6808	251.3079	269.5035	290.4000	306.6920	(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	3.9000				11.2829		0.4600		0.0000		0.7700		15.5860 (75)	
Southwest	3.4700				36.7938		0.4600		0.0000		0.7700		45.2223 (79)	
Southwest	3.3300				36.7938		0.4300		0.0000		0.7700		40.5675 (79)	
Solar gains	101.3759	177.8577	257.1038	341.6132	403.6733	410.0081	391.4405	343.7261	286.1472	200.2783	122.3677	86.1466	(83)	
Total gains	417.6405	492.7927	561.0101	627.4524	670.5229	659.1352	629.4376	585.4068	537.4551	469.7818	412.7677	392.8385	(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	35.7468	35.8419	35.9357	36.3827	36.4676	36.8679	36.8679	36.9430	36.7127	36.4676	36.2963	36.1189	
alpha	3.3831	3.3895	3.3957	3.4255	3.4312	3.4579	3.4579	3.4629	3.4475	3.4312	3.4198	3.4079	
util living area	0.9871	0.9767	0.9555	0.9062	0.8112	0.6628	0.5169	0.5674	0.7811	0.9327	0.9785	0.9894	(86)
MIT	19.1464	19.3831	19.7502	20.2160	20.6115	20.8667	20.9578	20.9415	20.7506	20.2298	19.6035	19.1058	(87)
Th 2	19.9637	19.9662	19.9686	19.9799	19.9821	19.9920	19.9920	19.9938	19.9882	19.9821	19.9778	19.9733	(88)
util rest of house	0.9844	0.9719	0.9460	0.8853	0.7679	0.5861	0.4116	0.4618	0.7168	0.9134	0.9733	0.9872	(89)
MIT 2	18.2731	18.5092	18.8722	19.3307	19.6964	19.9158	19.9759	19.9696	19.8288	19.3540	18.7382	18.2399	(90)
Living area fraction	18.4162	18.6523	19.0161	19.4758	19.8463	20.0716	20.1368	20.1289	19.9798	19.4975	18.8800	18.3818	(91)
MIT	18.4162	18.6523	19.0161	19.4758	19.8463	20.0716	20.1368	20.1289	19.9798	19.4975	18.8800	18.3818	(92)
Temperature adjustment	18.4162	18.6523	19.0161	19.4758	19.8463	20.0716	20.1368	20.1289	19.9798	19.4975	18.8800	18.3818	(93)
adjusted MIT	18.4162	18.6523	19.0161	19.4758	19.8463	20.0716	20.1368	20.1289	19.9798	19.4975	18.8800	18.3818	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	408.8289	475.0012	524.5244	547.7191	510.5504	390.6198	269.1034	279.1821	384.9505	423.6843	398.6263	385.9611	(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	1146.9650	1114.4340	1011.6041	844.2804	648.8196	431.0540	278.6305	293.1667	465.1768	708.6446	942.6536	1140.4188	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	549.1733	429.6989	362.3872	213.5241	102.8723	0.0000	0.0000	0.0000	0.0000	212.0105	391.6996	561.3165	(98)
Space heating													2822.6824 (98)
Space heating per m2													39.8009 (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	740.5398	582.9781	597.5170	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8279	0.8859	0.8622	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	613.0830	516.4657	515.1546	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	855.1149	818.7310	768.7736	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	174.2629	224.8854	188.6925	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												587.8408 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	43.5657	56.2213	47.1731	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												146.9602 (107)
Space cooling per m2												2.0722 (108)
Energy for space heating												39.8009 (99)
Energy for space cooling												2.0722 (108)
Total												41.8731 (109)
Dwelling Fabric Energy Efficiency (DFEE)												41.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.4600 (1b)	x 2.3100 (2b)	= 81.9126 (1b) - (3b)
First floor	35.4600 (1c)	x 2.6100 (2c)	= 92.5506 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.4632 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1720 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4220 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3903 (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	0.4976	0.4879	0.4781	0.4293	0.4196	0.3708	0.3708	0.3610	0.3903	0.4196	0.4391	0.4586 (22b)
Effective ac	0.6238	0.6190	0.6143	0.5922	0.5880	0.5687	0.5687	0.5652	0.5762	0.5880	0.5964	0.6052 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			10.7000	1.3258	14.1856		(27)					
150mm Wht + Wht Topsheet			35.4600	0.1300	4.6098		(28a)					
100mm Knauf Supafil 34	82.9000	12.8500	70.0500	0.1800	12.6090		(29a)					
FP McCann System	35.4600		35.4600	0.1300	4.6098		(30)					
Total net area of external elements Aum(A, m2)			153.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1642		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4435 (36)					
Total fabric heat loss						(33) + (36) =	46.6077 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.9154	Feb 35.6386	Mar 35.3672	Apr 34.0927	May 33.8543	Jun 32.7442	Jul 32.7442	Aug 32.5387	Sep 33.1718	Oct 33.8543	Nov 34.3367	Dec 34.8410 (38)
Heat transfer coeff	82.5231	82.2463	81.9749	80.7004	80.4620	79.3519	79.3519	79.1464	79.7795	80.4620	80.9444	81.4487 (39)
Average = Sum(39)m / 12 =												80.6993 (39)
HLP	Jan 1.1636	Feb 1.1597	Mar 1.1559	Apr 1.1379	May 1.1345	Jun 1.1189	Jul 1.1189	Aug 1.1160	Sep 1.1249	Oct 1.1345	Nov 1.1413	Dec 1.1485 (40)
HLP (average)												1.1379 (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												2.2683 (42)
Average daily hot water use (litres/day)												88.0710 (43)
Daily hot water use	Jan 96.8781	Feb 93.3552	Mar 89.8324	Apr 86.3096	May 82.7867	Jun 79.2639	Jul 79.2639	Aug 82.7867	Sep 86.3096	Oct 89.8324	Nov 93.3552	Dec 96.8781 (44)
Energy conte	143.6674	125.6524	129.6620	113.0425	108.4670	93.5987	86.7330	99.5274	100.7161	117.3749	128.1238	139.1342 (45)
Energy content (annual)										Total = Sum(45)m =		1385.6994 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	30.5293	26.7011	27.5532	24.0215	23.0492	19.8897	18.4308	21.1496	21.4022	24.9422	27.2263	29.5660 (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	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126	113.4126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7721	16.6732	13.5596	10.2655	7.6735	6.4783	7.0001	9.0990	12.2126	15.5067	18.0986	19.2938 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.4347	201.5042	196.2891	185.1868	171.1721	158.0003	149.2007	147.1312	152.3463	163.4486	177.4633	190.6351 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413	34.3413 (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)	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301 (71)
Water heating gains (Table 5)	41.0340	39.7338	37.0338	33.3632	30.9801	27.6246	24.7725	28.4268	29.7252	33.5244	37.8143	39.7393 (72)
Total internal gains	316.2646	314.9350	303.9063	285.8392	266.8496	249.1270	237.9971	241.6808	251.3079	269.5035	290.4000	306.6920 (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				3.9000	11.2829		0.6300		0.7000		0.7700	13.4480 (75)
Southwest				6.8000	36.7938		0.6300		0.7000		0.7700	76.4638 (79)
Solar gains	89.9118	157.6200	227.5274	301.8048	356.1988	361.6075	345.3054	303.5044	253.0580	177.4027	108.5071	76.4194 (83)
Total gains	406.1764	472.5550	531.4337	587.6440	623.0483	610.7345	583.3025	545.1851	504.3658	446.9062	398.9071	383.1114 (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	59.6803	59.8811	60.0794	61.0282	61.2090	62.0653	62.0653	62.2265	61.7327	61.2090	60.8443	60.4675
alpha	4.9787	4.9921	5.0053	5.0685	5.0806	5.1377	5.1377	5.1484	5.1155	5.0806	5.0563	5.0312
util living area	0.9984	0.9962	0.9901	0.9682	0.9017	0.7514	0.5806	0.6375	0.8708	0.9803	0.9966	0.9988 (86)
MIT	19.7152	19.8719	20.1237	20.4591	20.7524	20.9348	20.9860	20.9780	20.8519	20.4705	20.0350	19.6943 (87)
Th 2	19.9492	19.9524	19.9555	19.9700	19.9727	19.9854	19.9854	19.9878	19.9805	19.9727	19.9672	19.9615 (88)
util rest of house	0.9978	0.9949	0.9864	0.9555	0.8619	0.6619	0.4559	0.5120	0.8048	0.9702	0.9952	0.9984 (89)
MIT 2	18.7787	18.9374	19.1898	19.5296	19.8019	19.9547	19.9818	19.9814	19.8964	19.5470	19.1123	18.7676 (90)
Living area fraction									fLA = Living area / (4) =			0.1638 (91)
MIT	18.9321	19.0905	19.3428	19.6819	19.9576	20.1153	20.1463	20.1447	20.0530	19.6983	19.2635	18.9195 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9321	19.0905	19.3428	19.6819	19.9576	20.1153	20.1463	20.1447	20.0530	19.6983	19.2635	18.9195 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9971	0.9934	0.9836	0.9511	0.8612	0.6745	0.4765	0.5326	0.8103	0.9666	0.9938	0.9978 (94)
Useful gains	404.9864	469.4591	522.6953	558.8947	536.5608	411.9382	277.9268	290.3684	408.7026	431.9797	396.4345	382.2722 (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	1207.4876	1167.1134	1052.7894	870.1039	664.4239	437.6496	281.4095	296.3764	474.9242	732.0709	984.5660	1198.8815 (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	597.0609	468.8237	394.3900	224.0706	95.1301	0.0000	0.0000	0.0000	0.0000	223.2678	423.4547	607.5574 (98)
Space heating												3033.7552 (98)
Space heating per m2										(98) / (4) =		42.7771 (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	745.9081	587.2042	601.5123	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8642	0.9256	0.9033	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	644.6268	543.4881	543.3226	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	798.5427	764.8068	721.7611	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	110.8194	164.6611	132.7583	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												408.2388 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	27.7049	41.1653	33.1896	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											102.0597 (107)
Space cooling per m2											1.4391 (108)
Energy for space heating											42.7771 (99)
Energy for space cooling											1.4391 (108)
Total											44.2162 (109)
Target Fabric Energy Efficiency (TFEE)											50.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.4600 (1b)	x 2.3100 (2b)	= 81.9126 (1b) - (3b)
First floor	35.4600 (1c)	x 2.6100 (2c)	= 92.5506 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.4632 (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												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			7.3700	1.1450	8.4389		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm Wht + Wht Topsheet			35.4600	0.1100	3.9006	75.0000	2659.5000 (28a)					
100mm Knauf Supafil 34	82.9000	12.8500	70.0500	0.2500	17.5125	52.8000	3698.6400 (29a)					
FP McCann System	35.4600		35.4600	0.1800	6.3828	9.0000	319.1400 (30)					
Total net area of external elements Aum(A, m2)			153.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.7996		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			65.7000			9.0000	591.3000 (32c)					
Timber 1F			69.5700			9.0000	626.1300 (32c)					
Internal Floor			35.4600			12.6000	446.7960 (32d)					
Internal Ceiling			35.4600			9.0000	319.1400 (32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			10456.1460 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4358 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1111 (36)					
Total fabric heat loss						(33) + (36) =	46.9107 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 28.7864	Feb 28.7864	Mar 28.7864	Apr 28.7864	May 28.7864	Jun 28.7864	Jul 28.7864	Aug 28.7864	Sep 28.7864	Oct 28.7864	Nov 28.7864	Dec 28.7864 (38)
Heat transfer coeff	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972 (39)
Average = Sum(39)m / 12 =												75.6972 (39)
HLP	Jan 1.0674	Feb 1.0674	Mar 1.0674	Apr 1.0674	May 1.0674	Jun 1.0674	Jul 1.0674	Aug 1.0674	Sep 1.0674	Oct 1.0674	Nov 1.0674	Dec 1.0674 (40)
HLP (average)												1.0674 (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												2.2683 (42)
Average daily hot water use (litres/day)												88.0710 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	96.8781	93.3552	89.8324	86.3096	82.7867	79.2639	79.2639	82.7867	86.3096	89.8324	93.3552	96.8781 (44)
Energy conte	143.6674	125.6524	129.6620	113.0425	108.4670	93.5987	86.7330	99.5274	100.7161	117.3749	128.1238	139.1342 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	21.5501	18.8479	19.4493	16.9564	16.2700	14.0398	13.0100	14.9291	15.1074	17.6062	19.2186	20.8701 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8424 (55)
Total storage loss												
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (56)
If cylinder contains dedicated solar storage												
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	193.0442	170.2508	179.0388	160.8265	157.8438	141.3827	136.1098	148.9042	148.5001	166.7517	175.9078	188.5110 (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)
												0.0000 (63)
Output from w/h												
	193.0442	170.2508	179.0388	160.8265	157.8438	141.3827	136.1098	148.9042	148.5001	166.7517	175.9078	188.5110 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	87.2708	77.4581	82.6141	75.8138	75.5667	69.3488	68.3402	72.5943	71.7153	78.5286	80.8284	85.7636 (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	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	46.9302	41.6830	33.8989	25.6636	19.1839	16.1958	17.5002	22.7474	30.5315	38.7667	45.2465	48.2345 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	297.6637	300.7525	292.9688	276.3982	255.4807	235.8213	222.6876	219.5988	227.3825	243.9531	264.8706	284.5300 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778 (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)												
	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301 (71)
Water heating gains (Table 5)												
	117.2995	115.2651	111.0404	105.2970	101.5682	96.3178	91.8551	97.5730	99.6046	105.5492	112.2616	115.2736 (72)
Total internal gains												
	558.1362	553.9434	534.1509	503.6016	472.4756	444.5777	428.2856	436.1619	453.7613	484.5118	518.6215	544.2809 (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			3.9000			12.9236		0.4600	0.0000		0.7700	17.8523 (75)
Southwest			3.4700			40.4699		0.4600	0.0000		0.7700	49.7405 (79)
Southwest			3.3300			40.4699		0.4300	0.0000		0.7700	44.6206 (79)
Solar gains	112.2135	177.4647	254.4583	350.4173	405.0526	440.9333	416.1583	372.5546	307.6640	213.6472	138.8213	94.4046 (83)
Total gains	670.3497	731.4081	788.6092	854.0189	877.5282	885.5110	844.4439	808.7165	761.4253	698.1591	657.4428	638.6856 (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	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698
alpha	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580
util living area												
	0.9407	0.9194	0.8711	0.7742	0.6200	0.4153	0.2758	0.2966	0.5391	0.7880	0.9060	0.9479 (86)
Tweekday	18.5405	18.7655	19.1865	19.6239	19.9122	20.0143	20.0265	20.0261	19.9851	19.6799	19.0670	18.4695
Tweekend	20.2575	20.3608	20.5562	20.7680	20.9203	20.9861	20.9977	20.9970	20.9630	20.7908	20.4967	20.2248
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8540	20.0112	20.3150	20.6377	20.8770	20.9786	20.9964	20.9953	20.9423	20.6771	20.2141	19.8036 (87)
Th 2	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276 (88)
util rest of house												
	0.9301	0.9055	0.8488	0.7367	0.5614	0.3392	0.1903	0.2079	0.4609	0.7441	0.8872	0.9383 (89)
Tweekday	18.5405	18.7655	19.1865	19.6239	19.9122	20.0143	20.0265	20.0261	19.9851	19.6799	19.0670	18.4695
Tweekend	18.5405	18.7655	19.1865	19.6239	19.9122	20.0143	20.0265	20.0261	19.9851	19.6799	19.0670	18.4695
MIT 2	18.5405	18.7655	19.1865	19.6239	19.9122	20.0143	20.0265	20.0261	19.9851	19.6799	19.0670	18.4695 (90)
Living area fraction												
MIT	18.7557	18.9696	19.3714	19.7900	20.0703	20.1723	20.1854	20.1849	20.1420	19.8433	19.2549	18.6881 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7557	18.9696	19.3714	19.7900	20.0703	20.1723	20.1854	20.1849	20.1420	19.8433	19.2549	18.6881 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9126	0.8869	0.8314	0.7266	0.5641	0.3508	0.2043	0.2224	0.4706	0.7348	0.8690	0.9215	(94)
Useful gains	611.7436	648.7214	655.6203	620.5393	495.0365	310.5950	172.5126	179.8539	358.2930	513.0421	571.3270	588.5427	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
Month fracti	1033.6986	1012.0438	906.2008	748.6478	535.1980	315.8286	173.0013	180.5302	374.0920	623.9946	851.9642	1028.5802	(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	313.9345	244.1527	186.4318	92.2381	29.8801	0.0000	0.0000	0.0000	0.0000	82.5486	202.0588	327.3879	(98)
RHI space heating demand												1478.6326	(98)
												1479	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.4600 (1b)	x 2.3100 (2b)	= 81.9126 (1b) - (3b)
First floor	35.4600 (1c)	x 2.6100 (2c)	= 92.5506 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.4632 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50														4.0100			
Infiltration rate														0.2005 (18)			
Number of sides sheltered														1 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.1855 (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																	
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			7.3700	1.1450	8.4389		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm Wht + Wht Topsheet			35.4600	0.1100	3.9006	75.0000	2659.5000 (28a)					
100mm Knauf Supafil 34	82.9000	12.8500	70.0500	0.2500	17.5125	52.8000	3698.6400 (29a)					
FP McCann System	35.4600		35.4600	0.1800	6.3828	9.0000	319.1400 (30)					
Total net area of external elements Aum(A, m2)			153.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.7996		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			65.7000			9.0000	591.3000 (32c)					
Timber 1F			69.5700			9.0000	626.1300 (32c)					
Internal Floor			35.4600			12.6000	446.7960 (32d)					
Internal Ceiling			35.4600			9.0000	319.1400 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10456.1460 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4358 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1111 (36)					
Total fabric heat loss						(33) + (36) =	46.9107 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 28.7864	Feb 28.7864	Mar 28.7864	Apr 28.7864	May 28.7864	Jun 28.7864	Jul 28.7864	Aug 28.7864	Sep 28.7864	Oct 28.7864	Nov 28.7864	Dec 28.7864 (38)
Heat transfer coeff	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972 (39)
Average = Sum(39)m / 12 =												75.6972 (39)
HLP	Jan 1.0674	Feb 1.0674	Mar 1.0674	Apr 1.0674	May 1.0674	Jun 1.0674	Jul 1.0674	Aug 1.0674	Sep 1.0674	Oct 1.0674	Nov 1.0674	Dec 1.0674 (40)
HLP (average)												1.0674 (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												2.2683 (42)
Average daily hot water use (litres/day)												88.0710 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use												
	96.8781	93.3552	89.8324	86.3096	82.7867	79.2639	79.2639	82.7867	86.3096	89.8324	93.3552	96.8781 (44)
Energy conte	143.6674	125.6524	129.6620	113.0425	108.4670	93.5987	86.7330	99.5274	100.7161	117.3749	128.1238	139.1342 (45)
Energy content (annual)	Total = Sum (45)m =											
Distribution loss (46)m = 0.15 x (45)m	21.5501	18.8479	19.4493	16.9564	16.2700	14.0398	13.0100	14.9291	15.1074	17.6062	19.2186	20.8701 (46)
Water storage loss:												
Store volume	200.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.5600 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.8424 (55)											
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	193.0442	170.2508	179.0388	160.8265	157.8438	141.3827	136.1098	148.9042	148.5001	166.7517	175.9078	188.5110 (62)
WWHRS	-46.2092	-40.6549	-41.4954	-34.1633	-31.7328	-26.1861	-22.1768	-26.8460	-27.6226	-34.1312	-39.5146	-44.6584 eq. (G10)
Total of WWHRS savings	-415.3914											
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	146.8350	129.5959	137.5434	126.6632	126.1110	115.1967	113.9330	122.0581	120.8775	132.6205	136.3932	143.8526 (64)
Heat gains from water heating, kWh/month	87.2708	77.4581	82.6141	75.8138	75.5667	69.3488	68.3402	72.5943	71.7153	78.5286	80.8284	85.7636 (65)
Total per year (kWh/year) = Sum (64)m =	1551.6800 (64)											

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.9302	41.6830	33.8989	25.6636	19.1839	16.1958	17.5002	22.7474	30.5315	38.7667	45.2465	48.2345 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.6637	300.7525	292.9688	276.3982	255.4807	235.8213	222.6876	219.5988	227.3825	243.9531	264.8706	284.5300 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778 (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)	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301 (71)
Water heating gains (Table 5)	117.2995	115.2651	111.0404	105.2970	101.5682	96.3178	91.8551	97.5730	99.6046	105.5492	112.2616	115.2736 (72)
Total internal gains	558.1362	553.9434	534.1509	503.6016	472.4756	444.5777	428.2856	436.1619	453.7613	484.5118	518.6215	544.2809 (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			3.9000	11.2829	0.4600	0.0000	0.7700	15.5860 (75)				
Southwest			3.4700	36.7938	0.4600	0.0000	0.7700	45.2223 (79)				
Southwest			3.3300	36.7938	0.4300	0.0000	0.7700	40.5675 (79)				
Solar gains	101.3759	177.8577	257.1038	341.6132	403.6733	410.0081	391.4405	343.7261	286.1472	200.2783	122.3677	86.1466 (83)
Total gains	659.5121	731.8011	791.2547	845.2148	876.1489	854.5858	819.7261	779.8880	739.9086	684.7901	640.9892	630.4275 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)	21.0000 (85)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698
alpha	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580
util living area	0.9502	0.9279	0.8876	0.8108	0.6886	0.5317	0.3964	0.4321	0.6303	0.8315	0.9252	0.9567 (86)
Tweekday	18.3553	18.6329	19.0391	19.4883	19.8205	19.9796	20.0188	20.0147	19.9301	19.5336	18.8678	18.2666
Tweekend	20.1739	20.3006	20.4878	20.7012	20.8696	20.9610	20.9894	20.9855	20.9275	20.7177	20.4050	20.1336
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.7251	19.9181	20.2094	20.5334	20.7987	20.9401	20.9837	20.9776	20.8868	20.5643	20.0709	19.6629 (87)
Th 2	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276 (88)
util rest of house	0.9415	0.9157	0.8686	0.7793	0.6390	0.4616	0.3129	0.3465	0.5616	0.7964	0.9104	0.9490 (89)
Tweekday	18.3553	18.6329	19.0391	19.4883	19.8205	19.9796	20.0188	20.0147	19.9301	19.5336	18.8678	18.2666
Tweekend	18.3553	18.6329	19.0391	19.4883	19.8205	19.9796	20.0188	20.0147	19.9301	19.5336	18.8678	18.2666
MIT 2	18.3553	18.6329	19.0391	19.4883	19.8205	19.9796	20.0188	20.0147	19.9301	19.5336	18.8678	18.2666 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.5797	18.8435	19.2308	19.6595	19.9808	20.1370	20.1769	20.1725	20.0869	19.7025	19.0649	18.4953 (91)
Temperature adjustment	0.0000											
adjusted MIT	18.5797	18.8435	19.2308	19.6595	19.9808	20.1370	20.1769	20.1725	20.0869	19.7025	19.0649	18.4953 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9249	0.8973	0.8503	0.7659	0.6364	0.4698	0.3260	0.3596	0.5660	0.7830	0.8923	0.9333	(94)
Useful gains	609.9728	656.6775	672.8375	647.3659	557.5957	401.5182	267.2186	280.4412	418.8151	536.1960	571.9486	588.3510	(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													
Month fracti	1080.9321	1055.4827	963.6872	814.4665	626.8304	419.1343	270.7633	285.5666	453.1906	689.0303	905.7124	1082.1166	(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	350.3938	267.9971	216.3922	120.3124	51.5106	0.0000	0.0000	0.0000	0.0000	113.7087	240.3100	367.3616	(98)
Space heating												1727.9863	(98)
Space heating per m2												24.3653	(99)

(98) / (4) = 24.3653 (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 %)	222.0383	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	778.2381	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	350.3938	267.9971	216.3922	120.3124	51.5106	0.0000	0.0000	0.0000	0.0000	113.7087	240.3100	367.3616	(98)
Space heating efficiency (main heating system 1)	222.0383	222.0383	222.0383	222.0383	222.0383	0.0000	0.0000	0.0000	0.0000	222.0383	222.0383	222.0383	(210)
Space heating fuel (main heating system)	157.8078	120.6986	97.4572	54.1855	23.1990	0.0000	0.0000	0.0000	0.0000	51.2113	108.2291	165.4497	(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	146.8350	129.5959	137.5434	126.6632	126.1110	115.1967	113.9330	122.0581	120.8775	132.6205	136.3932	143.8526	(64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)
Fuel for water heating, kWh/month	86.2315	76.1075	80.7748	74.3852	74.0609	67.6513	66.9092	71.6808	70.9875	77.8838	80.0994	84.4800	(219)
Water heating fuel used												911.2520	(219)
Annual totals kWh/year													
Space heating fuel - main system												778.2381	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)		
mechanical ventilation fans (SFP = 0.2282)	48.5654	(230a)
Total electricity for the above, kWh/year	48.5654	(231)
Electricity for lighting (calculated in Appendix L)	331.5208	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =	-988.0192	-988.0192	(233)
Total delivered energy for all uses		1081.5571	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	778.2381	13.1900	102.6496	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	911.2520	13.1900	120.1941	(247)
Mechanical ventilation fans	48.5654	13.1900	6.4058	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	331.5208	13.1900	43.7276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-988.0192	13.1900	-130.3197	(252)
Total energy cost			142.6574	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	0.5169	(257)
SAP value	92.7896	
SAP rating (Section 12)	93	(258)
SAP band	A	

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	778.2381	0.5190	403.9056	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating (other fuel)	911.2520	0.5190	472.9398 (264)
Space and water heating			876.8454 (265)
Pumps and fans	48.5654	0.5190	25.2054 (267)
Energy for lighting	331.5208	0.5190	172.0593 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			561.3281 (272)
CO2 emissions per m2			7.9100 (273)
EI value			93.5112
EI rating			94 (274)
EI band			A

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 2.2204 = 5.940$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 2.2204 = 0.2337$, stars = 4
Water heating energy efficiency	$13.19 / 1.7028 = 7.746$, stars = 3
Water heating environmental impact	$0.519 / 1.7028 = 0.3048$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.4600 (1b)	x 2.3100 (2b)	= 81.9126 (1b) - (3b)
First floor	35.4600 (1c)	x 2.6100 (2c)	= 92.5506 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.4632 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.0100		
Infiltration rate															0.2005 (18)		
Number of sides sheltered															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1855 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			7.3700	1.1450	8.4389		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm Wht + Wht Topsheet			35.4600	0.1100	3.9006	75.0000	2659.5000 (28a)					
100mm Knauf Supafil 34	82.9000	12.8500	70.0500	0.2500	17.5125	52.8000	3698.6400 (29a)					
FP McCann System	35.4600		35.4600	0.1800	6.3828	9.0000	319.1400 (30)					
Total net area of external elements Aum(A, m2)			153.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.7996		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			65.7000			9.0000	591.3000 (32c)					
Timber 1F			69.5700			9.0000	626.1300 (32c)					
Internal Floor			35.4600			12.6000	446.7960 (32d)					
Internal Ceiling			35.4600			9.0000	319.1400 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10456.1460 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4358 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1111 (36)					
Total fabric heat loss						(33) + (36) =	46.9107 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 28.7864	Feb 28.7864	Mar 28.7864	Apr 28.7864	May 28.7864	Jun 28.7864	Jul 28.7864	Aug 28.7864	Sep 28.7864	Oct 28.7864	Nov 28.7864	Dec 28.7864 (38)
Heat transfer coeff	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972 (39)
Average = Sum(39)m / 12 =												75.6972 (39)
HLP	Jan 1.0674	Feb 1.0674	Mar 1.0674	Apr 1.0674	May 1.0674	Jun 1.0674	Jul 1.0674	Aug 1.0674	Sep 1.0674	Oct 1.0674	Nov 1.0674	Dec 1.0674 (40)
HLP (average)												1.0674 (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												2.2683 (42)
Average daily hot water use (litres/day)												88.0710 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	96.8781	93.3552	89.8324	86.3096	82.7867	79.2639	79.2639	82.7867	86.3096	89.8324	93.3552	96.8781 (44)
Energy conte	143.6674	125.6524	129.6620	113.0425	108.4670	93.5987	86.7330	99.5274	100.7161	117.3749	128.1238	139.1342 (45)
Energy content (annual)										Total = Sum (45)m =		1385.6994 (45)
Distribution loss (46)m = 0.15 x (45)m	21.5501	18.8479	19.4493	16.9564	16.2700	14.0398	13.0100	14.9291	15.1074	17.6062	19.2186	20.8701 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8424 (55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	193.0442	170.2508	179.0388	160.8265	157.8438	141.3827	136.1098	148.9042	148.5001	166.7517	175.9078	188.5110 (62)
WWHRS	-46.2092	-40.6549	-41.4954	-34.1633	-31.7328	-26.1861	-22.1768	-26.8460	-27.6226	-34.1312	-39.5146	-44.6584 eq. (G10)
Total of WWHRS savings												-415.3914
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	146.8350	129.5959	137.5434	126.6632	126.1110	115.1967	113.9330	122.0581	120.8775	132.6205	136.3932	143.8526 (64)
Heat gains from water heating, kWh/month	87.2708	77.4581	82.6141	75.8138	75.5667	69.3488	68.3402	72.5943	71.7153	78.5286	80.8284	85.7636 (65)
Total per year (kWh/year) = Sum (64)m =												1551.6800 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.9302	41.6830	33.8989	25.6636	19.1839	16.1958	17.5002	22.7474	30.5315	38.7667	45.2465	48.2345 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.6637	300.7525	292.9688	276.3982	255.4807	235.8213	222.6876	219.5988	227.3825	243.9531	264.8706	284.5300 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778 (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)	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301 (71)
Water heating gains (Table 5)	117.2995	115.2651	111.0404	105.2970	101.5682	96.3178	91.8551	97.5730	99.6046	105.5492	112.2616	115.2736 (72)
Total internal gains	558.1362	553.9434	534.1509	503.6016	472.4756	444.5777	428.2856	436.1619	453.7613	484.5118	518.6215	544.2809 (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					3.9000	12.9236	0.4600	0.0000	0.7700		17.8523 (75)	
Southwest					3.4700	40.4699	0.4600	0.0000	0.7700		49.7405 (79)	
Southwest					3.3300	40.4699	0.4300	0.0000	0.7700		44.6206 (79)	
Solar gains	112.2135	177.4647	254.4583	350.4173	405.0526	440.9333	416.1583	372.5546	307.6640	213.6472	138.8213	94.4046 (83)
Total gains	670.3497	731.4081	788.6092	854.0189	877.5282	885.5110	844.4439	808.7165	761.4253	698.1591	657.4428	638.6856 (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	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698
alpha	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580
util living area	0.9407	0.9194	0.8711	0.7742	0.6200	0.4153	0.2758	0.2966	0.5391	0.7880	0.9060	0.9479 (86)
Tweekday	18.5405	18.7655	19.1865	19.6239	19.9122	20.0143	20.0265	20.0261	19.9851	19.6799	19.0670	18.4695
Tweekend	20.2575	20.3608	20.5562	20.7680	20.9203	20.9861	20.9977	20.9970	20.9630	20.7908	20.4967	20.2248
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8540	20.0112	20.3150	20.6377	20.8770	20.9786	20.9964	20.9953	20.9423	20.6771	20.2141	19.8036 (87)
Th 2	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276 (88)
util rest of house	0.9301	0.9055	0.8488	0.7367	0.5614	0.3392	0.1903	0.2079	0.4609	0.7441	0.8872	0.9383 (89)
Tweekday	18.5405	18.7655	19.1865	19.6239	19.9122	20.0143	20.0265	20.0261	19.9851	19.6799	19.0670	18.4695
Tweekend	18.5405	18.7655	19.1865	19.6239	19.9122	20.0143	20.0265	20.0261	19.9851	19.6799	19.0670	18.4695
MIT 2	18.5405	18.7655	19.1865	19.6239	19.9122	20.0143	20.0265	20.0261	19.9851	19.6799	19.0670	18.4695 (90)
Living area fraction									fLA = Living area / (4) =			0.1638 (91)
MIT	18.7557	18.9696	19.3714	19.7900	20.0703	20.1723	20.1854	20.1849	20.1420	19.8433	19.2549	18.6881 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7557	18.9696	19.3714	19.7900	20.0703	20.1723	20.1854	20.1849	20.1420	19.8433	19.2549	18.6881 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9126	0.8869	0.8314	0.7266	0.5641	0.3508	0.2043	0.2224	0.4706	0.7348	0.8690	0.9215	(94)
Useful gains	611.7436	648.7214	655.6203	620.5393	495.0365	310.5950	172.5126	179.8539	358.2930	513.0421	571.3270	588.5427	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1033.6986	1012.0438	906.2008	748.6478	535.1980	315.8286	173.0013	180.5302	374.0920	623.9946	851.9642	1028.5802	(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													
	313.9345	244.1527	186.4318	92.2381	29.8801	0.0000	0.0000	0.0000	0.0000	82.5486	202.0588	327.3879	(98)
Space heating													
Space heating per m2												1478.6326	(98)
										(98) / (4) =		20.8493	(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 %)	222.0383	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	665.9360	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	313.9345	244.1527	186.4318	92.2381	29.8801	0.0000	0.0000	0.0000	0.0000	82.5486	202.0588	327.3879	(98)
Space heating efficiency (main heating system 1)	222.0383	222.0383	222.0383	222.0383	222.0383	0.0000	0.0000	0.0000	0.0000	222.0383	222.0383	222.0383	(210)
Space heating fuel (main heating system)	141.3876	109.9597	83.9638	41.5415	13.4572	0.0000	0.0000	0.0000	0.0000	37.1777	91.0018	147.4466	(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	146.8350	129.5959	137.5434	126.6632	126.1110	115.1967	113.9330	122.0581	120.8775	132.6205	136.3932	143.8526	(64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	86.2315	76.1075	80.7748	74.3852	74.0609	67.6513	66.9092	71.6808	70.9875	77.8838	80.0994	84.4800	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													
Space heating fuel - secondary													
665.9360													(211)
0.0000													(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)		
mechanical ventilation fans (SFP = 0.2282)		
48.5654		(230a)
Total electricity for the above, kWh/year		
48.5654		(231)
Electricity for lighting (calculated in Appendix L)		
331.5208		(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 1.20 * 1090 * 1.00) =	-1046.8728	-1046.8728	(233)
Total delivered energy for all uses		910.4015	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	665.9360	16.9600	112.9427	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	911.2520	16.9600	154.5483	(247)
Mechanical ventilation fans	48.5654	16.9600	8.2367	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	331.5208	16.9600	56.2259	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1046.8728	16.9600	-177.5496	(252)
Total energy cost			154.4041	(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	665.9360	0.5190	345.6208	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	911.2520	0.5190	472.9398	(264)
Space and water heating			818.5606	(265)
Pumps and fans	48.5654	0.5190	25.2054	(267)
Energy for lighting	331.5208	0.5190	172.0593	(268)
Energy saving/generation technologies				
PV Unit	-1046.8728	0.5190	-543.3270	(269)
Total kg/year			472.4984	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	665.9360	3.0700	2044.4235 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	911.2520	3.0700	2797.5438 (264)
Space and water heating			4841.9673 (265)
Pumps and fans	48.5654	3.0700	149.0957 (267)
Energy for lighting	331.5208	3.0700	1017.7689 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			2794.9325 (272)
Primary energy kWh/m2/year			39.4097 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 93
Current environmental impact rating: A 94

(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	+ 2.4	-£ 62	-191 kg (40.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£62 2.69 kg/m²	A 95	A 96
Total Savings	£62 2.69 kg/m²		

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£332	£270	£62
Space heating	£121	£121	-£0
Water heating	£155	£92	£63
Lighting	£56	£56	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£154	£92	£62
Total cost of uses	£154	£91	£63
Delivered energy	13 kWh/m²	8 kWh/m²	5 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	7 kg/m²	4 kg/m²	3 kg/m²
Primary energy	39 kWh/m²	24 kWh/m²	16 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.4600 (1b)	x 2.3100 (2b)	= 81.9126 (1b) - (3b)
First floor	35.4600 (1c)	x 2.6100 (2c)	= 92.5506 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.4632 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50																4.0100	
Infiltration rate																0.2005 (18)	
Number of sides sheltered																1 (19)	
Shelter factor														(20) = 1 - [0.075 x (19)] =		0.9250 (20)	
Infiltration rate adjusted to include shelter factor														(21) = (18) x (20) =		0.1855 (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																	
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			7.3700	1.1450	8.4389		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm Wht + Wht Topsheet			35.4600	0.1100	3.9006	75.0000	2659.5000 (28a)					
100mm Knauf Supafil 34	82.9000	12.8500	70.0500	0.2500	17.5125	52.8000	3698.6400 (29a)					
FP McCann System	35.4600		35.4600	0.1800	6.3828	9.0000	319.1400 (30)					
Total net area of external elements Aum(A, m2)			153.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.7996		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			65.7000			9.0000	591.3000 (32c)					
Timber 1F			69.5700			9.0000	626.1300 (32c)					
Internal Floor			35.4600			12.6000	446.7960 (32d)					
Internal Ceiling			35.4600			9.0000	319.1400 (32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			10456.1460 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4358 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1111 (36)					
Total fabric heat loss						(33) + (36) =	46.9107 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 28.7864	Feb 28.7864	Mar 28.7864	Apr 28.7864	May 28.7864	Jun 28.7864	Jul 28.7864	Aug 28.7864	Sep 28.7864	Oct 28.7864	Nov 28.7864	Dec 28.7864 (38)
Heat transfer coeff	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972 (39)
Average = Sum(39)m / 12 =												75.6972 (39)
HLP	Jan 1.0674	Feb 1.0674	Mar 1.0674	Apr 1.0674	May 1.0674	Jun 1.0674	Jul 1.0674	Aug 1.0674	Sep 1.0674	Oct 1.0674	Nov 1.0674	Dec 1.0674 (40)
HLP (average)												1.0674 (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												2.2683 (42)
Average daily hot water use (litres/day)												88.0710 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	96.8781	93.3552	89.8324	86.3096	82.7867	79.2639	79.2639	82.7867	86.3096	89.8324	93.3552	96.8781 (44)
Energy conte	143.6674	125.6524	129.6620	113.0425	108.4670	93.5987	86.7330	99.5274	100.7161	117.3749	128.1238	139.1342 (45)
Energy content (annual)												1385.6994 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.5501	18.8479	19.4493	16.9564	16.2700	14.0398	13.0100	14.9291	15.1074	17.6062	19.2186	20.8701 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8424 (55)
Total storage loss												
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (56)
If cylinder contains dedicated solar storage												
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	193.0442	170.2508	177.6431	154.0729	145.0495	128.7760	123.0829	136.8077	143.0972	165.3559	175.9078	188.5110 (62)
WWHRS	-46.2092	-40.6549	-41.4954	-34.1633	-31.7328	-26.1861	-22.1768	-26.8460	-27.6226	-34.1312	-39.5146	-44.6584 eq. (G10)
Total of WWHRS savings												-415.3914
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												1.8691 (H8)
Utilisation factor												0.4143 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												88.0710 (H14)
Volume ratio Veff/V												0.8516 (H15)
Solar storage volume factor												0.9679 (H16)
Solar input												-639.5139 (H17)
Solar input	-18.5446	-30.9457	-52.7040	-70.6337	-87.2620	-85.7925	-84.6587	-73.9667	-57.9308	-39.5599	-21.9966	-15.5187 (63)
Output from w/h												
	128.2903	98.6502	83.4437	49.2758	26.0546	16.7975	16.2474	35.9950	57.5438	91.6648	114.3966	128.3339 (64)
Heat gains from water heating, kWh/month												
	87.2708	77.4581	81.4975	70.4110	65.3313	59.2634	57.9186	62.9171	67.3930	77.4120	80.8284	85.7636 (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	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.9302	41.6830	33.8989	25.6636	19.1839	16.1958	17.5002	22.7474	30.5315	38.7667	45.2465	48.2345 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.6637	300.7525	292.9688	276.3982	255.4807	235.8213	222.6876	219.5988	227.3825	243.9531	264.8706	284.5300 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778 (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)	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301 (71)
Water heating gains (Table 5)	117.2995	115.2651	109.5396	97.7930	87.8108	82.3103	77.8476	84.5660	93.6014	104.0484	112.2616	115.2736 (72)
Total internal gains	558.1362	553.9434	532.6501	496.0976	458.7182	430.5702	414.2782	423.1550	447.7581	483.0110	518.6215	544.2809 (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				3.9000	11.2829	0.4600	0.0000	0.7700	15.5860 (75)			
Southwest				3.4700	36.7938	0.4600	0.0000	0.7700	45.2223 (79)			
Southwest				3.3300	36.7938	0.4300	0.0000	0.7700	40.5675 (79)			
Solar gains	101.3759	177.8577	257.1038	341.6132	403.6733	410.0081	391.4405	343.7261	286.1472	200.2783	122.3677	86.1466 (83)
Total gains	659.5121	731.8011	789.7539	837.7108	862.3916	840.5784	805.7187	766.8811	733.9054	683.2893	640.9892	630.4275 (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	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698
alpha	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580
util living area	0.9502	0.9279	0.8881	0.8140	0.6956	0.5389	0.4027	0.4387	0.6340	0.8323	0.9252	0.9567 (86)
Tweekday	18.3553	18.6329	19.0365	19.4797	19.8128	19.9774	20.0184	20.0141	19.9281	19.5317	18.8678	18.2666
Tweekend	20.1739	20.3006	20.4865	20.6968	20.8651	20.9593	20.9889	20.9847	20.9261	20.7167	20.4050	20.1336
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.7251	19.9181	20.2075	20.5265	20.7918	20.9374	20.9828	20.9764	20.8847	20.5628	20.0709	19.6629	(87)
Th 2	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	(88)
util rest of house	0.9415	0.9157	0.8692	0.7827	0.6461	0.4684	0.3181	0.3521	0.5652	0.7972	0.9104	0.9490	(89)
Tweekday	18.3553	18.6329	19.0365	19.4797	19.8128	19.9774	20.0184	20.0141	19.9281	19.5317	18.8678	18.2666	
Tweekend	18.3553	18.6329	19.0365	19.4797	19.8128	19.9774	20.0184	20.0141	19.9281	19.5317	18.8678	18.2666	
MIT 2	18.3553	18.6329	19.0365	19.4797	19.8128	19.9774	20.0184	20.0141	19.9281	19.5317	18.8678	18.2666	(90)
Living area fraction									fLA = Living area / (4) =			0.1638	(91)
MIT	18.5797	18.8435	19.2284	19.6512	19.9733	20.1347	20.1764	20.1717	20.0848	19.7007	19.0649	18.4953	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5797	18.8435	19.2284	19.6512	19.9733	20.1347	20.1764	20.1717	20.0848	19.7007	19.0649	18.4953	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9249	0.8973	0.8509	0.7692	0.6432	0.4765	0.3314	0.3653	0.5695	0.7838	0.8923	0.9333	(94)
Useful gains	609.9728	656.6775	671.9842	644.3532	554.6765	400.5456	266.9860	280.1218	417.9894	535.5501	571.9486	588.3510	(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	1080.9321	1055.4827	963.5017	813.8360	626.2615	418.9583	270.7223	285.5101	453.0353	688.8944	905.7124	1082.1166	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	350.3938	267.9971	216.8890	122.0276	53.2592	0.0000	0.0000	0.0000	0.0000	114.0882	240.3100	367.3616	(98)
Space heating												1732.3264	(98)
Space heating per m2										(98) / (4) =		24.4265	(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 %)													222.0383	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													780.1928	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	350.3938	267.9971	216.8890	122.0276	53.2592	0.0000	0.0000	0.0000	0.0000	114.0882	240.3100	367.3616	(98)	
Space heating efficiency (main heating system 1)	222.0383	222.0383	222.0383	222.0383	222.0383	0.0000	0.0000	0.0000	0.0000	222.0383	222.0383	222.0383	(210)	
Space heating fuel (main heating system)	157.8078	120.6986	97.6809	54.9579	23.9865	0.0000	0.0000	0.0000	0.0000	51.3822	108.2291	165.4497	(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	128.2903	98.6502	83.4437	49.2758	26.0546	16.7975	16.2474	35.9950	57.5438	91.6648	114.3966	128.3339	(64)	
Efficiency of water heater													170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)	
Fuel for water heating, kWh/month	75.3408	57.9341	49.0038	28.9381	15.3010	9.8646	9.5416	21.1387	33.7936	53.8318	67.1815	75.3664	(219)	
Water heating fuel used												497.2362	(219)	
Annual totals kWh/year														
Space heating fuel - main system												780.1928	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)														
mechanical ventilation fans (SFP = 0.2282)													48.5654	(230a)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													98.5654	(231)
Electricity for lighting (calculated in Appendix L)													331.5208	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =										-988.0192		-988.0192	(233)	
Total delivered energy for all uses												719.4959	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	780.1928	13.1900	102.9074	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	497.2362	13.1900	65.5854	(247)
Mechanical ventilation fans	48.5654	13.1900	6.4058	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	331.5208	13.1900	43.7276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-988.0192	13.1900	-130.3197	(252)
Total energy cost			94.9015	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):
Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] =$ 0.4200 (256)
SAP value 0.3438 (257)
SAP rating (Section 12) 95.2033
SAP band 95 (258)
A

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	780.1928	0.5190	404.9201	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	497.2362	0.5190	258.0656	(264)
Space and water heating			662.9856	(265)
Pumps and fans	98.5654	0.5190	51.1554	(267)
Energy for lighting	331.5208	0.5190	172.0593	(268)
Energy saving/generation technologies				
PV Unit	-988.0192	0.5190	-512.7820	(269)
Total kg/year			373.4184	(272)
CO2 emissions per m2			5.2700	(273)
EI value			95.6834	
EI rating			96	(274)
EI band			A	

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Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.4600 (1b)	x 2.3100 (2b)	= 81.9126 (1b) - (3b)
First floor	35.4600 (1c)	x 2.6100 (2c)	= 92.5506 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 174.4632 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.0100		
Number of sides sheltered															0.2005 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1855 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			7.3700	1.1450	8.4389		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm Wht + Wht Topsheet			35.4600	0.1100	3.9006	75.0000	2659.5000 (28a)					
100mm Knauf Supafil 34	82.9000	12.8500	70.0500	0.2500	17.5125	52.8000	3698.6400 (29a)					
FP McCann System	35.4600		35.4600	0.1800	6.3828	9.0000	319.1400 (30)					
Total net area of external elements Aum(A, m2)			153.8200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.7996		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			65.7000			9.0000	591.3000 (32c)					
Timber 1F			69.5700			9.0000	626.1300 (32c)					
Internal Floor			35.4600			12.6000	446.7960 (32d)					
Internal Ceiling			35.4600			9.0000	319.1400 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10456.1460 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4358 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1111 (36)					
Total fabric heat loss						(33) + (36) =	46.9107 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 28.7864	Feb 28.7864	Mar 28.7864	Apr 28.7864	May 28.7864	Jun 28.7864	Jul 28.7864	Aug 28.7864	Sep 28.7864	Oct 28.7864	Nov 28.7864	Dec 28.7864 (38)
Heat transfer coeff	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972	75.6972 (39)
Average = Sum(39)m / 12 =												75.6972 (39)
HLP	Jan 1.0674	Feb 1.0674	Mar 1.0674	Apr 1.0674	May 1.0674	Jun 1.0674	Jul 1.0674	Aug 1.0674	Sep 1.0674	Oct 1.0674	Nov 1.0674	Dec 1.0674 (40)
HLP (average)												1.0674 (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												2.2683 (42)
Average daily hot water use (litres/day)												88.0710 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Calculation Type: New Build (As Designed)

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

Daily hot water use	96.8781	93.3552	89.8324	86.3096	82.7867	79.2639	79.2639	82.7867	86.3096	89.8324	93.3552	96.8781 (44)
Energy conte	143.6674	125.6524	129.6620	113.0425	108.4670	93.5987	86.7330	99.5274	100.7161	117.3749	128.1238	139.1342 (45)
Energy content (annual)												1385.6994 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.5501	18.8479	19.4493	16.9564	16.2700	14.0398	13.0100	14.9291	15.1074	17.6062	19.2186	20.8701 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8424 (55)
Total storage loss												
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (56)
If cylinder contains dedicated solar storage												
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	193.0442	170.2508	177.6431	154.0729	145.0495	128.7760	123.0829	136.8077	143.0972	165.3559	175.9078	188.5110 (62)
WWHRS	-46.2092	-40.6549	-41.4954	-34.1633	-31.7328	-26.1861	-22.1768	-26.8460	-27.6226	-34.1312	-39.5146	-44.6584 eq. (G10)
Total of WWHRS savings												-415.3914
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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.9740 (H8)
Utilisation factor												0.3975 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												88.0710 (H14)
Volume ratio Veff/V												0.8516 (H15)
Solar storage volume factor												0.9679 (H16)
Solar input												-647.8721 (H17)
Solar input	-19.9412	-29.9716	-50.4759	-69.7731	-84.0303	-88.4382	-86.3147	-77.0795	-60.1608	-40.9263	-24.2390	-16.5214 (63)
Output from w/h												
	126.8938	99.6243	85.6718	50.1364	29.2863	14.1517	14.5914	32.8822	55.3137	90.2984	112.1542	127.3312 (64)
Heat gains from water heating, kWh/month												
	87.2708	77.4581	81.4975	70.4110	65.3313	59.2634	57.9186	62.9171	67.3930	77.4120	80.8284	85.7636 (65)
Total per year (kWh/year) = Sum(64)m =												838.3355 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951	136.0951 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.9302	41.6830	33.8989	25.6636	19.1839	16.1958	17.5002	22.7474	30.5315	38.7667	45.2465	48.2345 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.6637	300.7525	292.9688	276.3982	255.4807	235.8213	222.6876	219.5988	227.3825	243.9531	264.8706	284.5300 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778	50.8778 (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)	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301	-90.7301 (71)
Water heating gains (Table 5)	117.2995	115.2651	109.5396	97.7930	87.8108	82.3103	77.8476	84.5660	93.6014	104.0484	112.2616	115.2736 (72)
Total internal gains	558.1362	553.9434	532.6501	496.0976	458.7182	430.5702	414.2782	423.1550	447.7581	483.0110	518.6215	544.2809 (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					3.9000	12.9236	0.4600	0.0000			0.7700	17.8523 (75)
Southwest					3.4700	40.4699	0.4600	0.0000			0.7700	49.7405 (79)
Southwest					3.3300	40.4699	0.4300	0.0000			0.7700	44.6206 (79)
Solar gains	112.2135	177.4647	254.4583	350.4173	405.0526	440.9333	416.1583	372.5546	307.6640	213.6472	138.8213	94.4046 (83)
Total gains	670.3497	731.4081	787.1084	846.5149	863.7708	871.5035	830.4364	795.7096	755.4221	696.6583	657.4428	638.6856 (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	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698	38.3698
alpha	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580	3.5580
util living area	0.9407	0.9194	0.8717	0.7777	0.6272	0.4214	0.2803	0.3013	0.5426	0.7888	0.9060	0.9479 (86)
Tweekday	18.5405	18.7655	19.1841	19.6169	19.9075	20.0136	20.0265	20.0260	19.9842	19.6785	19.0670	18.4695
Tweekend	20.2575	20.3608	20.5550	20.7643	20.9173	20.9854	20.9976	20.9968	20.9623	20.7900	20.4967	20.2248
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0

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24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8540	20.0112	20.3132	20.6319	20.8724	20.9776	20.9962	20.9951	20.9411	20.6759	20.2141	19.8036 (87)
Th 2	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276	20.0276 (88)
util rest of house												
	0.9301	0.9055	0.8494	0.7404	0.5685	0.3444	0.1935	0.2112	0.4642	0.7450	0.8872	0.9383 (89)
Tweekday	18.5405	18.7655	19.1841	19.6169	19.9075	20.0136	20.0265	20.0260	19.9842	19.6785	19.0670	18.4695
Tweekend	18.5405	18.7655	19.1841	19.6169	19.9075	20.0136	20.0265	20.0260	19.9842	19.6785	19.0670	18.4695
MIT 2	18.5405	18.7655	19.1841	19.6169	19.9075	20.0136	20.0265	20.0260	19.9842	19.6785	19.0670	18.4695 (90)
Living area fraction									fLA = Living area / (4) =			0.1638 (91)
MIT	18.7557	18.9696	19.3691	19.7832	20.0656	20.1715	20.1854	20.1848	20.1410	19.8419	19.2549	18.6881 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7557	18.9696	19.3691	19.7832	20.0656	20.1715	20.1854	20.1848	20.1410	19.8419	19.2549	18.6881 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9126	0.8869	0.8319	0.7301	0.5709	0.3560	0.2077	0.2260	0.4737	0.7357	0.8690	0.9215 (94)
Useful gains	611.7436	648.7214	654.8293	618.0244	493.1476	310.2841	172.4787	179.8090	357.8794	512.5226	571.3270	588.5427 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1033.6986	1012.0438	906.0301	748.1327	534.8427	315.7738	172.9951	180.5221	374.0170	623.8881	851.9642	1028.5802 (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	313.9345	244.1527	186.8934	93.6779	31.0212	0.0000	0.0000	0.0000	0.0000	82.8559	202.0588	327.3879 (98)
Space heating												1481.9823 (98)
Space heating per m2										(98) / (4) =		20.8965 (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 %)												222.0383 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												667.4446 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	313.9345	244.1527	186.8934	93.6779	31.0212	0.0000	0.0000	0.0000	0.0000	82.8559	202.0588	327.3879 (98)
Space heating efficiency (main heating system 1)	222.0383	222.0383	222.0383	222.0383	222.0383	0.0000	0.0000	0.0000	0.0000	222.0383	222.0383	222.0383 (210)
Space heating fuel (main heating system)	141.3876	109.9597	84.1717	42.1900	13.9711	0.0000	0.0000	0.0000	0.0000	37.3161	91.0018	147.4466 (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	126.8938	99.6243	85.6718	50.1364	29.2863	14.1517	14.5914	32.8822	55.3137	90.2984	112.1542	127.3312 (64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800 (216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800 (217)
Fuel for water heating, kWh/month	74.5207	58.5062	50.3123	29.4435	17.1989	8.3108	8.5691	19.3107	32.4840	53.0294	65.8646	74.7776 (219)
Water heating fuel used												492.3276 (219)
Annual totals kWh/year												
Space heating fuel - main system												667.4446 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)												
mechanical ventilation fans (SFP = 0.2282)												48.5654 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												98.5654 (231)
Electricity for lighting (calculated in Appendix L)												331.5208 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.20 * 1090 * 1.00) =									-1046.8728			-1046.8728 (233)
Total delivered energy for all uses												542.9857 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	667.4446	16.9600	113.1986 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	492.3276	16.9600	83.4988 (247)
Mechanical ventilation fans	48.5654	16.9600	8.2367 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	16.9600	8.4800 (249)
Energy for lighting	331.5208	16.9600	56.2259 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1046.8728	16.9600	-177.5496 (252)
Total energy cost			92.0904 (255)

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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	667.4446	0.5190	346.4038 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	492.3276	0.5190	255.5180 (264)
Space and water heating			601.9218 (265)
Pumps and fans	98.5654	0.5190	51.1554 (267)
Energy for lighting	331.5208	0.5190	172.0593 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	0.5190	-543.3270 (269)
Total kg/year			281.8096 (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	667.4446	3.0700	2049.0550 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	492.3276	3.0700	1511.4459 (264)
Space and water heating			3560.5008 (265)
Pumps and fans	98.5654	3.0700	302.5957 (267)
Energy for lighting	331.5208	3.0700	1017.7689 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			1666.9661 (272)
Primary energy kWh/m2/year			23.5049 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	147.4 (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	230.29 (P1)
Transmission heat loss coefficient	46.91 (37)
Summer heat loss coefficient	277.20 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None
South 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 West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.9000	98.8453	0.4600	0.0000	0.9000	159.5956
South West	3.4700	119.9223	0.4600	0.0000	0.9000	172.2780
South West	3.3300	119.9223	0.4300	0.0000	0.9000	154.5451
total:						486.4187

	Jun	Jul	Aug	
Solar gains	515	486	435	(P3/P4)
Internal gains	445	428	436	
Total summer gains	960	915	872	(P5)
Summer gain/loss ratio	3.46	3.30	3.14	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 147.4)	0.97	0.97	0.97	
Threshold temperature	20.43	22.17	21.91	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

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

Assessment of likelihood of high internal temperature: Medium