

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-01			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 1, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	14.03	TER	25.54
Environmental	89 B	% DER<TER	45.06		
CO ₂ Emissions (t/year)	0.92	DFEE	43.35	TFEE	48.63
General Requirements Compliance	Pass	% DFEE<TFEE	10.86		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

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

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DWELLING AS DESIGNED

Ground-floor flat, total floor area 79 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 (c)
 Fuel factor: 1.55 (electricity)
 Target Carbon Dioxide Emission Rate (TER) 25.54 kgCO₂/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 14.03 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 48.6 kWh/m²/yr
 Dwelling Fabric Energy Efficiency (DFEE) 43.3 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.067

3 Air permeability

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

4 Heating efficiency

Main heating system: Community heating scheme -
 Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day
 Permitted by DBSCG 2.10 OK
 Primary pipework insulated: Yes (assumed) OK

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room stats OK
 Hot water controls: Cylinderstat OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
 Based on:
 Overshading: Average
 Windows facing South East: 1.11 m², No overhang
 Windows facing South: 7.72 m², No overhang
 Windows facing South West: 1.11 m², No overhang
 Windows facing West: 3.99 m², No overhang
 Air change rate: 4.00 ach
 Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

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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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (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	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.8758		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (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	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	96.1784	95.8716	95.5708	94.1579	93.8936	92.6631	92.6631	92.4352	93.1371	93.8936	94.4284	94.9874 (39)
Average = Sum(39)m / 12 =												94.1567 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2107	1.2068	1.2031	1.1853	1.1819	1.1665	1.1665	1.1636	1.1724	1.1819	1.1887	1.1957 (40)
HLP (average)												1.1853 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

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Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.7200	(55)
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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														
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum(63)m =					0.0000	(63)
Output from w/h														
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(64)	
								Total per year (kWh/year) = Sum(64)m =					1991.1144	(64)
Heat gains from water heating, kWh/month														
	86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	(65)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9977	0.9932	0.9804	0.9396	0.8325	0.6262	0.4293	0.4670	0.7366	0.9523	0.9936	0.9984 (94)
Useful gains	572.2844	677.6599	749.2906	772.2217	703.3268	511.0196	337.7667	354.8561	538.0381	625.3365	571.2064	538.6951 (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	1419.7798	1377.7137	1247.7277	1035.2717	791.9873	522.7960	338.7168	356.4434	569.4352	874.5585	1164.1594	1409.3116 (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	630.5366	470.4361	370.8372	189.3960	65.9634	0.0000	0.0000	0.0000	0.0000	185.4212	426.9261	647.7387 (98)
Space heating												2987.2553 (98)
Space heating per m2												37.6039 (99)
										(98) / (4) =		

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8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2987.2553	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3136.6181	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1991.1144	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702	(310a)
Electricity used for heat distribution	52.2729	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	352.5010	(332)
Total delivered energy for all uses	5579.7893	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1742.4294	0.5190	904.3209 (367)
Electrical energy for heat distribution	52.2729	0.5190	27.1296 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			931.4505 (373)
Space and water heating			931.4505 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	0.5190	182.9480 (379)
Total CO2, kg/year			1114.3985 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0300 (384)

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

DER	14.0300	ZC1
Total Floor Area	79.4400	TFA
Assumed number of occupants	2.4521	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	16.2815	ZC2
CO2 emissions from cooking, equation (L16)	2.2388	ZC3
Total CO2 emissions	32.5503	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	32.5503	ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	53.9800	13.9300	40.0500	0.1800	7.2090		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8870		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2826 (36)
Total fabric heat loss						(33) + (36) =	52.1696 (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	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	93.3276	93.0833	92.8438	91.7190	91.5085	90.5288	90.5288	90.3474	90.9062	91.5085	91.9342	92.3793 (39)
Average = Sum(39)m / 12 =												91.7179 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1748	1.1717	1.1687	1.1546	1.1519	1.1396	1.1396	1.1373	1.1443	1.1519	1.1573	1.1629 (40)
HLP (average)												1.1546 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

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Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (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	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Heat gains from water heating, kWh/month	89.5325	79.4331	84.6448	77.5740	77.2479	70.7883	69.6630	74.1281	73.2722	80.3567	82.8372	87.9505 (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	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607 (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)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)	
Water heating gains (Table 5)	120.3394	118.2041	113.7699	107.7416	103.8279	98.3171	93.6331	99.6346	101.7669	108.0063	115.0517	118.2130 (72)	
Total internal gains	421.3479	419.2458	405.7933	384.1119	362.1042	340.9070	327.1473	333.1155	344.2661	366.1587	391.2980	410.1457 (73)	

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (77)
South			7.7200		46.7521		0.6300		0.7000		0.7700		110.3037 (78)
Southwest			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (79)
West			3.9900		19.6403		0.6300		0.7000		0.7700		23.9493 (80)
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705	(83)
Total gains	580.5640	689.2661	771.2429	828.8051	851.7721	823.0563	793.6659	766.8688	737.3790	663.5922	581.8075	546.5162	(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	59.1108	59.2659	59.4188	60.1475	60.2858	60.9382	60.9382	61.0606	60.6853	60.2858	60.0067	59.7175	
alpha	4.9407	4.9511	4.9613	5.0098	5.0191	5.0625	5.0625	5.0707	5.0457	5.0191	5.0004	4.9812	
util living area	0.9952	0.9883	0.9721	0.9291	0.8335	0.6639	0.4941	0.5306	0.7606	0.9441	0.9893	0.9964 (86)	
MIT	19.8457	20.0374	20.2972	20.5987	20.8333	20.9610	20.9927	20.9897	20.9214	20.6157	20.1708	19.8118 (87)	
Th 2	19.9402	19.9427	19.9451	19.9565	19.9587	19.9686	19.9686	19.9705	19.9648	19.9587	19.9543	19.9498 (88)	
util rest of house	0.9936	0.9846	0.9628	0.9054	0.7803	0.5730	0.3824	0.4176	0.6777	0.9202	0.9851	0.9952 (89)	
MIT 2	18.4185	18.6981	19.0724	19.5002	19.8010	19.9436	19.9661	19.9664	19.9068	19.5333	18.9019	18.3760 (90)	
Living area fraction									fLA = Living area / (4) =			0.2942 (91)	
MIT	18.8384	19.0921	19.4327	19.8234	20.1047	20.2429	20.2681	20.2675	20.2053	19.8517	19.2752	18.7984 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.8384	19.0921	19.4327	19.8234	20.1047	20.2429	20.2681	20.2675	20.2053	19.8517	19.2752	18.7984 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9913	0.9805	0.9572	0.9018	0.7886	0.5984	0.4154	0.4510	0.6986	0.9172	0.9814	0.9934 (94)	
Useful gains	575.5217	675.8279	738.2004	747.3967	671.7008	492.5046	329.7105	345.8511	515.1166	608.6683	570.9964	542.8863 (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	1356.8294	1321.0514	1200.7221	1001.8805	769.1006	510.8468	332.0674	349.4146	555.0081	846.6104	1119.3159	1348.5884 (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	581.2929	433.5901	344.1162	183.2283	72.4654	0.0000	0.0000	0.0000	0.0000	177.0290	394.7900	599.4424 (98)	
Space heating												2785.9543 (98)	
Space heating per m2										(98) / (4) =		35.0699 (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												2979.6303 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	581.2929	433.5901	344.1162	183.2283	72.4654	0.0000	0.0000	0.0000	0.0000	177.0290	394.7900	599.4424 (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)	621.7037	463.7328	368.0387	195.9661	77.5031	0.0000	0.0000	0.0000	0.0000	189.3358	422.2353	641.1148 (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	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Efficiency of water heater (217)m	87.4964	87.1223	86.4427	85.0727	82.8121	79.8000	79.8000	79.8000	79.8000	84.8839	86.8247	79.8000 (216)
Fuel for water heating, kWh/month	228.6206	202.4291	214.4020	195.4830	196.9382	182.8254	175.7856	192.6138	192.1866	203.1461	209.7697	87.6134 (217)
Water heating fuel used												222.8846 (219)
Annual totals kWh/year												2417.0847 (219)
Space heating fuel - main system												2979.6303 (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)												352.5010 (232)
Total delivered energy for all uses												5824.2161 (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	2979.6303	0.2160	643.6001 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2417.0847	0.2160	522.0903 (264)
Space and water heating			1165.6904 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	352.5010	0.5190	182.9480 (268)
Total CO2, kg/m2/year			1387.5635 (272)
Emissions per m2 for space and water heating			14.6738 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3030 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6738 * 1.55) + 2.3030 + 0.4900, rounded to 2 d.p.			25.5400 (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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (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) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1420 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3920 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.8758		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			20.0000	1588.8000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25763.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							324.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (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	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	94.5675	94.3232	94.0837	92.9589	92.7484	91.7687	91.7687	91.5873	92.1461	92.7484	93.1742	93.6193 (39)
Average = Sum(39)m / 12 =												92.9579 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1904	1.1874	1.1843	1.1702	1.1675	1.1552	1.1552	1.1529	1.1599	1.1675	1.1729	1.1785 (40)
HLP (average)												1.1702 (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	2.4521 (42)
Average daily hot water use (litres/day)	92.4386 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (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:												

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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	32.0433	28.0253	28.9196	25.2128	24.1923	20.8761	19.3448	22.1984	22.4635	26.1791	28.5765	31.0322 (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	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(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)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	43.0690	41.7043	38.8704	35.0178	32.5165	28.9946	26.0010	29.8366	31.1993	35.1869	39.6896	41.7100	(72)
Total internal gains	341.0775	339.7460	327.8939	308.3880	287.7928	268.5845	256.5152	260.3175	270.6985	290.3393	312.9359	330.6428	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Southeast				1.1100	36.7938	0.6300	0.7000	0.7700	12.4816 (77)				
South				7.7200	46.7521	0.6300	0.7000	0.7700	110.3037 (78)				
Southwest				1.1100	36.7938	0.6300	0.7000	0.7700	12.4816 (79)				
West				3.9900	19.6403	0.6300	0.7000	0.7700	23.9493 (80)				
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705	(83)
Total gains	500.2935	609.7663	693.3434	753.0812	777.4608	750.7337	723.0339	694.0708	663.8114	587.7728	503.4454	467.0132	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.6757	75.8717	76.0648	76.9852	77.1599	77.9836	77.9836	78.1381	77.6643	77.1599	76.8073	76.4422	
alpha	6.0450	6.0581	6.0710	6.1323	6.1440	6.1989	6.1989	6.2092	6.1776	6.1440	6.1205	6.0961	
util living area	0.9993	0.9976	0.9919	0.9701	0.9005	0.7375	0.5517	0.5959	0.8415	0.9808	0.9981	0.9996	(86)
MIT	19.9729	20.1334	20.3556	20.6237	20.8449	20.9678	20.9953	20.9927	20.9262	20.6295	20.2438	19.9457	(87)
Th 2	19.9277	19.9301	19.9326	19.9439	19.9461	19.9560	19.9560	19.9579	19.9522	19.9461	19.9418	19.9372	(88)
util rest of house	0.9991	0.9966	0.9880	0.9552	0.8529	0.6375	0.4247	0.4672	0.7579	0.9684	0.9971	0.9994	(89)
MIT 2	18.9969	19.1590	19.3813	19.6507	19.8489	19.9437	19.9552	19.9563	19.9176	19.6619	19.2791	18.9777	(90)
Living area fraction									fLA = Living area / (4) =			0.2942	(91)
MIT	19.2841	19.4456	19.6680	19.9369	20.1419	20.2450	20.2612	20.2612	20.2143	19.9465	19.5629	19.2625	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2841	19.4456	19.6680	19.9369	20.1419	20.2450	20.2612	20.2612	20.2143	19.9465	19.5629	19.2625	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	499.6950	607.2675	684.1902	719.2863	670.9821	500.7332	334.4188	350.9816	518.6842	569.2304	501.7285	466.6425	(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	1417.0051	1371.9887	1238.8900	1025.9799	782.9751	518.0304	335.9798	353.6376	563.4099	866.8771	1161.2214	1410.1363	(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	682.4788	513.8926	412.6966	220.8194	83.3229	0.0000	0.0000	0.0000	0.0000	221.4492	474.8348	701.9594	(98)
Space heating												3311.4537	(98)
Space heating per m2											(98) / (4) =	41.6850	(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	862.6261	679.0887	696.0636	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9059	0.9581	0.9461	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	781.4243	650.6163	658.5662	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	969.0631	934.8130	902.5501	0.0000	0.0000	0.0000	0.0000	(103)

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Month fraction	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	135.0999	211.4424	181.5240	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												528.0663 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.7750	52.8606	45.3810	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												132.0166 (107)
Space cooling per m2												1.6618 (108)
Energy for space heating												41.6850 (99)
Energy for space cooling												1.6618 (108)
Total												43.3468 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.3 (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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) =					Air changes per hour 30.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	53.9800	13.9300	40.0500	0.1800	7.2090		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8870		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2826 (36)
Total fabric heat loss						(33) + (36) =	52.1696 (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	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	93.3276	93.0833	92.8438	91.7190	91.5085	90.5288	90.5288	90.3474	90.9062	91.5085	91.9342	92.3793 (39)
Average = Sum(39)m / 12 =												91.7179 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1748	1.1717	1.1687	1.1546	1.1519	1.1396	1.1396	1.1373	1.1443	1.1519	1.1573	1.1629 (40)
HLP (average)												1.1546 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (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	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	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	0.0000 (57)

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 (59)
Heat gains from water heating, kWh/month	32.0433	28.0253	28.9196	25.2128	24.1923	20.8761	19.3448	22.1984	22.4635	26.1791	28.5765	31.0322 (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	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607 (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)												
	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)
Water heating gains (Table 5)												
	43.0690	41.7043	38.8704	35.0178	32.5165	28.9946	26.0010	29.8366	31.1993	35.1869	39.6896	41.7100 (72)
Total internal gains	341.0775	339.7460	327.8939	308.3880	287.7928	268.5845	256.5152	260.3175	270.6985	290.3393	312.9359	330.6428 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (77)
South			7.7200		46.7521		0.6300		0.7000		0.7700		110.3037 (78)
Southwest			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (79)
West			3.9900		19.6403		0.6300		0.7000		0.7700		23.9493 (80)
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705	(83)
Total gains	500.2935	609.7663	693.3434	753.0812	777.4608	750.7337	723.0339	694.0708	663.8114	587.7728	503.4454	467.0132	(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	59.1108	59.2659	59.4188	60.1475	60.2858	60.9382	60.9382	61.0606	60.6853	60.2858	60.0067	59.7175
alpha	4.9407	4.9511	4.9613	5.0098	5.0191	5.0625	5.0625	5.0707	5.0457	5.0191	5.0004	4.9812
util living area	0.9975	0.9931	0.9816	0.9490	0.8692	0.7119	0.5385	0.5801	0.8101	0.9640	0.9942	0.9982 (86)
MIT	19.7530	19.9483	20.2157	20.5332	20.7928	20.9467	20.9894	20.9847	20.8941	20.5449	20.0822	19.7194 (87)
Th 2	19.9402	19.9427	19.9451	19.9565	19.9587	19.9686	19.9686	19.9705	19.9648	19.9587	19.9543	19.9498 (88)
util rest of house	0.9967	0.9907	0.9752	0.9304	0.8218	0.6202	0.4187	0.4596	0.7319	0.9471	0.9919	0.9976 (89)
MIT 2	18.8092	19.0052	19.2710	19.5863	19.8206	19.9444	19.9660	19.9662	19.9088	19.6044	19.1487	18.7833 (90)
Living area fraction									fLA = Living area / (4) =			0.2942 (91)
MIT	19.0868	19.2827	19.5489	19.8649	20.1066	20.2393	20.2670	20.2658	20.1987	19.8811	19.4233	19.0587 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0868	19.2827	19.5489	19.8649	20.1066	20.2393	20.2670	20.2658	20.1987	19.8811	19.4233	19.0587 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9958	0.9888	0.9722	0.9284	0.8294	0.6458	0.4543	0.4954	0.7516	0.9455	0.9903	0.9969 (94)
Useful gains	498.1676	602.9395	674.0475	699.1978	644.8405	484.8522	328.4519	343.8513	498.8933	555.7444	498.5626	465.5774 (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	1380.0195	1338.7839	1211.5120	1005.6857	769.2783	510.5188	331.9728	349.2687	554.4065	849.2998	1132.9333	1372.6323 (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	656.0978	494.4874	399.8736	220.6713	92.5818	0.0000	0.0000	0.0000	0.0000	218.4052	456.7469	674.8489 (98)
Space heating												3213.7128 (98)
Space heating per m2										(98) / (4) =		40.4546 (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	850.9709	669.9132	686.6402	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8842	0.9395	0.9262	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	752.4491	629.3998	635.9373	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	969.0631	934.8130	902.5501	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	155.9621	227.2275	198.3599	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												581.5494 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.9905	56.8069	49.5900	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												145.3874 (107)
Space cooling per m2												1.8302 (108)
Energy for space heating												40.4546 (99)
Energy for space cooling												1.8302 (108)
Total												42.2847 (109)
Target Fabric Energy Efficiency (TFEE)												48.6 (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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.4201	0.4014	0.4107	0.3734	0.3734	0.3454	0.3454	0.3174	0.3454	0.3641	0.3547	0.3827 (22b)
Effective ac	0.5882	0.5806	0.5844	0.5697	0.5697	0.5596	0.5596	0.5504	0.5596	0.5663	0.5629	0.5732 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	42.8758			(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (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	41.0188	40.4841	40.7484	39.7275	39.7275	39.0257	39.0257	38.3785	39.0257	39.4875	39.2536	39.9737 (38)
Heat transfer coeff	94.4284	93.8936	94.1579	93.1371	93.1371	92.4352	92.4352	91.7881	92.4352	92.8970	92.6631	93.3832 (39)
Average = Sum(39)m / 12 =												93.0659 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1887	1.1819	1.1853	1.1724	1.1724	1.1636	1.1636	1.1554	1.1636	1.1694	1.1665	1.1755 (40)
HLP (average)												1.1715 (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	2.4521 (42)
Average daily hot water use (litres/day)	92.4386 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	(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													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month													
86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	85.0223	(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	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
49.9002	44.3209	36.0442	27.2878	20.3979	17.2208	18.6077	24.1869	32.4637	41.2201	48.1099	51.2870	51.2870	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
325.7704	329.1509	320.6322	302.4969	279.6043	258.0886	243.7147	240.3342	248.8529	266.9882	289.8808	311.3965	311.3965	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	(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)													
-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)													
116.4036	114.2683	109.8341	103.8059	99.8921	94.3813	89.6973	95.6988	97.8311	104.0705	111.1159	114.2772	114.2772	(72)
Total internal gains													
593.2822	588.9481	567.7185	534.7985	501.1024	470.8987	453.2277	461.4280	480.3558	513.4869	550.3146	578.1689	578.1689	(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	
Southeast				1.1100	40.4699		0.6300		0.7000	0.7700	13.7286 (77)	
South				7.7200	50.9848		0.6300		0.7000	0.7700	120.2901 (78)	
Southwest				1.1100	40.4699		0.6300		0.7000	0.7700	13.7286 (79)	
West				3.9900	22.3313		0.6300		0.7000	0.7700	27.2307 (80)	

Solar gains	174.9781	266.7895	360.5110	452.1503	484.4895	511.9300	489.3815	460.4763	416.5881	313.7384	208.9242	148.4801 (83)
Total gains	768.2603	855.7376	928.2295	986.9489	985.5919	982.8288	942.6092	921.9043	896.9438	827.2253	759.2388	726.6490 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	78.1240	78.5690	78.3484	79.2072	79.2072	79.8086	80.3713	79.8086	79.4118	79.6123	78.9984	78.9984	
alpha	6.2083	6.2379	6.2232	6.2805	6.2805	6.3206	6.3206	6.3581	6.3206	6.2941	6.3075	6.2666	
util living area													
0.9930	0.9851	0.9601	0.8887	0.7332	0.4863	0.3137	0.3383	0.6067	0.8931	0.9814	0.9947	0.9947	(86)
MIT	20.2882	20.4224	20.6297	20.8369	20.9618	20.9975	20.9999	20.9998	20.9903	20.8576	20.5462	20.2653	(87)
Th 2	19.9291	19.9345	19.9318	19.9421	19.9421	19.9492	19.9492	19.9558	19.9492	19.9446	19.9469	19.9396	(88)
util rest of house													
0.9901	0.9790	0.9437	0.8475	0.6552	0.3896	0.2108	0.2345	0.5065	0.8445	0.9723	0.9924	0.9924	(89)
MIT 2	19.0209	19.2174	19.5055	19.7821	19.9157	19.9484	19.9492	19.9558	19.9449	19.8148	19.4060	18.9962	(90)
Living area fraction													
MIT	19.3937	19.5719	19.8362	20.0924	20.2234	20.2570	20.2583	20.2629	20.2524	20.1215	19.7414	19.3696	(91)
Temperature adjustment													
adjusted MIT	19.3937	19.5719	19.8362	20.0924	20.2234	20.2570	20.2583	20.2629	20.2524	20.1215	19.7414	19.3696	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9881	0.9763	0.9419	0.8541	0.6771	0.4182	0.2410	0.2651	0.5361	0.8538	0.9700	0.9908	0.9908	(94)
Useful gains	759.0876	835.4563	874.2783	842.9585	667.3059	411.0027	227.2133	244.3858	480.8545	706.2613	736.4804	719.9307	(95)
Ext temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	(96)
Heat loss rate W													
1378.0634	1330.6498	1180.3817	967.9171	691.3961	411.9869	227.2348	244.4246	485.5076	810.2056	1115.7958	1360.5526	1360.5526	(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													
460.5180	332.7700	227.7409	89.9702	17.9231	0.0000	0.0000	0.0000	0.0000	77.3345	273.1071	476.6227	476.6227	(98)
Space heating													
RHI space heating demand													
1955.9865													(98)
1956													(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3734 (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												
	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.8758		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss							(33) + (36) = 53.4095 (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	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	96.1784	95.8716	95.5708	94.1579	93.8936	92.6631	92.6631	92.4352	93.1371	93.8936	94.4284	94.9874 (39)
Average = Sum(39)m / 12 =												94.1567 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2107	1.2068	1.2031	1.1853	1.1819	1.1665	1.1665	1.1636	1.1724	1.1819	1.1887	1.1957 (40)
HLP (average)												1.1853 (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	2.4521 (42)
Average daily hot water use (litres/day)	92.4386 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

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																					180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):																	1.2000	(48)				
Temperature factor from Table 2b																	0.6000	(49)				
Enter (49) or (54) in (55)																	0.7200	(55)				
Total storage loss																						
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	(56)				
If cylinder contains dedicated solar storage																						
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	(57)				
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)				
Total heat required for water heating calculated for each month																						
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	178.5897	168.7781	149.8227	150.0455	(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	0.0000	0.0000	0.0000	0.0000	0.0000	(63)				
																	Solar input (sum of months) = Sum(63)m =	0.0000	(64)			
Output from w/h																						
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	178.5897	168.7781	149.8227	150.0455	(65)				
																	Total per year (kWh/year) = Sum(64)m =	1991.1144	(64)			
Heat gains from water heating, kWh/month																						
	86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	85.0223	80.0034	77.4285	70.4384	71.1999	(65)				

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9909	0.9799	0.9543	0.8884	0.7532	0.5436	0.3679	0.3976	0.6377	0.8971	0.9788	0.9931 (94)
Useful gains	745.6440	841.6631	890.5376	870.1967	746.2019	518.0691	338.3967	355.9257	557.0185	727.4602	725.0926	709.5754 (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	1440.4159	1397.2866	1264.5988	1046.6415	796.6680	523.5298	338.7902	356.5643	571.4267	886.3953	1182.2836	1429.4153 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	516.9103	373.3790	278.3016	127.0402	37.5468	0.0000	0.0000	0.0000	0.0000	118.2477	329.1776	535.5608 (98)
Space heating												2316.1640 (98)
Space heating per m2												29.1561 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2316.1640	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2431.9722	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1991.1144	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702	(310a)
Electricity used for heat distribution	45.2264	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	352.5010	(332)
Total delivered energy for all uses	4875.1434	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2431.9722	4.2400	103.1156 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2090.6702	4.2400	88.6444 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	352.5010	13.1900	46.4949 (350)
Additional standing charges			120.0000 (351)
Total energy cost			358.2549 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2092 (357)
SAP value		83.1323
SAP rating (Section 12)		83 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1507.5475	0.5190	782.4171 (367)
Electrical energy for heat distribution	45.2264	0.5190	23.4725 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			805.8896 (373)
Space and water heating			805.8896 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	0.5190	182.9480 (379)
Total kg/year			988.8377 (383)
CO2 emissions per m2			12.4500 (384)
EI value			89.3520 (384a)
EI rating			89 (385)
EI band			B

Calculation of stars for heating and DHW

Space heating energy efficiency	1.00 x 4.240 x 1.05
= 4.452, stars = 4	
Space heating environmental impact	1.00 x 0.519 x 1.05 / 3.0000
= 0.1817, stars = 5	
Water heating energy efficiency	4.452, stars = 4
Water heating environmental impact	0.1817, 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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.4201	0.4014	0.4107	0.3734	0.3734	0.3454	0.3454	0.3174	0.3454	0.3641	0.3547	0.3827 (22b)
Effective ac	0.5882	0.5806	0.5844	0.5697	0.5697	0.5596	0.5596	0.5504	0.5596	0.5663	0.5629	0.5732 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	42.8758			(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (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	41.0188	40.4841	40.7484	39.7275	39.7275	39.0257	39.0257	38.3785	39.0257	39.4875	39.2536	39.9737 (38)
Heat transfer coeff	94.4284	93.8936	94.1579	93.1371	93.1371	92.4352	92.4352	91.7881	92.4352	92.8970	92.6631	93.3832 (39)
Average = Sum(39)m / 12 =												93.0659 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1887	1.1819	1.1853	1.1724	1.1724	1.1636	1.1636	1.1554	1.1636	1.1694	1.1665	1.1755 (40)
HLP (average)												1.1715 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

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store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.7200	(55)
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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														
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum(63)m =					0.0000	(63)
Output from w/h														
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(64)	
								Total per year (kWh/year) = Sum(64)m =					1991.1144	(64)
Heat gains from water heating, kWh/month														
	86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	(65)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9881	0.9763	0.9419	0.8541	0.6771	0.4182	0.2410	0.2651	0.5361	0.8538	0.9700	0.9908 (94)
Useful gains	759.0876	835.4563	874.2783	842.9585	667.3059	411.0027	227.2133	244.3858	480.8545	706.2613	736.4804	719.9307 (95)
Ext temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000 (96)
Heat loss rate W	1378.0634	1330.6498	1180.3817	967.9171	691.3961	411.9869	227.2348	244.4246	485.5076	810.2056	1115.7958	1360.5526 (97)
Month fracti	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	460.5180	332.7700	227.7409	89.9702	17.9231	0.0000	0.0000	0.0000	0.0000	77.3345	273.1071	476.6227 (98)
Space heating												1955.9865 (98)
Space heating per m2												24.6222 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	1955.9865 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2053.7858 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1991.1144 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702 (310a)
Electricity used for heat distribution	41.4446 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	352.5010 (332)
Total delivered energy for all uses	4496.9570 (338)

10b. Fuel costs - using BEDF prices (482)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2053.7858	4.5600	93.6526 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2090.6702	4.5600	95.3346 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	352.5010	19.1200	67.3982 (350)
Additional standing charges			94.0000 (351)
Total energy cost			350.3854 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1381.4853	0.5190	716.9909 (367)
Electrical energy for heat distribution	41.4446	0.5190	21.5097 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			738.5006 (373)
Space and water heating			738.5006 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	0.5190	182.9480 (379)
Total kg/year			921.4486 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1381.4853	3.0700	4241.1600 (367)
Electrical energy for heat distribution	41.4446	3.0700	127.2348 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			4368.3948 (373)
Space and water heating			4368.3948 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	3.0700	1082.1781 (379)
Primary energy kWh/year			5450.5729 (383)
Primary energy kWh/m2/year			68.6124 (384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
 Current environmental impact rating: B 89

(For testing purposes):

A Not considered
 B Not considered
 C Not considered

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures: SAP change Cost change CO2 change
 (none)

Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 482 TEST (31 Aug 2021)
 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	£67	£67	£0
Community scheme	£283	£283	£0
Space heating	£188	£188	£0
Water heating	£95	£95	£0
Lighting	£67	£67	£0
Total cost of fuels	£350	£350	£0
Total cost of uses	£350	£350	£0
Delivered energy	57 kWh/m²	57 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	334.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	278.93 (P1)
Transmission heat loss coefficient	53.41 (37)
Summer heat loss coefficient	332.34 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	1.1100	119.9223	0.6300	0.7000	0.9000	47.5496
South	7.7200	112.2060	0.6300	0.7000	0.9000	309.4261
South West	1.1100	119.9223	0.6300	0.7000	0.9000	47.5496
West	3.9900	117.5071	0.6300	0.7000	0.9000	167.4791
total:						572.0043

	Jun	Jul	Aug	
Solar gains	598	572	541	(P3)
Internal gains	471	453	461	
Total summer gains	1069	1025	1003	(P5)
Summer gain/loss ratio	3.22	3.08	3.02	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 334.3)	0.00	0.00	0.00	
Threshold temperature	19.22	20.98	20.82	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-02			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 2, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	82 B	DER	15.19	TER	27.50
Environmental	89 B	% DER<TER	44.77		
CO ₂ Emissions (t/year)	0.92	DFEE	47.52	TFEE	53.03
General Requirements Compliance	Pass	% DFEE<TFEE	10.39		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 74 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 (c)
 Fuel factor: 1.55 (electricity)
 Target Carbon Dioxide Emission Rate (TER) 27.50 kgCO₂/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 15.19 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.0 kWh/m²/yr
 Dwelling Fabric Energy Efficiency (DFEE) 47.5 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.075

3 Air permeability

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

4 Heating efficiency

Main heating system: Community heating scheme -
 Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day
 Permitted by DBSCG 2.10 OK
 Primary pipework insulated: Yes (assumed) OK

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room stats OK
 Hot water controls: Cylinderstat OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
 Based on:
 Overshading: Average
 Windows facing North: 9.73 m², No overhang
 Windows facing West: 1.76 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 0.12 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3860 (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	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss							(33) + (36) = 43.7911 (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	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	83.9656	83.6615	83.3634	81.9632	81.7012	80.4817	80.4817	80.2559	80.9515	81.7012	82.2312	82.7852 (39)
Average = Sum(39)m / 12 =												81.9620 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1394	1.1353	1.1313	1.1123	1.1087	1.0922	1.0922	1.0891	1.0985	1.1087	1.1159	1.1234 (40)
HLP (average)												1.1123 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(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													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(64)
Heat gains from water heating, kWh/month													
85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	83.5268	(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	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(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)													
-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)													
114.3281	112.2585	107.9609	102.1183	98.3251	92.9841	88.4443	94.2610	96.3276	102.3749	109.2032	112.2672	112.2672	(72)
Total internal gains													
397.2998	395.2146	382.3461	361.6741	340.7663	320.6115	307.5281	313.3604	323.9979	344.8746	368.8175	386.6953	386.6953	(73)

6. Solar gains

[Jan]													
				Area	Solar flux		g		FF		Access		Gains
				m2	Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
North				9.7300	10.6334		0.6300		0.7000		0.7700		31.6196
West				1.7600	19.6403		0.6300		0.7000		0.7700		10.5641 (80)

Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471	(83)
Total gains	439.4835	476.3069	519.0591	576.2395	623.7723	620.7277	588.8715	540.4603	487.0343	441.3262	420.9965	421.7423	(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	87.6276	87.9462	88.2607	89.7684	90.0563	91.4208	91.4208	91.6781	90.8904	90.0563	89.4759	88.8770	
alpha	6.8418	6.8631	6.8840	6.9846	7.0038	7.0947	7.0947	7.1119	7.0594	7.0038	6.9651	6.9251	
util living area													
0.9998	0.9995	0.9983	0.9904	0.9434	0.7816	0.5947	0.6680	0.9272	0.9951	0.9994	0.9998	0.9998	(86)
MIT	20.0871	20.1738	20.3445	20.5993	20.8368	20.9714	20.9963	20.9922	20.8980	20.6091	20.3130	20.0791	(87)
Th 2	19.9688	19.9721	19.9754	19.9908	19.9937	20.0072	20.0072	20.0097	20.0020	19.9937	19.9879	19.9817	(88)
util rest of house													
0.9996	0.9992	0.9973	0.9844	0.9082	0.6832	0.4646	0.5331	0.8674	0.9911	0.9990	0.9997	0.9997	(89)
MIT 2	18.7518	18.8813	19.1333	19.5144	19.8388	19.9917	20.0063	20.0075	19.9247	19.5334	19.0974	18.7503	(90)
Living area fraction													
fLA = Living area / (4) =												0.2679	(91)
MIT	19.1095	19.2276	19.4578	19.8051	20.1061	20.2542	20.2715	20.2713	20.1855	19.8216	19.4230	19.1062	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1095	19.2276	19.4578	19.8051	20.1061	20.2542	20.2715	20.2713	20.1855	19.8216	19.4230	19.1062	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9995	0.9989	0.9966	0.9829	0.9129	0.7096	0.4999	0.5700	0.8809	0.9901	0.9987	0.9996	0.9996	(94)
Useful gains	439.2527	475.7970	517.3173	566.4020	569.4669	440.4527	294.3813	308.0884	429.0103	436.9483	420.4539	421.5784	(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													
1243.4886	1198.6645	1080.2050	893.8141	686.7907	455.0570	295.4902	310.6935	492.6264	753.4136	1013.3356	1234.0161	1234.0161	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
598.3515	485.7669	418.7885	235.7366	87.2889	0.0000	0.0000	0.0000	0.0000	235.4502	426.8748	604.4536	3092.7111	(98)
Space heating													
Space heating per m2													
(98) / (4) =												41.9692	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	3092.7111	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3247.3466	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1946.3205	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365	(310a)
Electricity used for heat distribution	52.9098	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	339.7119	(332)
Total delivered energy for all uses	5630.6950	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1763.6610	0.5190	915.3401 (367)
Electrical energy for heat distribution	52.9098	0.5190	27.4602 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			942.8003 (373)
Space and water heating			942.8003 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total CO2, kg/year			1119.1108 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1900 (384)

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

DER		15.1900	ZC1
Total Floor Area	TFA	73.6900	
Assumed number of occupants	N	2.3323	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5455	ZC2
CO2 emissions from cooking, equation (L16)		2.3745	ZC3
Total CO2 emissions		34.1100	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.1100	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5662		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4323 (36)
Total fabric heat loss						(33) + (36) =	42.9985 (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	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	81.5119	81.2723	81.0374	79.9342	79.7278	78.7669	78.7669	78.5890	79.1370	79.7278	80.1453	80.5819 (39)
Average = Sum(39)m / 12 =												79.9332 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1061	1.1029	1.0997	1.0847	1.0819	1.0689	1.0689	1.0665	1.0739	1.0819	1.0876	1.0935 (40)
HLP (average)												1.0847 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (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	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (64)
Heat gains from water heating, kWh/month	87.9883	78.0826	83.2511	76.3590	76.0821	69.7823	68.7308	73.0584	72.1896	79.0951	81.4601	86.4550 (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	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (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)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	118.2639	116.1943	111.8967	106.0541	102.2609	96.9198	92.3801	98.1967	100.2634	106.3106	113.1390	116.2030 (72)
Total internal gains	404.2356	402.1504	389.2819	368.6099	347.7021	327.5473	314.4638	320.2962	330.9337	351.8104	375.7533	393.6310 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				9.7300	10.6334	0.6300	0.7000	0.7700	31.6196 (74)			
West				1.7600	19.6403	0.6300	0.7000	0.7700	10.5641 (80)			

Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	446.4193	483.2427	525.9949	583.1753	630.7080	627.6635	595.8073	547.3961	493.9701	448.2619	427.9323	428.6781 (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	62.7805	62.9656	63.1481	64.0197	64.1854	64.9684	64.9684	65.1155	64.6646	64.1854	63.8510	63.5051
alpha	5.1854	5.1977	5.2099	5.2680	5.2790	5.3312	5.3312	5.3410	5.3110	5.2790	5.2567	5.2337
util living area	0.9979	0.9964	0.9916	0.9712	0.9003	0.7377	0.5677	0.6341	0.8805	0.9817	0.9960	0.9983 (86)
MIT	19.8235	19.9369	20.1594	20.4830	20.7759	20.9468	20.9892	20.9813	20.8564	20.4979	20.1133	19.8078 (87)
Th 2	19.9958	19.9985	20.0011	20.0133	20.0156	20.0263	20.0263	20.0283	20.0222	20.0156	20.0110	20.0061 (88)
util rest of house	0.9972	0.9952	0.9884	0.9597	0.8610	0.6503	0.4493	0.5131	0.8186	0.9724	0.9943	0.9978 (89)
MIT 2	18.4261	18.5936	18.9194	19.3924	19.7888	19.9898	20.0222	20.0202	19.9005	19.4206	18.8606	18.4106 (90)
Living area fraction									fLA = Living area / (4) =			0.2679 (91)
MIT	18.8004	18.9534	19.2516	19.6846	20.0533	20.2462	20.2812	20.2777	20.1566	19.7092	19.1962	18.7849 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8004	18.9534	19.2516	19.6846	20.0533	20.2462	20.2812	20.2777	20.1566	19.7092	19.1962	18.7849 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	444.6323	480.0385	518.2187	556.8291	544.1144	421.4517	286.7243	298.6791	409.2983	434.1455	424.6654	427.2866 (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	1181.9570	1142.1556	1033.3535	862.0562	665.9875	444.7314	289.9592	304.7430	479.2983	726.2577	969.4542	1175.2769 (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	548.5696	444.9427	383.2603	219.7635	90.6736	0.0000	0.0000	0.0000	0.0000	217.3314	392.2479	556.5048 (98)
Space heating												2853.2938 (98)
Space heating per m2										(98) / (4) =		38.7202 (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													3051.6511 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.5696	444.9427	383.2603	219.7635	90.6736	0.0000	0.0000	0.0000	0.0000	217.3314	392.2479	556.5048	(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)	586.7054	475.8746	409.9041	235.0412	96.9771	0.0000	0.0000	0.0000	0.0000	232.4400	419.5165	595.1923	(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	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791	(64)
Efficiency of water heater (217)m	87.4214	87.2349	86.7661	85.6173	83.3715	79.8000	79.8000	79.8000	79.8000	85.4914	86.8645	79.8000	(216)
Fuel for water heating, kWh/month	223.5043	197.5118	208.7721	189.9715	191.4112	179.0338	172.2722	188.5820	188.1068	197.2644	204.9055	218.0218	(219)
Water heating fuel used												2359.3574	(219)
Annual totals kWh/year													
Space heating fuel - main system												3051.6511	(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)												339.7119	(232)
Total delivered energy for all uses												5825.7204	(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	3051.6511	0.2160	659.1566 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2359.3574	0.2160	509.6212 (264)
Space and water heating			1168.7778 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1384.0133 (272)
Emissions per m2 for space and water heating			15.8607 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8607 * 1.55) + 2.3926 + 0.5282, rounded to 2 d.p.			27.5000 (273)

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (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) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1530 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4030 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum (m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			20.0000	1473.8000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25750.8500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							349.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss						(33) + (36) =	43.7911 (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	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	82.3046	82.0649	81.8301	80.7268	80.5204	79.5596	79.5596	79.3816	79.9297	80.5204	80.9380	81.3745 (39)
Average = Sum(39)m / 12 =												80.7259 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1169	1.1137	1.1105	1.0955	1.0927	1.0797	1.0797	1.0772	1.0847	1.0927	1.0984	1.1043 (40)
HLP (average)												1.0955 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (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:												

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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	31.0564	27.1622	28.0289	24.4363	23.4472	20.2331	18.7490	21.5147	21.7717	25.3728	27.6964	30.0765 (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	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(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)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)	41.7425	40.4199	37.6733	33.9393	31.5150	28.1016	25.2002	28.9177	30.2385	34.1032	38.4672	40.4254	(72)
Total internal gains	324.7143	323.3759	312.0585	293.4950	273.9563	255.7290	244.2840	248.0171	257.9087	276.6030	298.0815	314.8535	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					9.7300	10.6334	0.6300	0.7000	0.7700		31.6196 (74)	
West					1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)	

Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	366.8980	404.4682	448.7715	508.0605	556.9622	555.8453	525.6274	475.1170	420.9451	373.0545	350.2605	349.9005 (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	86.9091	87.1628	87.4130	88.6076	88.8348	89.9076	89.9076	90.1092	89.4913	88.8348	88.3765	87.9024	
alpha	6.7939	6.8109	6.8275	6.9072	6.9223	6.9938	6.9938	7.0073	6.9661	6.9223	6.8918	6.8602	
util living area	0.9999	0.9998	0.9992	0.9947	0.9635	0.8334	0.6525	0.7365	0.9592	0.9979	0.9998	0.9999	(86)
MIT	20.0185	20.1065	20.2804	20.5394	20.7926	20.9550	20.9931	20.9851	20.8554	20.5454	20.2433	20.0074	(87)
Th 2	19.9871	19.9897	19.9923	20.0045	20.0068	20.0175	20.0175	20.0195	20.0134	20.0068	20.0022	19.9973	(88)
util rest of house	0.9999	0.9997	0.9987	0.9913	0.9385	0.7416	0.5148	0.5976	0.9190	0.9962	0.9996	0.9999	(89)
MIT 2	19.0868	19.1770	19.3529	19.6208	19.8639	19.9991	20.0162	20.0161	19.9294	19.6298	19.3243	19.0844	(90)
Living area fraction									fLA = Living area / (4) =			0.2679	(91)
MIT	19.3364	19.4260	19.6013	19.8669	20.1127	20.2552	20.2779	20.2757	20.1775	19.8750	19.5705	19.3317	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3364	19.4260	19.6013	19.8669	20.1127	20.2552	20.2779	20.2757	20.1775	19.8750	19.5705	19.3317	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9998	0.9996	0.9985	0.9907	0.9418	0.7663	0.5525	0.6363	0.9277	0.9959	0.9996	0.9999	(94)
Ext temp.	366.8312	404.2985	448.0879	503.3294	524.5484	425.9549	290.4334	302.3346	390.5100	371.5192	350.1051	349.8558	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1237.5625	1192.0745	1072.0832	885.3215	677.3950	449.9214	292.6106	307.6591	485.7712	746.8303	1009.3362	1231.3317	(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	647.8241	529.3855	464.2525	275.0343	113.7179	0.0000	0.0000	0.0000	0.0000	279.2315	474.6464	655.8180	(98)
Space heating per m2												3439.9102	(98)
												46.6808	(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	747.8600	588.7408	603.3004	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8683	0.9367	0.9007	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	649.3342	551.4527	543.3854	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	736.7452	699.6884	642.1945	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													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	62.9359	110.2874	73.5140	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			246.7373 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	15.7340	27.5718	18.3785	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												61.6843 (107)
Energy for space heating												0.8371 (108)
Energy for space cooling												46.6808 (99)
Total												0.8371 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.5179 (109)
												47.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (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) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5662		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4323 (36)
Total fabric heat loss							(33) + (36) = 42.9985 (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	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	81.5119	81.2723	81.0374	79.9342	79.7278	78.7669	78.7669	78.5890	79.1370	79.7278	80.1453	80.5819 (39)
Average = Sum(39)m / 12 =												79.9332 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1061	1.1029	1.0997	1.0847	1.0819	1.0689	1.0689	1.0665	1.0739	1.0819	1.0876	1.0935 (40)
HLP (average)												1.0847 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (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	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	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	0.0000 (57)

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Primary loss	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	31.0564	27.1622	28.0289	24.4363	23.4472	20.2331	18.7490	21.5147	21.7717	25.3728	27.6964	30.0765 (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	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (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)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	41.7425	40.4199	37.6733	33.9393	31.5150	28.1016	25.2002	28.9177	30.2385	34.1032	38.4672	40.4254 (72)
Total internal gains	324.7143	323.3759	312.0585	293.4950	273.9563	255.7290	244.2840	248.0171	257.9087	276.6030	298.0815	314.8535 (73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		W	
North					9.7300	10.6334	0.6300	0.7000	0.7700		31.6196 (74)	
West					1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)	

Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	366.8980	404.4682	448.7715	508.0605	556.9622	555.8453	525.6274	475.1170	420.9451	373.0545	350.2605	349.9005 (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	62.7805	62.9656	63.1481	64.0197	64.1854	64.9684	64.9684	65.1155	64.6646	64.1854	63.8510	63.5051
alpha	5.1854	5.1977	5.2099	5.2680	5.2790	5.3312	5.3312	5.3410	5.3110	5.2790	5.2567	5.2337
util living area	0.9992	0.9985	0.9959	0.9837	0.9341	0.7982	0.6331	0.7095	0.9287	0.9918	0.9984	0.9994 (86)
MIT	19.7221	19.8371	20.0635	20.3971	20.7146	20.9218	20.9821	20.9684	20.7995	20.4075	20.0147	19.7070 (87)
Th 2	19.9958	19.9985	20.0011	20.0133	20.0156	20.0263	20.0263	20.0283	20.0222	20.0156	20.0110	20.0061 (88)
util rest of house	0.9989	0.9979	0.9943	0.9767	0.9042	0.7149	0.5062	0.5838	0.8831	0.9873	0.9978	0.9992 (89)
MIT 2	18.8230	18.9399	19.1677	19.5076	19.8099	19.9875	20.0214	20.0183	19.8969	19.5222	19.1276	18.8162 (90)
Living area fraction									fLA = Living area / (4) =			0.2679 (91)
MIT	19.0638	19.1802	19.4077	19.7459	20.0523	20.2378	20.2788	20.2728	20.1387	19.7593	19.3652	19.0548 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0638	19.1802	19.4077	19.7459	20.0523	20.2378	20.2788	20.2728	20.1387	19.7593	19.3652	19.0548 (93)

8. Space heating requirement

Utilisation	0.9985	0.9973	0.9930	0.9743	0.9055	0.7349	0.5407	0.6179	0.8898	0.9857	0.9972	0.9989 (94)
Useful gains	366.3586	403.3668	445.6365	495.0048	504.3386	408.5062	284.2007	293.5809	374.5392	367.7118	349.2654	349.5039 (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	1203.4291	1160.5872	1046.0046	866.9572	665.9068	444.0698	289.7638	304.3582	477.8838	730.2526	982.9996	1197.0280 (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	622.7804	508.8521	446.6739	267.8058	120.2067	0.0000	0.0000	0.0000	0.0000	269.7303	456.2886	630.5579 (98)
Space heating												3322.8958 (98)
Space heating per m2										(98) / (4) =		45.0929 (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	740.4089	582.8751	597.2761	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8400	0.9080	0.8712	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	621.9115	529.2593	520.3289	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	736.7452	699.6884	642.1945	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	82.6803	126.7993	90.6680	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												300.1475 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
												fC = cooled area / (4) =

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Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	20.6701	31.6998	22.6670	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												75.0369 (107)
Energy for space heating												1.0183 (108)
Energy for space cooling												45.0929 (99)
Total												1.0183 (108)
Target Fabric Energy Efficiency (TFEE)												46.1112 (109)
												53.0 (109)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate												
	0.4342	0.4149	0.4246	0.3860	0.3860	0.3570	0.3570	0.3281	0.3570	0.3763	0.3667	0.3956 (22b)
Effective ac	0.5943	0.5861	0.5901	0.5745	0.5745	0.5637	0.5637	0.5538	0.5637	0.5708	0.5672	0.5783 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum (m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss							(33) + (36) = 43.7911 (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	38.4401	37.9101	38.1721	37.1603	37.1603	36.4648	36.4648	35.8234	36.4648	36.9225	36.6906	37.4042 (38)
Heat transfer coeff	82.2312	81.7012	81.9632	80.9515	80.9515	80.2559	80.2559	79.6145	80.2559	80.7136	80.4817	81.1954 (39)
Average = Sum(39)m / 12 =												80.8810 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1159	1.1087	1.1123	1.0985	1.0985	1.0891	1.0891	1.0804	1.0891	1.0953	1.0922	1.1019 (40)
HLP (average)												1.0976 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

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Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(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													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month													
85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	83.5268	(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	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
48.0897	42.7129	34.7364	26.2977	19.6579	16.5960	17.9326	23.3094	31.2858	39.7246	46.3644	49.4263	49.4263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
307.0921	310.2788	302.2485	285.1530	263.5730	243.2909	229.7412	226.5545	234.5848	251.6803	273.2602	293.5424	293.5424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	(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)													
-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)													
114.3281	112.2585	107.9609	102.1183	98.3251	92.9841	88.4443	94.2610	96.3276	102.3749	109.2032	112.2672	112.2672	(72)
Total internal gains													
567.4814	563.2217	542.9173	511.5405	479.5275	450.8424	434.0895	442.0963	460.1697	491.7512	526.7994	553.2074	553.2074	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W		
North					9.7300	11.9814	0.6300	0.7000	0.7700	35.6282 (74)		
West					1.7600	22.3313	0.6300	0.7000	0.7700	12.0115 (80)		

Solar gains	47.6397	82.9485	140.5634	227.1417	289.6702	328.2720	304.6180	250.4375	180.1939	105.6655	58.9355	39.1237 (83)
Total gains	615.1211	646.1702	683.4807	738.6822	769.1977	779.1144	738.7075	692.5338	640.3636	597.4167	585.7349	592.3310 (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	89.4759	90.0563	89.7684	90.8904	90.8904	91.6781	91.6781	92.4167	91.6781	91.1582	91.4208	90.6173	
alpha	6.9651	7.0038	6.9846	7.0594	7.0594	7.1119	7.1119	7.1611	7.1119	7.0772	7.0947	7.0412	
util living area													
0.9975	0.9957	0.9876	0.9482	0.8029	0.5327	0.3475	0.3906	0.7247	0.9586	0.9937	0.9980	0.9980	(86)
MIT	20.3165	20.3991	20.5737	20.7956	20.9559	20.9978	20.9999	20.9998	20.9833	20.8072	20.5340	20.3098	(87)
Th 2	19.9879	19.9937	19.9908	20.0020	20.0020	20.0097	20.0097	20.0169	20.0097	20.0047	20.0072	19.9993	(88)
util rest of house													
0.9963	0.9937	0.9811	0.9222	0.7289	0.4330	0.2401	0.2778	0.6191	0.9316	0.9900	0.9970	0.9970	(89)
MIT 2	19.1017	19.2264	19.4756	19.7887	19.9708	20.0090	20.0097	20.0169	20.0019	19.8119	19.4333	19.1011	(90)
Living area fraction													
MIT	19.4272	19.5405	19.7698	20.0585	20.2347	20.2739	20.2750	20.2802	20.2648	20.0785	19.7282	19.4249	(92)
Temperature adjustment													
adjusted MIT	19.4272	19.5405	19.7698	20.0585	20.2347	20.2739	20.2750	20.2802	20.2648	20.0785	19.7282	19.4249	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9954	0.9924	0.9792	0.9240	0.7475	0.4598	0.2689	0.3081	0.6478	0.9341	0.9886	0.9962	0.9962	(94)
Useful gains	612.2929	641.2581	669.2840	682.5307	574.9590	358.2724	198.6193	213.3480	414.7966	558.0248	579.0716	590.1060	(95)
Ext temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	(96)
Heat loss rate W													
1202.8091	1155.3003	1022.0636	838.5336	601.8506	359.0576	198.6320	213.3802	422.5332	700.4733	968.0479	1187.4708	1187.4708	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
439.3441	345.4364	262.4680	112.3221	20.0074	0.0000	0.0000	0.0000	0.0000	105.9817	280.0630	444.4394	444.4394	(98)
Space heating													
RHI space heating demand													
2010.0621													(98)
2010													(98)

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Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3860 (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	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss						(33) + (36) =	43.7911 (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	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	83.9656	83.6615	83.3634	81.9632	81.7012	80.4817	80.4817	80.2559	80.9515	81.7012	82.2312	82.7852 (39)
Average = Sum(39)m / 12 =												81.9620 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1394	1.1353	1.1313	1.1123	1.1087	1.0922	1.0922	1.0891	1.0985	1.1087	1.1159	1.1234 (40)
HLP (average)												1.1123 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

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												180.0000	(47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2000	(48)	
Temperature factor from Table 2b												0.6000	(49)	
Enter (49) or (54) in (55)												0.7200	(55)	
Total storage loss	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum(63)m =					0.0000	(63)
Output from w/h	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(64)	
								Total per year (kWh/year) = Sum(64)m =					1946.3205	(64)
Heat gains from water heating, kWh/month	85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	(65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2366.1112 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2484.4168 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1946.3205 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365 (310a)
Electricity used for heat distribution	45.2805 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	339.7119 (332)
Total delivered energy for all uses	4867.7652 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2484.4168	4.2400	105.3393 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2043.6365	4.2400	86.6502 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	339.7119	13.1900	44.8080 (350)
Additional standing charges			120.0000 (351)
Total energy cost			356.7975 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200 (356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.2626 (357)
SAP value	82.3871
SAP rating (Section 12)	82 (358)
SAP band	B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1509.3511	0.5190	783.3532 (367)
Electrical energy for heat distribution	45.2805	0.5190	23.5006 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			806.8538 (373)
Space and water heating			806.8538 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total kg/year			983.1643 (383)
CO2 emissions per m2			13.3400 (384)
EI value			88.9002 (384a)
EI rating			89 (385)
EI band			B

Calculation of stars for heating and DHW

Space heating energy efficiency	1.00 x 4.240 x 1.05
= 4.452, stars = 4	
Space heating environmental impact	1.00 x 0.519 x 1.05 / 3.0000
= 0.1817, stars = 5	
Water heating energy efficiency	4.452, stars = 4
Water heating environmental impact	0.1817, 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	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate												
	0.4342	0.4149	0.4246	0.3860	0.3860	0.3570	0.3570	0.3281	0.3570	0.3763	0.3667	0.3956 (22b)
Effective ac	0.5943	0.5861	0.5901	0.5745	0.5745	0.5637	0.5637	0.5538	0.5637	0.5708	0.5672	0.5783 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	33.8851			(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss						(33) + (36) =	43.7911 (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	38.4401	37.9101	38.1721	37.1603	37.1603	36.4648	36.4648	35.8234	36.4648	36.9225	36.6906	37.4042 (38)
Heat transfer coeff	82.2312	81.7012	81.9632	80.9515	80.9515	80.2559	80.2559	79.6145	80.2559	80.7136	80.4817	81.1954 (39)
Average = Sum(39)m / 12 =												80.8810 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1159	1.1087	1.1123	1.0985	1.0985	1.0891	1.0891	1.0804	1.0891	1.0953	1.0922	1.1019 (40)
HLP (average)												1.0976 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

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Store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.7200	(55)
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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														
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum(63)m =					0.0000	(63)
Output from w/h														
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(64)	
								Total per year (kWh/year) = Sum(64)m =					1946.3205	(64)
Heat gains from water heating, kWh/month														
	85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	(65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2010.0621 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2110.5652 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1946.3205 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365 (310a)
Electricity used for heat distribution	41.5420 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	339.7119 (332)
Total delivered energy for all uses	4493.9136 (338)

10b. Fuel costs - using BEDF prices (482)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2110.5652	4.5600	96.2418 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2043.6365	4.5600	93.1898 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	339.7119	19.1200	64.9529 (350)
Additional standing charges			94.0000 (351)
Total energy cost			348.3845 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1384.7339	0.5190	718.6769 (367)
Electrical energy for heat distribution	41.5420	0.5190	21.5603 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			740.2372 (373)
Space and water heating			740.2372 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total kg/year			916.5477 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1384.7339	3.0700	4251.1331 (367)
Electrical energy for heat distribution	41.5420	3.0700	127.5340 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			4378.6671 (373)
Space and water heating			4378.6671 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	3.0700	1042.9155 (379)
Primary energy kWh/year			5421.5825 (383)
Primary energy kWh/m2/year			73.5728 (384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 82
Current environmental impact rating: B 89

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures: SAP change Cost change CO2 change
 (none)

Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 82
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 482 TEST (31 Aug 2021)
 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	£65	£65	£0
Community scheme	£283	£283	£0
Space heating	£190	£190	£0
Water heating	£93	£93	£0
Lighting	£65	£65	£0
Total cost of fuels	£348	£348	£0
Total cost of uses	£348	£348	£0
Delivered energy	61 kWh/m²	61 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	74 kWh/m²	74 kWh/m²	0 kWh/m²

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	359.4 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	258.74 (P1)
Transmission heat loss coefficient	43.79 (37)
Summer heat loss coefficient	302.53 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	9.7300	81.1852	0.6300	0.7000	0.9000	282.1715
West	1.7600	117.5071	0.6300	0.7000	0.9000	73.8755
total:						356.0470

Solar gains	Jun	Jul	Aug	
	384	356	294	(P3)
Internal gains	451	434	442	
Total summer gains	835	790	737	(P5)
Summer gain/loss ratio	2.76	2.61	2.43	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 359.4)	0.00	0.00	0.00	
Threshold temperature	18.76	20.51	20.23	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	
Assessment of likelihood of high internal temperature:	Slight			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-03			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 3, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	82 B	DER	15.65	TER	28.39
Environmental	90 B	% DER<TER	44.87		
CO ₂ Emissions (t/year)	0.76	DFEE	45.70	TFEE	50.08
General Requirements Compliance	Pass	% DFEE<TFEE	8.75		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 59 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 (c)
 Fuel factor: 1.55 (electricity)
 Target Carbon Dioxide Emission Rate (TER) 28.39 kgCO₂/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 15.65 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.1 kWh/m²/yr
 Dwelling Fabric Energy Efficiency (DFEE) 45.7 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.36 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.078

3 Air permeability

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

4 Heating efficiency

Main heating system: Community heating scheme -
 Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day
 Permitted by DBSCG 2.10 OK
 Primary pipework insulated: Yes (assumed) OK

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room stats OK
 Hot water controls: Cylinderstat OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
 Based on:
 Overshading: Average
 Windows facing North: 8.46 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 0.12 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1918 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4418 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3755 (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												
	0.4788	0.4694	0.4600	0.4131	0.4037	0.3568	0.3568	0.3474	0.3755	0.4037	0.4225	0.4413 (22b)
Effective ac	0.6146	0.6102	0.6058	0.5853	0.5815	0.5636	0.5636	0.5603	0.5705	0.5815	0.5892	0.5974 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1200	7.0560	75.0000	4410.0000 (28a)
Main Type 3	19.0300	8.4600	10.5700	0.1700	1.7969	110.0000	1162.7000 (29a)
Corridor	19.0300	1.9500	17.0800	0.2257	3.8555	110.0000	1878.8000 (29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	26.2643			(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			58.8000			30.0000	1764.0000 (32b)
Internal Wall 1			114.2100			75.0000	8565.7500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18673.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5689 (35)
Thermal bridges (User defined value 0.078 * total exposed area)							7.5551 (36)
Total fabric heat loss							(33) + (36) = 33.8194 (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	31.7238	31.4941	31.2689	30.2111	30.0132	29.0920	29.0920	28.9214	29.4468	30.0132	30.4136	30.8321 (38)
Heat transfer coeff	65.5432	65.3135	65.0883	64.0306	63.8327	62.9114	62.9114	62.7408	63.2663	63.8327	64.2330	64.6516 (39)
Average = Sum(39)m / 12 =												64.0296 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1147	1.1108	1.1069	1.0890	1.0856	1.0699	1.0699	1.0670	1.0760	1.0856	1.0924	1.0995 (40)
HLP (average)												1.0889 (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	1.9475 (42)
Average daily hot water use (litres/day)	80.4534 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												

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Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.7200	(55)
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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														
	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum(63)m =					0.0000	(63)
Output from w/h														
	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	(64)	
								Total per year (kWh/year) = Sum(64)m =					1802.5405	(64)
Heat gains from water heating, kWh/month														
	80.1036	71.1027	75.8496	69.6252	69.4118	63.7194	62.8103	66.6964	65.8812	72.1174	74.2060	78.7266	(65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2325.0716	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2441.3252	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1802.5405	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	1892.6676	(310a)
Electricity used for heat distribution	43.3399	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	285.3006	(332)
Total delivered energy for all uses	4619.2933	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1444.6643	0.5190	749.7807 (367)
Electrical energy for heat distribution	43.3399	0.5190	22.4934 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			772.2742 (373)
Space and water heating			772.2742 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	285.3006	0.5190	148.0710 (379)
Total CO2, kg/year			920.3452 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			15.6500 (384)

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

DER		15.6500	ZC1
Total Floor Area	TFA	58.8000	
Assumed number of occupants	N	1.9475	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1234	ZC2
CO2 emissions from cooking, equation (L16)		2.8187	ZC3
Total CO2 emissions		35.5921	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		35.5921	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1279 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3779 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3212 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4095	0.4015	0.3935	0.3533	0.3453	0.3051	0.3051	0.2971	0.3212	0.3453	0.3613	0.3774 (22b)
	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1300	7.6440		(28a)
Main Type 3	19.0300	8.4600	10.5700	0.1800	1.9026		(29a)
Corridor	19.0300	1.9500	17.0800	0.1800	3.0744		(29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.7869		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3601 (36)
Total fabric heat loss						(33) + (36) =	32.1470 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.1353	29.9673	29.8025	29.0288	28.8840	28.2101	28.2101	28.0853	28.4697	28.8840	29.1769	29.4830 (38)
Heat transfer coeff	62.2823	62.1143	61.9495	61.1758	61.0310	60.3571	60.3571	60.2323	60.6167	61.0310	61.3239	61.6301 (39)
Average = Sum(39)m / 12 =												61.1751 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0592	1.0564	1.0536	1.0404	1.0379	1.0265	1.0265	1.0244	1.0309	1.0379	1.0429	1.0481 (40)
HLP (average)												1.0404 (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												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	180.4837	159.2615	167.6897	150.9192	148.3279	133.1572	128.4738	140.1615	139.6589	156.4653	164.6961	176.3426 (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	180.4837	159.2615	167.6897	150.9192	148.3279	133.1572	128.4738	140.1615	139.6589	156.4653	164.6961	176.3426 (64)
Heat gains from water heating, kWh/month	83.0318	73.7476	78.7778	72.4590	72.3400	66.5531	65.7385	69.6247	68.7149	75.0457	77.0398	81.6549 (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	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375 (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)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004 (71)
Water heating gains (Table 5)	111.6018	109.7434	105.8841	100.6375	97.2311	92.4349	88.3582	93.5815	95.4374	100.8678	106.9997	109.7511 (72)
Total internal gains	352.8800	350.9785	339.9966	322.4564	304.8795	287.8328	276.7082	281.9747	290.9531	308.6771	328.9795	343.9814 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W

North				8.4600	10.6334	0.6300	0.7000			0.7700			27.4925 (74)

Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191	(83)
Total gains	380.3725	403.5180	429.2741	465.8590	498.0560	494.6339	469.7834	435.1552	398.2937	371.2186	362.8950	366.9005	(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	65.5617	65.7391	65.9139	66.7475	66.9059	67.6529	67.6529	67.7931	67.3632	66.9059	66.5863	66.2556
alpha	5.3708	5.3826	5.3943	5.4498	5.4604	5.5102	5.5102	5.5195	5.4909	5.4604	5.4391	5.4170
util living area	0.9971	0.9955	0.9902	0.9687	0.8947	0.7262	0.5544	0.6165	0.8658	0.9771	0.9945	0.9977 (86)
MIT	19.9268	20.0277	20.2307	20.5291	20.8011	20.9557	20.9917	20.9856	20.8802	20.5565	20.1993	19.9107 (87)
Th 2	20.0343	20.0366	20.0389	20.0498	20.0518	20.0613	20.0613	20.0631	20.0577	20.0518	20.0477	20.0434 (88)
util rest of house	0.9962	0.9940	0.9866	0.9566	0.8548	0.6408	0.4419	0.5011	0.8017	0.9659	0.9923	0.9969 (89)
MIT 2	18.6046	18.7536	19.0503	19.4854	19.8513	20.0310	20.0581	20.0569	19.9576	19.5305	19.0125	18.5878 (90)
Living area fraction	19.0329	19.1664	19.4327	19.8235	20.1590	20.3306	20.3606	20.3578	20.2565	19.8629	19.3970	19.0164 (92)
Temperature adjustment	19.0329	19.1664	19.4327	19.8235	20.1590	20.3306	20.3606	20.3578	20.2565	19.8629	19.3970	19.0164 (93)
adjusted MIT	19.0329	19.1664	19.4327	19.8235	20.1590	20.3306	20.3606	20.3578	20.2565	19.8629	19.3970	19.0164 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9948	0.9921	0.9837	0.9530	0.8600	0.6668	0.4786	0.5387	0.8171	0.9630	0.9902	0.9957 (94)
Ext temp.	378.3988	400.3123	422.2638	443.9720	428.3136	329.8302	224.8268	234.4170	325.4522	357.4907	359.3389	365.3245 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	917.6023	886.1447	801.1759	668.2551	516.2635	345.8844	226.9767	238.3858	373.1882	565.3257	754.0982	913.1365 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	401.1674	326.4793	281.9106	161.4838	65.4347	0.0000	0.0000	0.0000	0.0000	154.6293	284.2267	407.5721 (98)
												2082.9039 (98)
												35.4235 (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													2227.7047 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	401.1674	326.4793	281.9106	161.4838	65.4347	0.0000	0.0000	0.0000	0.0000	154.6293	284.2267	407.5721	(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)	429.0560	349.1758	301.5087	172.7100	69.9837	0.0000	0.0000	0.0000	0.0000	165.3789	303.9857	435.9060	(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	180.4837	159.2615	167.6897	150.9192	148.3279	133.1572	128.4738	140.1615	139.6589	156.4653	164.6961	176.3426	(64)
Efficiency of water heater (217)m	86.8851	86.6889	86.1896	84.9944	82.7966	79.8000	79.8000	79.8000	79.8000	84.7824	86.2569	86.9779	(216)
Fuel for water heating, kWh/month	207.7269	183.7161	194.5590	177.5636	179.1474	166.8637	160.9947	175.6410	175.0112	184.5492	190.9368	202.7440	(219)
Water heating fuel used												2199.4536	(219)
Annual totals kWh/year													
Space heating fuel - main system													2227.7047 (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)													285.3006 (232)
Total delivered energy for all uses													4787.4589 (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	2227.7047	0.2160	481.1842 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2199.4536	0.2160	475.0820 (264)
Space and water heating			956.2662 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	285.3006	0.5190	148.0710 (268)
Total CO2, kg/m2/year			1143.2622 (272)
Emissions per m2 for space and water heating			16.2630 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.5182 (272b)
Emissions per m2 for pumps and fans			0.6620 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2630 * 1.55) + 2.5182 + 0.6620, rounded to 2 d.p.			28.3900 (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	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1279 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3779 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3212 (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												
	0.4095	0.4015	0.3935	0.3533	0.3453	0.3051	0.3051	0.2971	0.3212	0.3453	0.3613	0.3774 (22b)
Effective ac	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1200	7.0560	75.0000	4410.0000 (28a)
Main Type 3	19.0300	8.4600	10.5700	0.1700	1.7969	110.0000	1162.7000 (29a)
Corridor	19.0300	1.9500	17.0800	0.2257	3.8555	110.0000	1878.8000 (29a)
Total net area of external elements Aum (m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.2643		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			58.8000			20.0000	1176.0000 (32b)
Internal Wall 1			114.2100			75.0000	8565.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18085.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							307.5689 (35)
Thermal bridges (User defined value 0.078 * total exposed area)							7.5551 (36)
Total fabric heat loss						(33) + (36) =	33.8194 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.1353	29.9673	29.8025	29.0288	28.8840	28.2101	28.2101	28.0853	28.4697	28.8840	29.1769	29.4830 (38)
Heat transfer coeff	63.9547	63.7867	63.6219	62.8482	62.7034	62.0295	62.0295	61.9047	62.2891	62.7034	62.9963	63.3025 (39)
Average = Sum(39)m / 12 =												62.8475 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0877	1.0848	1.0820	1.0688	1.0664	1.0549	1.0549	1.0528	1.0593	1.0664	1.0714	1.0766 (40)
HLP (average)												1.0688 (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												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (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:												

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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	27.8887	24.3916	25.1700	21.9438	21.0556	18.1694	16.8366	19.3203	19.5510	22.7848	24.8714	27.0087 (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	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	(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)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	(71)
Water heating gains (Table 5)	37.4848	36.2971	33.8306	30.4775	28.3005	25.2353	22.6299	25.9681	27.1542	30.6247	34.5436	36.3021	(72)
Total internal gains	275.7630	274.5322	264.9431	249.2964	232.9489	217.6332	207.9799	211.3612	219.6699	235.4341	253.5234	267.5323	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				8.4600	10.6334	0.6300	0.7000	0.7700	27.4925 (74)			
Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191 (83)
Total gains	303.2555	327.0717	354.2207	392.6990	426.1254	424.4343	401.0551	364.5418	327.0104	297.9755	287.4390	290.4514 (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	78.5497	78.7566	78.9606	79.9327	80.1172	80.9876	80.9876	81.1509	80.6501	80.1172	79.7448	79.3591	
alpha	6.2366	6.2504	6.2640	6.3288	6.3411	6.3992	6.3992	6.4101	6.3767	6.3411	6.3163	6.2906	
util living area	0.9997	0.9995	0.9985	0.9926	0.9591	0.8343	0.6609	0.7393	0.9517	0.9962	0.9994	0.9998	(86)
MIT	19.9565	20.0444	20.2232	20.4928	20.7612	20.9412	20.9892	20.9791	20.8375	20.5137	20.1952	19.9434	(87)
Th 2	20.0109	20.0133	20.0156	20.0264	20.0284	20.0378	20.0378	20.0396	20.0342	20.0284	20.0243	20.0200	(88)
util rest of house	0.9996	0.9992	0.9977	0.9885	0.9346	0.7488	0.5273	0.6069	0.9113	0.9935	0.9991	0.9997	(89)
MIT 2	19.0536	19.1435	19.3239	19.6007	19.8587	20.0111	20.0354	20.0340	19.9360	19.6244	19.3035	19.0482	(90)
Living area fraction													(91)
MIT	19.3461	19.4354	19.6153	19.8897	20.1511	20.3124	20.3444	20.3402	20.2281	19.9125	19.5924	19.3382	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3461	19.4354	19.6153	19.8897	20.1511	20.3124	20.3444	20.3402	20.2281	19.9125	19.5924	19.3382	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	303.1007	326.7573	353.2673	387.8683	399.8773	329.3249	229.2448	237.4447	301.3271	295.9125	287.1238	290.3405	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	962.2712	927.1647	834.4207	690.6819	529.9128	354.3397	232.2633	243.9167	381.7122	583.9247	786.9726	958.2868	(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	490.4229	403.4738	357.9781	218.0258	96.7464	0.0000	0.0000	0.0000	0.0000	214.2811	359.8911	496.9520	(98)
Space heating												2637.7711	(98)
Space heating per m2												44.8601	(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	583.0775	459.0185	470.4759	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8544	0.9246	0.8893	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	498.1553	424.3920	418.4009	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	569.3821	540.6666	499.2588	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	51.2833	86.5083	60.1582	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												197.9498 (104)
Cooled Fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	12.8208	21.6271	15.0396	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												49.4875 (107)
Space cooling per m2												0.8416 (108)
Energy for space heating												44.8601 (99)
Energy for space cooling												0.8416 (108)
Total												45.7017 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.7 (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	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1279 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3779 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3212 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4095	0.4015	0.3935	0.3533	0.3453	0.3051	0.3051	0.2971	0.3212	0.3453	0.3613	0.3774 (22b)
	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1300	7.6440		(28a)
Main Type 3	19.0300	8.4600	10.5700	0.1800	1.9026		(29a)
Corridor	19.0300	1.9500	17.0800	0.1800	3.0744		(29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.7869		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3601 (36)
Total fabric heat loss						(33) + (36) =	32.1470 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.1353	29.9673	29.8025	29.0288	28.8840	28.2101	28.2101	28.0853	28.4697	28.8840	29.1769	29.4830 (38)
Heat transfer coeff	62.2823	62.1143	61.9495	61.1758	61.0310	60.3571	60.3571	60.2323	60.6167	61.0310	61.3239	61.6301 (39)
Average = Sum(39)m / 12 =												61.1751 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0592	1.0564	1.0536	1.0404	1.0379	1.0265	1.0265	1.0244	1.0309	1.0379	1.0429	1.0481 (40)
HLP (average)												1.0404 (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												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (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)

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 (59)
Heat gains from water heating, kWh/month	27.8887	24.3916	25.1700	21.9438	21.0556	18.1694	16.8366	19.3203	19.5510	22.7848	24.8714	27.0087 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375 (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)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004 (71)
Water heating gains (Table 5)	37.4848	36.2971	33.8306	30.4775	28.3005	25.2353	22.6299	25.9681	27.1542	30.6247	34.5436	36.3021 (72)
Total internal gains	275.7630	274.5322	264.9431	249.2964	232.9489	217.6332	207.9799	211.3612	219.6699	235.4341	253.5234	267.5323 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
North	8.4600	10.6334	0.6300	0.7000	0.7700	27.4925 (74)						
Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191 (83)
Total gains	303.2555	327.0717	354.2207	392.6990	426.1254	424.4343	401.0551	364.5418	327.0104	297.9755	287.4390	290.4514 (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	65.5617	65.7391	65.9139	66.7475	66.9059	67.6529	67.7931	67.7931	66.9059	66.5863	66.2556	
alpha	5.3708	5.3826	5.3943	5.4498	5.4604	5.5102	5.5195	5.4909	5.4604	5.4391	5.4170	
util living area	0.9991	0.9984	0.9960	0.9849	0.9382	0.8039	0.6374	0.7119	0.9292	0.9914	0.9982	0.9993 (86)
MIT	19.8028	19.9056	20.1132	20.4240	20.7264	20.9263	20.9838	20.9713	20.8132	20.4468	20.0788	19.7873 (87)
Th 2	20.0343	20.0366	20.0389	20.0498	20.0518	20.0613	20.0613	20.0631	20.0577	20.0518	20.0477	20.0434 (88)
util rest of house	0.9987	0.9978	0.9945	0.9785	0.9101	0.7233	0.5140	0.5897	0.8846	0.9867	0.9975	0.9990 (89)
MIT 2	18.9346	19.0392	19.2480	19.5644	19.8530	20.0243	20.0568	20.0538	19.9404	19.5907	19.2213	18.9266 (90)
Living area fraction									fLA = Living area / (4) =			0.3240 (91)
MIT	19.2159	19.3199	19.5283	19.8429	20.1360	20.3165	20.3571	20.3511	20.2232	19.8680	19.4992	19.2055 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2159	19.3199	19.5283	19.8429	20.1360	20.3165	20.3571	20.3511	20.2232	19.8680	19.4992	19.2055 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9984	0.9972	0.9934	0.9767	0.9130	0.7473	0.5545	0.6299	0.8941	0.9855	0.9969	0.9987 (94)
Useful gains	302.7552	326.1533	351.8694	383.5345	389.0618	317.1849	222.4028	229.6132	292.3869	293.6478	286.5369	290.0756 (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	928.9973	895.6797	807.0992	669.4379	514.8575	345.0342	226.7672	237.9820	371.1654	565.6366	760.3643	924.7868 (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	465.9241	382.7218	338.6910	205.8504	93.5919	0.0000	0.0000	0.0000	0.0000	202.3597	341.1558	472.2251 (98)
Space heating												2502.5199 (98)
Space heating per m2												(98) / (4) = 42.5599 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8479	0.8808	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	481.0611	408.5537	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	569.3821	540.6666	0.0000	0.0000	0.0000	0.0000 (102)
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 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	63.5911	98.2920	71.4559	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												233.3390 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	15.8978	24.5730	17.8640	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													58.3347 (107)
Space cooling per m2													0.9921 (108)
Energy for space heating													42.5599 (99)
Energy for space cooling													0.9921 (108)
Total													43.5519 (109)
Target Fabric Energy Efficiency (TFEE)													50.1 (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	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) =	0.1918 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4418 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.4225	0.4037	0.4131	0.3755	0.3755	0.3474	0.3474	0.3192	0.3474	0.3661	0.3568	0.3849 (22b)
Effective ac	0.5892	0.5815	0.5853	0.5705	0.5705	0.5603	0.5603	0.5509	0.5603	0.5670	0.5636	0.5741 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1200	7.0560	75.0000	4410.0000 (28a)
Main Type 3	19.0300	8.4600	10.5700	0.1700	1.7969	110.0000	1162.7000 (29a)
Corridor	19.0300	1.9500	17.0800	0.2257	3.8555	110.0000	1878.8000 (29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	26.2643			(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			58.8000			30.0000	1764.0000 (32b)
Internal Wall 1			114.2100			75.0000	8565.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18673.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5689 (35)
Thermal bridges (User defined value 0.078 * total exposed area)							7.5551 (36)
Total fabric heat loss						(33) + (36) =	33.8194 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.4136	30.0132	30.2111	29.4468	29.4468	28.9214	28.9214	28.4369	28.9214	29.2671	29.0920	29.6311 (38)
Heat transfer coeff	64.2330	63.8327	64.0306	63.2663	63.2663	62.7408	62.7408	62.2563	62.7408	63.0866	62.9114	63.4505 (39)
Average = Sum(39)m / 12 =												63.2130 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0924	1.0856	1.0890	1.0760	1.0760	1.0670	1.0670	1.0588	1.0670	1.0729	1.0699	1.0791 (40)
HLP (average)												1.0751 (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	1.9475 (42)
Average daily hot water use (litres/day)	80.4534 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200 (56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200 (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	23.2624 (59)
Total heat required for water heating calculated for each month													
176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	172.6823 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)	
Output from w/h													
176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	172.6823 (64)	
								Total per year (kWh/year) = Sum(64)m =				1802.5405 (64)	
RHI water heating demand												1803 (64)	
Heat gains from water heating, kWh/month													
80.1036	71.1027	75.8496	69.6252	69.4118	63.7194	62.8103	66.6964	65.8812	72.1174	74.2060	78.7266	78.7266 (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	116.8506	116.8506	116.8506	116.8506	116.8506	116.8506	116.8506	116.8506	116.8506	116.8506	116.8506	116.8506 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	40.3872	35.8716	29.1727	22.0856	16.5093	13.9378	15.0603	19.5760	26.2748	33.3619	38.9383	41.5097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	253.5980	256.2296	249.5981	235.4806	217.6598	200.9107	189.7213	187.0897	193.7211	207.8387	225.6595	242.4086 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	48.6326	48.6326	48.6326	48.6326	48.6326	48.6326	48.6326	48.6326	48.6326	48.6326	48.6326	48.6326 (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)												
	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004 (71)
Water heating gains (Table 5)												
	107.6661	105.8076	101.9483	96.7017	93.2954	88.4991	84.4224	89.6458	91.5016	96.9320	103.0639	105.8154 (72)
Total internal gains												
	489.2341	485.4915	468.3020	441.8507	415.0472	390.9304	376.7867	383.8942	399.0803	425.7154	455.2445	477.3165 (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	
North				8.4600	11.9814	0.6300		0.7000		0.7700		30.9778 (74)	
Solar gains		30.9778	53.7445	92.0705	152.4856	198.5709	227.0886	209.9031	169.6816	119.0957	68.6031	38.2445	25.5120 (83)
Total gains		520.2119	539.2360	560.3725	594.3362	613.6181	618.0190	586.6899	553.5757	518.1761	494.3185	493.4890	502.8285 (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	80.7522	81.2587	81.0075	81.9862	81.9862	82.6728	82.6728	83.3162	82.6728	82.2197	82.4486	81.7481
alpha	6.3835	6.4172	6.4005	6.4657	6.4657	6.5115	6.5115	6.5544	6.5115	6.4813	6.4966	6.4499
util living area												
	0.9940	0.9910	0.9787	0.9317	0.7837	0.5240	0.3420	0.3819	0.6992	0.9369	0.9865	0.9949 (86)
MIT	20.3051	20.3868	20.5633	20.7855	20.9496	20.9968	20.9998	20.9997	20.9812	20.8103	20.5339	20.2982 (87)
Th 2	20.0070	20.0126	20.0099	20.0205	20.0205	20.0279	20.0279	20.0346	20.0279	20.0230	20.0255	20.0179 (88)
util rest of house												
	0.9915	0.9873	0.9695	0.9031	0.7127	0.4282	0.2382	0.2738	0.5991	0.9040	0.9800	0.9928 (89)
MIT 2	19.1108	19.2333	19.4836	19.7941	19.9826	20.0267	20.0278	20.0346	20.0181	19.8336	19.4562	19.1093 (90)
Living area fraction												
MIT	19.4977	19.6070	19.8334	20.1153	20.2959	20.3410	20.3427	20.3473	20.3301	20.1500	19.8054	19.4945 (91)
Temperature adjustment												0.3240 (92)
adjusted MIT	19.4977	19.6070	19.8334	20.1153	20.2959	20.3410	20.3427	20.3473	20.3301	20.1500	19.8054	19.4945 (93)
												0.0000

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9899	0.9853	0.9674	0.9063	0.7340	0.4594	0.2719	0.3089	0.6316	0.9091	0.9781	0.9913	(94)
Useful gains	514.9451	531.2903	542.1201	538.6692	450.3930	283.9083	159.5098	170.9807	327.3017	449.3799	482.7042	498.4677	(95)
Ext temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	(96)
Heat loss rate W													
	944.0764	906.8720	802.5195	658.9361	474.2345	284.9031	159.5340	171.0343	334.4160	552.0102	761.5655	932.3732	(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													
	319.2736	252.3909	193.7371	86.5921	17.7380	0.0000	0.0000	0.0000	0.0000	76.3570	200.7801	322.8257	(98)
Space heating													
RHI space heating demand													1469.6946 (98)
													1470 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1918 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4418 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4788	0.4694	0.4600	0.4131	0.4037	0.3568	0.3568	0.3474	0.3755	0.4037	0.4225	0.4413 (22b)
Effective ac	0.6146	0.6102	0.6058	0.5853	0.5815	0.5636	0.5636	0.5603	0.5705	0.5815	0.5892	0.5974 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1200	7.0560	75.0000	4410.0000 (28a)
Main Type 3	19.0300	8.4600	10.5700	0.1700	1.7969	110.0000	1162.7000 (29a)
Corridor	19.0300	1.9500	17.0800	0.2257	3.8555	110.0000	1878.8000 (29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.2643		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			58.8000			30.0000	1764.0000 (32b)
Internal Wall 1			114.2100			75.0000	8565.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18673.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5689 (35)
Thermal bridges (User defined value 0.078 * total exposed area)							7.5551 (36)
Total fabric heat loss						(33) + (36) =	33.8194 (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	31.7238	31.4941	31.2689	30.2111	30.0132	29.0920	29.0920	28.9214	29.4468	30.0132	30.4136	30.8321 (38)
Heat transfer coeff	65.5432	65.3135	65.0883	64.0306	63.8327	62.9114	62.9114	62.7408	63.2663	63.8327	64.2330	64.6516 (39)
Average = Sum(39)m / 12 =												64.0296 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1147	1.1108	1.1069	1.0890	1.0856	1.0699	1.0699	1.0670	1.0760	1.0856	1.0924	1.0995 (40)
HLP (average)												1.0889 (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												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												

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											180.0000	(47)		
a) If manufacturer declared loss factor is known (kWh/day):									1.2000	(48)				
Temperature factor from Table 2b									0.6000	(49)				
Enter (49) or (54) in (55)									0.7200	(55)				
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	(56)		
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	(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														
Solar input	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	(62)	
	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														
	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	(64)	
									Total per year (kWh/year) = Sum(64)m =				1802.5405	(64)
Heat gains from water heating, kWh/month														
	80.1036	71.1027	75.8496	69.6252	69.4118	63.7194	62.8103	66.6964	65.8812	72.1174	74.2060	78.7266	(65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	1735.4110 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	1822.1816 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1802.5405 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	1892.6676 (310a)
Electricity used for heat distribution	37.1485 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	285.3006 (332)
Total delivered energy for all uses	4000.1497 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	1822.1816	4.2400	77.2605 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	1892.6676	4.2400	80.2491 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	285.3006	13.1900	37.6311 (350)
Additional standing charges			120.0000 (351)
Total energy cost			315.1407 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200 (356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.2751 (357)
SAP value	82.2119
SAP rating (Section 12)	82 (358)
SAP band	B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1238.2830	0.5190	642.6689 (367)
Electrical energy for heat distribution	37.1485	0.5190	19.2801 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			661.9490 (373)
Space and water heating			661.9490 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	285.3006	0.5190	148.0710 (379)
Total kg/year			810.0200 (383)
CO2 emissions per m2			13.7800 (384)
EI value			89.5431 (384a)
EI rating			90 (385)
EI band			B

Calculation of stars for heating and DHW

Space heating energy efficiency	1.00 x 4.240 x 1.05
= 4.452, stars = 4	
Space heating environmental impact	1.00 x 0.519 x 1.05 / 3.0000
= 0.1817, stars = 5	
Water heating energy efficiency	4.452, stars = 4
Water heating environmental impact	0.1817, 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	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1918 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4418 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.4225	0.4037	0.4131	0.3755	0.3755	0.3474	0.3474	0.3192	0.3474	0.3661	0.3568	0.3849 (22b)
Effective ac	0.5892	0.5815	0.5853	0.5705	0.5705	0.5603	0.5603	0.5509	0.5603	0.5670	0.5636	0.5741 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1200	7.0560	75.0000	4410.0000 (28a)
Main Type 3	19.0300	8.4600	10.5700	0.1700	1.7969	110.0000	1162.7000 (29a)
Corridor	19.0300	1.9500	17.0800	0.2257	3.8555	110.0000	1878.8000 (29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	26.2643			(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			58.8000			30.0000	1764.0000 (32b)
Internal Wall 1			114.2100			75.0000	8565.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18673.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5689 (35)
Thermal bridges (User defined value 0.078 * total exposed area)							7.5551 (36)
Total fabric heat loss						(33) + (36) =	33.8194 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.4136	30.0132	30.2111	29.4468	29.4468	28.9214	28.9214	28.4369	28.9214	29.2671	29.0920	29.6311 (38)
Heat transfer coeff	64.2330	63.8327	64.0306	63.2663	63.2663	62.7408	62.7408	62.2563	62.7408	63.0866	62.9114	63.4505 (39)
Average = Sum(39)m / 12 =												63.2130 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0924	1.0856	1.0890	1.0760	1.0760	1.0670	1.0670	1.0588	1.0670	1.0729	1.0699	1.0791 (40)
HLP (average)												1.0751 (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												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												

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store volume																		180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):																		1.2000	(48)
Temperature factor from Table 2b																		0.6000	(49)
Enter (49) or (54) in (55)																		0.7200	(55)
Total storage loss																			
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200			(56)
If cylinder contains dedicated solar storage																			
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200			(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	22.5120	23.2624	22.5120	23.2624			(59)
Total heat required for water heating calculated for each month																			
	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	161.1539	172.6823	161.1539	172.6823			(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	0.0000	0.0000	0.0000	0.0000			(63)
Solar input (sum of months) = Sum(63)m =																		0.0000	(63)
Output from w/h																			
	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	161.1539	172.6823	161.1539	172.6823			(64)
Total per year (kWh/year) = Sum(64)m =																		1802.5405	(64)
Heat gains from water heating, kWh/month																			
	80.1036	71.1027	75.8496	69.6252	69.4118	63.7194	62.8103	66.6964	65.8812	72.1174	74.2060	78.7266	74.2060	78.7266	74.2060	78.7266			(65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	1469.6946 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	1543.1793 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1802.5405 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	1892.6676 (310a)
Electricity used for heat distribution	34.3585 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	285.3006 (332)
Total delivered energy for all uses	3721.1475 (338)

10b. Fuel costs - using BEDF prices (482)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	1543.1793	4.5600	70.3690 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	1892.6676	4.5600	86.3056 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	285.3006	19.1200	54.5495 (350)
Additional standing charges			94.0000 (351)
Total energy cost			305.2241 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1145.2823	0.5190	594.4015 (367)
Electrical energy for heat distribution	34.3585	0.5190	17.8320 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			612.2336 (373)
Space and water heating			612.2336 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	285.3006	0.5190	148.0710 (379)
Total kg/year			760.3046 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1145.2823	3.0700	3516.0167 (367)
Electrical energy for heat distribution	34.3585	3.0700	105.4805 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			3621.4972 (373)
Space and water heating			3621.4972 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	285.3006	3.0700	875.8727 (379)
Primary energy kWh/year			4497.3699 (383)
Primary energy kWh/m2/year			76.4859 (384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 82
Current environmental impact rating: B 90

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures: (none)	SAP change	Cost change	CO2 change
---------------------------------	------------	-------------	------------

Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings £0	0.00 kg/m²	

Potential energy efficiency rating: B 82
 Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 482 TEST (31 Aug 2021)
 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	£55	£55	£0
Community scheme	£251	£251	£0
Space heating	£164	£164	£0
Water heating	£86	£86	£0
Lighting	£55	£55	£0
Total cost of fuels	£306	£306	£0
Total cost of uses	£305	£305	£0
Delivered energy	63 kWh/m²	63 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	76 kWh/m²	76 kWh/m²	0 kWh/m²

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	317.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	206.46 (P1)
Transmission heat loss coefficient	33.82 (37)
Summer heat loss coefficient	240.28 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
North	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
North	8.4600	81.1852	0.6300 0.7000
total:			0.9000 245.3413

	Jun	Jul	Aug	
Solar gains	265	245	199	(P3)
Internal gains	391	377	384	
Total summer gains	656	622	583	(P5)
Summer gain/loss ratio	2.73	2.59	2.43	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 317.6)	0.00	0.00	0.00	
Threshold temperature	18.73	20.49	20.23	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-04			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 4, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	82 B	DER	15.19	TER	27.50
Environmental	89 B	% DER<TER	44.77		
CO ₂ Emissions (t/year)	0.92	DFEE	47.52	TFEE	53.03
General Requirements Compliance	Pass	% DFEE<TFEE	10.39		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 74 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 (c)
 Fuel factor: 1.55 (electricity)
 Target Carbon Dioxide Emission Rate (TER) 27.50 kgCO₂/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 15.19 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.0 kWh/m²/yr
 Dwelling Fabric Energy Efficiency (DFEE) 47.5 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.075

3 Air permeability

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

4 Heating efficiency

Main heating system: Community heating scheme -
 Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day
 Permitted by DBSCG 2.10 OK
 Primary pipework insulated: Yes (assumed) OK

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room stats OK
 Hot water controls: Cylinderstat OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
 Based on:
 Overshading: Average
 Windows facing North: 9.73 m², No overhang
 Windows facing West: 1.76 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 0.12 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3860 (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	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss							(33) + (36) = 43.7911 (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	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	83.9656	83.6615	83.3634	81.9632	81.7012	80.4817	80.4817	80.2559	80.9515	81.7012	82.2312	82.7852 (39)
Average = Sum(39)m / 12 =												81.9620 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1394	1.1353	1.1313	1.1123	1.1087	1.0922	1.0922	1.0891	1.0985	1.1087	1.1159	1.1234 (40)
HLP (average)												1.1123 (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	2.3323 (42)
Average daily hot water use (litres/day)	89.5916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)
If cylinder contains dedicated solar storage													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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													
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(64)
Heat gains from water heating, kWh/month													
	85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	(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	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(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)													
	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)													
	114.3281	112.2585	107.9609	102.1183	98.3251	92.9841	88.4443	94.2610	96.3276	102.3749	109.2032	112.2672	(72)
Total internal gains													
	397.2998	395.2146	382.3461	361.6741	340.7663	320.6115	307.5281	313.3604	323.9979	344.8746	368.8175	386.6953	(73)

6. Solar gains

[Jan]												Gains
	Area				Solar flux	g		FF		Access		W
	m2				Table 6a	or Table 6b		or Table 6c		factor		
					W/m2					Table 6d		
North	9.7300				10.6334	0.6300		0.7000		0.7700		31.6196
West	1.7600				19.6403	0.6300		0.7000		0.7700		10.5641 (80)
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	439.4835	476.3069	519.0591	576.2395	623.7723	620.7277	588.8715	540.4603	487.0343	441.3262	420.9965	421.7423 (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	87.6276	87.9462	88.2607	89.7684	90.0563	91.4208	91.4208	91.6781	90.8904	90.0563	89.4759	88.8770	
alpha	6.8418	6.8631	6.8840	6.9846	7.0038	7.0947	7.0947	7.1119	7.0594	7.0038	6.9651	6.9251	
util living area	0.9998	0.9995	0.9983	0.9904	0.9434	0.7816	0.5947	0.6680	0.9272	0.9951	0.9994	0.9998	(86)
MIT	20.0871	20.1738	20.3445	20.5993	20.8368	20.9714	20.9963	20.9922	20.8980	20.6091	20.3130	20.0791	(87)
Th 2	19.9688	19.9721	19.9754	19.9908	19.9937	20.0072	20.0072	20.0097	20.0020	19.9937	19.9879	19.9817	(88)
util rest of house	0.9996	0.9992	0.9973	0.9844	0.9082	0.6832	0.4646	0.5331	0.8674	0.9911	0.9990	0.9997	(89)
MIT 2	18.7518	18.8813	19.1333	19.5144	19.8388	19.9917	20.0063	20.0075	19.9247	19.5334	19.0974	18.7503	(90)
Living area fraction									fLA = Living area / (4) =			0.2679	(91)
MIT	19.1095	19.2276	19.4578	19.8051	20.1061	20.2542	20.2715	20.2713	20.1855	19.8216	19.4230	19.1062	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1095	19.2276	19.4578	19.8051	20.1061	20.2542	20.2715	20.2713	20.1855	19.8216	19.4230	19.1062	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9995	0.9989	0.9966	0.9829	0.9129	0.7096	0.4999	0.5700	0.8809	0.9901	0.9987	0.9996	(94)
Useful gains	439.2527	475.7970	517.3173	566.4020	569.4669	440.4527	294.3813	308.0884	429.0103	436.9483	420.4539	421.5784	(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													
	1243.4886	1198.6645	1080.2050	893.8141	686.7907	455.0570	295.4902	310.6935	492.6264	753.4136	1013.3356	1234.0161	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	598.3515	485.7669	418.7885	235.7366	87.2889	0.0000	0.0000	0.0000	0.0000	235.4502	426.8748	604.4536	(98)
Space heating												3092.7111	(98)
Space heating per m2										(98) / (4) =		41.9692	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	3092.7111 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3247.3466 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1946.3205 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365 (310a)
Electricity used for heat distribution	52.9098 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	339.7119 (332)
Total delivered energy for all uses	5630.6950 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1763.6610	0.5190	915.3401 (367)
Electrical energy for heat distribution	52.9098	0.5190	27.4602 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			942.8003 (373)
Space and water heating			942.8003 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total CO2, kg/year			1119.1108 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1900 (384)

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

DER		15.1900 ZC1
Total Floor Area	TFA	73.6900
Assumed number of occupants	N	2.3323
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.5455 ZC2
CO2 emissions from cooking, equation (L16)		2.3745 ZC3
Total CO2 emissions		34.1100 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		34.1100 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5662		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4323 (36)
Total fabric heat loss							(33) + (36) = 42.9985 (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	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	81.5119	81.2723	81.0374	79.9342	79.7278	78.7669	78.7669	78.5890	79.1370	79.7278	80.1453	80.5819 (39)
Average = Sum(39)m / 12 =												79.9332 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1061	1.1029	1.0997	1.0847	1.0819	1.0689	1.0689	1.0665	1.0739	1.0819	1.0876	1.0935 (40)
HLP (average)												1.0847 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (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	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (64)
Heat gains from water heating, kWh/month	87.9883	78.0826	83.2511	76.3590	76.0821	69.7823	68.7308	73.0584	72.1896	79.0951	81.4601	86.4550 (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	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (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)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	118.2639	116.1943	111.8967	106.0541	102.2609	96.9198	92.3801	98.1967	100.2634	106.3106	113.1390	116.2030 (72)
Total internal gains	404.2356	402.1504	389.2819	368.6099	347.7021	327.5473	314.4638	320.2962	330.9337	351.8104	375.7533	393.6310 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				9.7300	10.6334	0.6300	0.7000	0.7700		31.6196 (74)		
West				1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)		
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	446.4193	483.2427	525.9949	583.1753	630.7080	627.6635	595.8073	547.3961	493.9701	448.2619	427.9323	428.6781 (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	62.7805	62.9656	63.1481	64.0197	64.1854	64.9684	64.9684	65.1155	64.6646	64.1854	63.8510	63.5051
alpha	5.1854	5.1977	5.2099	5.2680	5.2790	5.3312	5.3312	5.3410	5.3110	5.2790	5.2567	5.2337
util living area	0.9979	0.9964	0.9916	0.9712	0.9003	0.7377	0.5677	0.6341	0.8805	0.9817	0.9960	0.9983 (86)
MIT	19.8235	19.9369	20.1594	20.4830	20.7759	20.9468	20.9892	20.9813	20.8564	20.4979	20.1133	19.8078 (87)
Th 2	19.9958	19.9985	20.0011	20.0133	20.0156	20.0263	20.0263	20.0283	20.0222	20.0156	20.0110	20.0061 (88)
util rest of house	0.9972	0.9952	0.9884	0.9597	0.8610	0.6503	0.4493	0.5131	0.8186	0.9724	0.9943	0.9978 (89)
MIT 2	18.4261	18.5936	18.9194	19.3924	19.7888	19.9898	20.0222	20.0202	19.9005	19.4206	18.8606	18.4106 (90)
Living area fraction									fLA = Living area / (4) =			0.2679 (91)
MIT	18.8004	18.9534	19.2516	19.6846	20.0533	20.2462	20.2812	20.2777	20.1566	19.7092	19.1962	18.7849 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8004	18.9534	19.2516	19.6846	20.0533	20.2462	20.2812	20.2777	20.1566	19.7092	19.1962	18.7849 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	444.6323	480.0385	518.2187	556.8291	544.1144	421.4517	286.7243	298.6791	409.2983	434.1455	424.6654	427.2866 (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	1181.9570	1142.1556	1033.3535	862.0562	665.9875	444.7314	289.9592	304.7430	479.2983	726.2577	969.4542	1175.2769 (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	548.5696	444.9427	383.2603	219.7635	90.6736	0.0000	0.0000	0.0000	0.0000	217.3314	392.2479	556.5048 (98)
Space heating												2853.2938 (98)
Space heating per m2										(98) / (4) =		38.7202 (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													3051.6511 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.5696	444.9427	383.2603	219.7635	90.6736	0.0000	0.0000	0.0000	0.0000	217.3314	392.2479	556.5048	(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)	586.7054	475.8746	409.9041	235.0412	96.9771	0.0000	0.0000	0.0000	0.0000	232.4400	419.5165	595.1923	(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	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791	(64)
Efficiency of water heater (217)m	87.4214	87.2349	86.7661	85.6173	83.3715	79.8000	79.8000	79.8000	79.8000	85.4914	86.8645	79.8000	(216)
Fuel for water heating, kWh/month	223.5043	197.5118	208.7721	189.9715	191.4112	179.0338	172.2722	188.5820	188.1068	197.2644	204.9055	218.0218	(219)
Water heating fuel used												2359.3574	(219)
Annual totals kWh/year													
Space heating fuel - main system												3051.6511	(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)												339.7119	(232)
Total delivered energy for all uses												5825.7204	(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	3051.6511	0.2160	659.1566 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2359.3574	0.2160	509.6212 (264)
Space and water heating			1168.7778 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1384.0133 (272)
Emissions per m2 for space and water heating			15.8607 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8607 * 1.55) + 2.3926 + 0.5282, rounded to 2 d.p.			27.5000 (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	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3426 (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												
	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum (m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			20.0000	1473.8000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25750.8500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							349.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss						(33) + (36) =	43.7911 (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	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	82.3046	82.0649	81.8301	80.7268	80.5204	79.5596	79.5596	79.3816	79.9297	80.5204	80.9380	81.3745 (39)
Average = Sum(39)m / 12 =												80.7259 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1169	1.1137	1.1105	1.0955	1.0927	1.0797	1.0797	1.0772	1.0847	1.0927	1.0984	1.1043 (40)
HLP (average)												1.0955 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (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:												

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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	31.0564	27.1622	28.0289	24.4363	23.4472	20.2331	18.7490	21.5147	21.7717	25.3728	27.6964	30.0765 (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	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(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)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)	41.7425	40.4199	37.6733	33.9393	31.5150	28.1016	25.2002	28.9177	30.2385	34.1032	38.4672	40.4254	(72)
Total internal gains	324.7143	323.3759	312.0585	293.4950	273.9563	255.7290	244.2840	248.0171	257.9087	276.6030	298.0815	314.8535	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					9.7300	10.6334	0.6300	0.7000	0.7700		31.6196 (74)	
West					1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)	

Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	366.8980	404.4682	448.7715	508.0605	556.9622	555.8453	525.6274	475.1170	420.9451	373.0545	350.2605	349.9005 (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	86.9091	87.1628	87.4130	88.6076	88.8348	89.9076	89.9076	90.1092	89.4913	88.8348	88.3765	87.9024	
alpha	6.7939	6.8109	6.8275	6.9072	6.9223	6.9938	6.9938	7.0073	6.9661	6.9223	6.8918	6.8602	
util living area	0.9999	0.9998	0.9992	0.9947	0.9635	0.8334	0.6525	0.7365	0.9592	0.9979	0.9998	0.9999	(86)
MIT	20.0185	20.1065	20.2804	20.5394	20.7926	20.9550	20.9931	20.9851	20.8554	20.5454	20.2433	20.0074	(87)
Th 2	19.9871	19.9897	19.9923	20.0045	20.0068	20.0175	20.0175	20.0195	20.0134	20.0068	20.0022	19.9973	(88)
util rest of house	0.9999	0.9997	0.9987	0.9913	0.9385	0.7416	0.5148	0.5976	0.9190	0.9962	0.9996	0.9999	(89)
MIT 2	19.0868	19.1770	19.3529	19.6208	19.8639	19.9991	20.0162	20.0161	19.9294	19.6298	19.3243	19.0844	(90)
Living area fraction									fLA = Living area / (4) =			0.2679	(91)
MIT	19.3364	19.4260	19.6013	19.8669	20.1127	20.2552	20.2779	20.2757	20.1775	19.8750	19.5705	19.3317	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3364	19.4260	19.6013	19.8669	20.1127	20.2552	20.2779	20.2757	20.1775	19.8750	19.5705	19.3317	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9998	0.9996	0.9985	0.9907	0.9418	0.7663	0.5525	0.6363	0.9277	0.9959	0.9996	0.9999	(94)
Ext temp.	366.8312	404.2985	448.0879	503.3294	524.5484	425.9549	290.4334	302.3346	390.5100	371.5192	350.1051	349.8558	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1237.5625	1192.0745	1072.0832	885.3215	677.3950	449.9214	292.6106	307.6591	485.7712	746.8303	1009.3362	1231.3317	(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	647.8241	529.3855	464.2525	275.0343	113.7179	0.0000	0.0000	0.0000	0.0000	279.2315	474.6464	655.8180	(98)
Space heating per m2												3439.9102	(98)
												46.6808	(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	747.8600	588.7408	603.3004	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8683	0.9367	0.9007	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	649.3342	551.4527	543.3854	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	736.7452	699.6884	642.1945	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													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	62.9359	110.2874	73.5140	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			246.7373 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	15.7340	27.5718	18.3785	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												61.6843 (107)
Energy for space heating												0.8371 (108)
Energy for space cooling												46.6808 (99)
Total												0.8371 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.5179 (109)
												47.5 (109)

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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	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (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) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1530 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4030 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5662		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4323 (36)
Total fabric heat loss						(33) + (36) =	42.9985 (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	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	81.5119	81.2723	81.0374	79.9342	79.7278	78.7669	78.7669	78.5890	79.1370	79.7278	80.1453	80.5819 (39)
Average = Sum(39)m / 12 =												79.9332 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1061	1.1029	1.0997	1.0847	1.0819	1.0689	1.0689	1.0665	1.0739	1.0819	1.0876	1.0935 (40)
HLP (average)												1.0847 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (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)

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Primary loss	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	31.0564	27.1622	28.0289	24.4363	23.4472	20.2331	18.7490	21.5147	21.7717	25.3728	27.6964	30.0765 (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	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(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)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)	41.7425	40.4199	37.6733	33.9393	31.5150	28.1016	25.2002	28.9177	30.2385	34.1032	38.4672	40.4254	(72)
Total internal gains	324.7143	323.3759	312.0585	293.4950	273.9563	255.7290	244.2840	248.0171	257.9087	276.6030	298.0815	314.8535	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North					9.7300	10.6334	0.6300	0.7000	0.7700		31.6196 (74)		
West					1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)		

Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)	
Total gains	366.8980	404.4682	448.7715	508.0605	556.9622	555.8453	525.6274	475.1170	420.9451	373.0545	350.2605	349.9005 (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	62.7805	62.9656	63.1481	64.0197	64.1854	64.9684	64.9684	65.1155	64.6646	64.1854	63.8510	63.5051	
alpha	5.1854	5.1977	5.2099	5.2680	5.2790	5.3312	5.3312	5.3410	5.3110	5.2790	5.2567	5.2337	
util living area	0.9992	0.9985	0.9959	0.9837	0.9341	0.7982	0.6331	0.7095	0.9287	0.9918	0.9984	0.9994	(86)
MIT	19.7221	19.8371	20.0635	20.3971	20.7146	20.9218	20.9821	20.9684	20.7995	20.4075	20.0147	19.7070	(87)
Th 2	19.9958	19.9985	20.0011	20.0133	20.0156	20.0263	20.0263	20.0283	20.0222	20.0156	20.0110	20.0061	(88)
util rest of house	0.9989	0.9979	0.9943	0.9767	0.9042	0.7149	0.5062	0.5838	0.8831	0.9873	0.9978	0.9992	(89)
MIT 2	18.8230	18.9399	19.1677	19.5076	19.8099	19.9875	20.0214	20.0183	19.8969	19.5222	19.1276	18.8162	(90)
Living area fraction										fLA = Living area / (4) =		0.2679	(91)
MIT	19.0638	19.1802	19.4077	19.7459	20.0523	20.2378	20.2788	20.2728	20.1387	19.7593	19.3652	19.0548	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0638	19.1802	19.4077	19.7459	20.0523	20.2378	20.2788	20.2728	20.1387	19.7593	19.3652	19.0548	(93)

8. Space heating requirement

Utilisation	0.9985	0.9973	0.9930	0.9743	0.9055	0.7349	0.5407	0.6179	0.8898	0.9857	0.9972	0.9989	(94)
Useful gains	366.3586	403.3668	445.6365	495.0048	504.3386	408.5062	284.2007	293.5809	374.5392	367.7118	349.2654	349.5039	(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	1203.4291	1160.5872	1046.0046	866.9572	665.9068	444.0698	289.7638	304.3582	477.8838	730.2526	982.9996	1197.0280	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	622.7804	508.8521	446.6739	267.8058	120.2067	0.0000	0.0000	0.0000	0.0000	269.7303	456.2886	630.5579	(98)
Space heating												3322.8958	(98)
Space heating per m2										(98) / (4) =		45.0929	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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	740.4089	582.8751	597.2761	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8400	0.9080	0.8712	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	621.9115	529.2593	520.3289	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	736.7452	699.6884	642.1945	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	82.6803	126.7993	90.6680	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												300.1475	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	20.6701	31.6998	22.6670	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												75.0369 (107)
Energy for space heating												1.0183 (108)
Energy for space cooling												45.0929 (99)
Total												1.0183 (108)
Target Fabric Energy Efficiency (TFEE)												46.1112 (109)
												53.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate												
	0.4342	0.4149	0.4246	0.3860	0.3860	0.3570	0.3570	0.3281	0.3570	0.3763	0.3667	0.3956 (22b)
Effective ac	0.5943	0.5861	0.5901	0.5745	0.5745	0.5637	0.5637	0.5538	0.5637	0.5708	0.5672	0.5783 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum (m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss							(33) + (36) = 43.7911 (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	38.4401	37.9101	38.1721	37.1603	37.1603	36.4648	36.4648	35.8234	36.4648	36.9225	36.6906	37.4042 (38)
Heat transfer coeff	82.2312	81.7012	81.9632	80.9515	80.9515	80.2559	80.2559	79.6145	80.2559	80.7136	80.4817	81.1954 (39)
Average = Sum(39)m / 12 =												80.8810 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1159	1.1087	1.1123	1.0985	1.0985	1.0891	1.0891	1.0804	1.0891	1.0953	1.0922	1.1019 (40)
HLP (average)												1.0976 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(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													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month													
85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	83.5268	(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	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	139.9366	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
48.0897	42.7129	34.7364	26.2977	19.6579	16.5960	17.9326	23.3094	31.2858	39.7246	46.3644	49.4263	49.4263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
307.0921	310.2788	302.2485	285.1530	263.5730	243.2909	229.7412	226.5545	234.5848	251.6803	273.2602	293.5424	293.5424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	51.3259	(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)													
-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)													
114.3281	112.2585	107.9609	102.1183	98.3251	92.9841	88.4443	94.2610	96.3276	102.3749	109.2032	112.2672	112.2672	(72)
Total internal gains													
567.4814	563.2217	542.9173	511.5405	479.5275	450.8424	434.0895	442.0963	460.1697	491.7512	526.7994	553.2074	553.2074	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W		
North					9.7300	11.9814	0.6300	0.7000	0.7700	35.6282 (74)		
West					1.7600	22.3313	0.6300	0.7000	0.7700	12.0115 (80)		

Solar gains	47.6397	82.9485	140.5634	227.1417	289.6702	328.2720	304.6180	250.4375	180.1939	105.6655	58.9355	39.1237 (83)
Total gains	615.1211	646.1702	683.4807	738.6822	769.1977	779.1144	738.7075	692.5338	640.3636	597.4167	585.7349	592.3310 (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	89.4759	90.0563	89.7684	90.8904	90.8904	91.6781	91.6781	92.4167	91.6781	91.1582	91.4208	90.6173	
alpha	6.9651	7.0038	6.9846	7.0594	7.0594	7.1119	7.1119	7.1611	7.1119	7.0772	7.0947	7.0412	
util living area													
0.9975	0.9957	0.9876	0.9482	0.8029	0.5327	0.3475	0.3906	0.7247	0.9586	0.9937	0.9980	0.9980	(86)
MIT	20.3165	20.3991	20.5737	20.7956	20.9559	20.9978	20.9999	20.9998	20.9833	20.8072	20.5340	20.3098	(87)
Th 2	19.9879	19.9937	19.9908	20.0020	20.0020	20.0097	20.0097	20.0169	20.0097	20.0047	20.0072	19.9993	(88)
util rest of house													
0.9963	0.9937	0.9811	0.9222	0.7289	0.4330	0.2401	0.2778	0.6191	0.9316	0.9900	0.9970	0.9970	(89)
MIT 2	19.1017	19.2264	19.4756	19.7887	19.9708	20.0090	20.0097	20.0169	20.0019	19.8119	19.4333	19.1011	(90)
Living area fraction													
MIT	19.4272	19.5405	19.7698	20.0585	20.2347	20.2739	20.2750	20.2802	20.2648	20.0785	19.7282	19.4249	(92)
Temperature adjustment													
adjusted MIT	19.4272	19.5405	19.7698	20.0585	20.2347	20.2739	20.2750	20.2802	20.2648	20.0785	19.7282	19.4249	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9954	0.9924	0.9792	0.9240	0.7475	0.4598	0.2689	0.3081	0.6478	0.9341	0.9886	0.9962	0.9962	(94)
Useful gains	612.2929	641.2581	669.2840	682.5307	574.9590	358.2724	198.6193	213.3480	414.7966	558.0248	579.0716	590.1060	(95)
Ext temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	(96)
Heat loss rate W													
1202.8091	1155.3003	1022.0636	838.5336	601.8506	359.0576	198.6320	213.3802	422.5332	700.4733	968.0479	1187.4708	1187.4708	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
439.3441	345.4364	262.4680	112.3221	20.0074	0.0000	0.0000	0.0000	0.0000	105.9817	280.0630	444.4394	444.4394	(98)
Space heating													
RHI space heating demand													
2010.0621													(98)
2010													(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) = 0.2041 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4541 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3860 (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	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss						(33) + (36) =	43.7911 (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	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	83.9656	83.6615	83.3634	81.9632	81.7012	80.4817	80.4817	80.2559	80.9515	81.7012	82.2312	82.7852 (39)
Average = Sum(39)m / 12 =												81.9620 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1394	1.1353	1.1313	1.1123	1.1087	1.0922	1.0922	1.0891	1.0985	1.1087	1.1159	1.1234 (40)
HLP (average)												1.1123 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

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Store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.7200	(55)
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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														
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum(63)m =					0.0000	(63)
Output from w/h														
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(64)	
								Total per year (kWh/year) = Sum(64)m =					1946.3205	(64)
Heat gains from water heating, kWh/month														
	85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	(65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2366.1112 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2484.4168 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1946.3205 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365 (310a)
Electricity used for heat distribution	45.2805 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	339.7119 (332)
Total delivered energy for all uses	4867.7652 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2484.4168	4.2400	105.3393 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2043.6365	4.2400	86.6502 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	339.7119	13.1900	44.8080 (350)
Additional standing charges			120.0000 (351)
Total energy cost			356.7975 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200 (356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.2626 (357)
SAP value	82.3871
SAP rating (Section 12)	82 (358)
SAP band	B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1509.3511	0.5190	783.3532 (367)
Electrical energy for heat distribution	45.2805	0.5190	23.5006 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			806.8538 (373)
Space and water heating			806.8538 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total kg/year			983.1643 (383)
CO2 emissions per m2			13.3400 (384)
EI value			88.9002 (384a)
EI rating			89 (385)
EI band			B

Calculation of stars for heating and DHW

Space heating energy efficiency	1.00 x 4.240 x 1.05
= 4.452, stars = 4	
Space heating environmental impact	1.00 x 0.519 x 1.05 / 3.0000
= 0.1817, stars = 5	
Water heating energy efficiency	4.452, stars = 4
Water heating environmental impact	0.1817, 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	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) = 0.2041 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4541 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate												
	0.4342	0.4149	0.4246	0.3860	0.3860	0.3570	0.3570	0.3281	0.3570	0.3763	0.3667	0.3956 (22b)
Effective ac	0.5943	0.5861	0.5901	0.5745	0.5745	0.5637	0.5637	0.5538	0.5637	0.5708	0.5672	0.5783 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss						(33) + (36) =	43.7911 (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	38.4401	37.9101	38.1721	37.1603	37.1603	36.4648	36.4648	35.8234	36.4648	36.9225	36.6906	37.4042 (38)
Heat transfer coeff	82.2312	81.7012	81.9632	80.9515	80.9515	80.2559	80.2559	79.6145	80.2559	80.7136	80.4817	81.1954 (39)
Average = Sum(39)m / 12 =												80.8810 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1159	1.1087	1.1123	1.0985	1.0985	1.0891	1.0891	1.0804	1.0891	1.0953	1.0922	1.1019 (40)
HLP (average)												1.0976 (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												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

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Store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.7200	(55)
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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														
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum(63)m =					0.0000	(63)
Output from w/h														
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(64)	
								Total per year (kWh/year) = Sum(64)m =					1946.3205	(64)
Heat gains from water heating, kWh/month														
	85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	(65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2010.0621 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2110.5652 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1946.3205 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365 (310a)
Electricity used for heat distribution	41.5420 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	339.7119 (332)
Total delivered energy for all uses	4493.9136 (338)

10b. Fuel costs - using BEDF prices (482)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2110.5652	4.5600	96.2418 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2043.6365	4.5600	93.1898 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	339.7119	19.1200	64.9529 (350)
Additional standing charges			94.0000 (351)
Total energy cost			348.3845 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1384.7339	0.5190	718.6769 (367)
Electrical energy for heat distribution	41.5420	0.5190	21.5603 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			740.2372 (373)
Space and water heating			740.2372 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total kg/year			916.5477 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1384.7339	3.0700	4251.1331 (367)
Electrical energy for heat distribution	41.5420	3.0700	127.5340 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			4378.6671 (373)
Space and water heating			4378.6671 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	3.0700	1042.9155 (379)
Primary energy kWh/year			5421.5825 (383)
Primary energy kWh/m2/year			73.5728 (384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 82
Current environmental impact rating: B 89

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
 (none)

Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 82
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 482 TEST (31 Aug 2021)
 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	£65	£65	£0
Community scheme	£283	£283	£0
Space heating	£190	£190	£0
Water heating	£93	£93	£0
Lighting	£65	£65	£0
Total cost of fuels	£348	£348	£0
Total cost of uses	£348	£348	£0
Delivered energy	61 kWh/m²	61 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	74 kWh/m²	74 kWh/m²	0 kWh/m²

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	359.4 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	258.74 (P1)
Transmission heat loss coefficient	43.79 (37)
Summer heat loss coefficient	302.53 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	9.7300	81.1852	0.6300	0.7000	0.9000	282.1715
West	1.7600	117.5071	0.6300	0.7000	0.9000	73.8755
total:						356.0470

Solar gains	Jun	Jul	Aug	
	384	356	294	(P3)
Internal gains	451	434	442	
Total summer gains	835	790	737	(P5)
Summer gain/loss ratio	2.76	2.61	2.43	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 359.4)	0.00	0.00	0.00	
Threshold temperature	18.76	20.51	20.23	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	
Assessment of likelihood of high internal temperature:	Slight			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-05			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 5, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	14.03	TER	25.54
Environmental	89 B	% DER<TER	45.06		
CO ₂ Emissions (t/year)	0.92	DFEE	43.35	TFEE	48.63
General Requirements Compliance	Pass	% DFEE<TFEE	10.86		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 79 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 (c)
 Fuel factor: 1.55 (electricity)
 Target Carbon Dioxide Emission Rate (TER) 25.54 kgCO₂/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 14.03 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 48.6 kWh/m²/yr
 Dwelling Fabric Energy Efficiency (DFEE) 43.3 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.067

3 Air permeability

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

4 Heating efficiency

Main heating system: Community heating scheme -
 Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day
 Permitted by DBSCG 2.10 OK
 Primary pipework insulated: Yes (assumed) OK

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room stats OK
 Hot water controls: Cylinderstat OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
 Based on:
 Overshading: Average
 Windows facing East: 3.99 m², No overhang
 Windows facing South East: 1.11 m², No overhang
 Windows facing South: 7.72 m², No overhang
 Windows facing South West: 1.11 m², No overhang
 Air change rate: 4.00 ach
 Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

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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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (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	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	42.8758			(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (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	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	96.1784	95.8716	95.5708	94.1579	93.8936	92.6631	92.6631	92.4352	93.1371	93.8936	94.4284	94.9874 (39)
Average = Sum(39)m / 12 =												94.1567 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2107	1.2068	1.2031	1.1853	1.1819	1.1665	1.1665	1.1636	1.1724	1.1819	1.1887	1.1957 (40)
HLP (average)												1.1853 (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	2.4521 (42)
Average daily hot water use (litres/day)	92.4386 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

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store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.7200	(55)
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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														
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum(63)m =					0.0000	(63)
Output from w/h														
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(64)	
								Total per year (kWh/year) = Sum(64)m =					1991.1144	(64)
Heat gains from water heating, kWh/month														
	86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	(65)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9977	0.9932	0.9804	0.9396	0.8325	0.6262	0.4293	0.4670	0.7366	0.9523	0.9936	0.9984 (94)
Useful gains	572.2844	677.6599	749.2906	772.2217	703.3268	511.0196	337.7667	354.8561	538.0381	625.3365	571.2064	538.6951 (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	1419.7798	1377.7137	1247.7277	1035.2717	791.9873	522.7960	338.7168	356.4434	569.4352	874.5585	1164.1594	1409.3116 (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	630.5366	470.4361	370.8372	189.3960	65.9634	0.0000	0.0000	0.0000	0.0000	185.4212	426.9261	647.7387 (98)
Space heating												2987.2553 (98)
Space heating per m2										(98) / (4) =		37.6039 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2987.2553 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3136.6181 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1991.1144 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702 (310a)
Electricity used for heat distribution	52.2729 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	352.5010 (332)
Total delivered energy for all uses	5579.7893 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1742.4294	0.5190	904.3209 (367)
Electrical energy for heat distribution	52.2729	0.5190	27.1296 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			931.4505 (373)
Space and water heating			931.4505 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	0.5190	182.9480 (379)
Total CO2, kg/year			1114.3985 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0300 (384)

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

DER	14.0300 ZC1
Total Floor Area	TFA 79.4400
Assumed number of occupants	N 2.4521
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	16.2815 ZC2
CO2 emissions from cooking, equation (L16)	2.2388 ZC3
Total CO2 emissions	32.5503 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	32.5503 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1420 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3920 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	53.9800	13.9300	40.0500	0.1800	7.2090		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8870		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2826 (36)
Total fabric heat loss						(33) + (36) =	52.1696 (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	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	93.3276	93.0833	92.8438	91.7190	91.5085	90.5288	90.5288	90.3474	90.9062	91.5085	91.9342	92.3793 (39)
Average = Sum(39)m / 12 =												91.7179 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1748	1.1717	1.1687	1.1546	1.1519	1.1396	1.1396	1.1373	1.1443	1.1519	1.1573	1.1629 (40)
HLP (average)												1.1546 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

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Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (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	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Heat gains from water heating, kWh/month	89.5325	79.4331	84.6448	77.5740	77.2479	70.7883	69.6630	74.1281	73.2722	80.3567	82.8372	87.9505 (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	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607 (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)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)	
Water heating gains (Table 5)	120.3394	118.2041	113.7699	107.7416	103.8279	98.3171	93.6331	99.6346	101.7669	108.0063	115.0517	118.2130 (72)	
Total internal gains	421.3479	419.2458	405.7933	384.1119	362.1042	340.9070	327.1473	333.1155	344.2661	366.1587	391.2980	410.1457 (73)	

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East			3.9900		19.6403		0.6300		0.7000		0.7700		23.9493 (76)
Southeast			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (77)
South			7.7200		46.7521		0.6300		0.7000		0.7700		110.3037 (78)
Southwest			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (79)
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095		136.3705 (83)
Total gains	580.5640	689.2661	771.2429	828.8051	851.7721	823.0563	793.6659	766.8688	737.3790	663.5922	581.8075		546.5162 (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	59.1108	59.2659	59.4188	60.1475	60.2858	60.9382	60.9382	61.0606	60.6853	60.2858	60.0067	59.7175	
alpha	4.9407	4.9511	4.9613	5.0098	5.0191	5.0625	5.0625	5.0707	5.0457	5.0191	5.0004	4.9812	
util living area	0.9952	0.9883	0.9721	0.9291	0.8335	0.6639	0.4941	0.5306	0.7606	0.9441	0.9893	0.9964 (86)	
MIT	19.8457	20.0374	20.2972	20.5987	20.8333	20.9610	20.9927	20.9897	20.9214	20.6157	20.1708	19.8118 (87)	
Th 2	19.9402	19.9427	19.9451	19.9565	19.9587	19.9686	19.9686	19.9705	19.9648	19.9587	19.9543	19.9498 (88)	
util rest of house	0.9936	0.9846	0.9628	0.9054	0.7803	0.5730	0.3824	0.4176	0.6777	0.9202	0.9851	0.9952 (89)	
MIT 2	18.4185	18.6981	19.0724	19.5002	19.8010	19.9436	19.9661	19.9664	19.9068	19.5333	18.9019	18.3760 (90)	
Living area fraction									fLA = Living area / (4) =			0.2942 (91)	
MIT	18.8384	19.0921	19.4327	19.8234	20.1047	20.2429	20.2681	20.2675	20.2053	19.8517	19.2752	18.7984 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.8384	19.0921	19.4327	19.8234	20.1047	20.2429	20.2681	20.2675	20.2053	19.8517	19.2752	18.7984 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9913	0.9805	0.9572	0.9018	0.7886	0.5984	0.4154	0.4510	0.6986	0.9172	0.9814	0.9934 (94)	
Useful gains	575.5217	675.8279	738.2004	747.3967	671.7008	492.5046	329.7105	345.8511	515.1166	608.6683	570.9964	542.8863 (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	1356.8294	1321.0514	1200.7221	1001.8805	769.1006	510.8468	332.0674	349.4146	555.0081	846.6104	1119.3159	1348.5884 (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	581.2929	433.5901	344.1162	183.2283	72.4654	0.0000	0.0000	0.0000	0.0000	177.0290	394.7900	599.4424 (98)	
Space heating												2785.9543 (98)	
Space heating per m2										(98) / (4) =		35.0699 (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												2979.6303 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	581.2929	433.5901	344.1162	183.2283	72.4654	0.0000	0.0000	0.0000	0.0000	177.0290	394.7900	599.4424 (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)	621.7037	463.7328	368.0387	195.9661	77.5031	0.0000	0.0000	0.0000	0.0000	189.3358	422.2353	641.1148 (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	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Efficiency of water heater (217)m	87.4964	87.1223	86.4427	85.0727	82.8121	79.8000	79.8000	79.8000	79.8000	84.8839	86.8247	79.8000 (216)
Fuel for water heating, kWh/month	228.6206	202.4291	214.4020	195.4830	196.9382	182.8254	175.7856	192.6138	192.1866	203.1461	209.7697	222.8846 (219)
Water heating fuel used												2417.0847 (219)
Annual totals kWh/year												
Space heating fuel - main system												2979.6303 (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)												352.5010 (232)
Total delivered energy for all uses												5824.2161 (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	2979.6303	0.2160	643.6001 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2417.0847	0.2160	522.0903 (264)
Space and water heating			1165.6904 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	352.5010	0.5190	182.9480 (268)
Total CO2, kg/m2/year			1387.5635 (272)
Emissions per m2 for space and water heating			14.6738 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3030 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6738 * 1.55) + 2.3030 + 0.4900, rounded to 2 d.p.			25.5400 (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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (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) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1420 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3920 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.8758		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			20.0000	1588.8000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25763.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							324.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (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	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	94.5675	94.3232	94.0837	92.9589	92.7484	91.7687	91.7687	91.5873	92.1461	92.7484	93.1742	93.6193 (39)
Average = Sum(39)m / 12 =												92.9579 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1904	1.1874	1.1843	1.1702	1.1675	1.1552	1.1552	1.1529	1.1599	1.1675	1.1729	1.1785 (40)
HLP (average)												1.1702 (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	2.4521 (42)
Average daily hot water use (litres/day)	92.4386 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (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:												

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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	32.0433	28.0253	28.9196	25.2128	24.1923	20.8761	19.3448	22.1984	22.4635	26.1791	28.5765	31.0322 (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	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(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)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	43.0690	41.7043	38.8704	35.0178	32.5165	28.9946	26.0010	29.8366	31.1993	35.1869	39.6896	41.7100	(72)
Total internal gains	341.0775	339.7460	327.8939	308.3880	287.7928	268.5845	256.5152	260.3175	270.6985	290.3393	312.9359	330.6428	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				3.9900	19.6403	0.6300	0.7000	0.7700	23.9493 (76)			
Southeast				1.1100	36.7938	0.6300	0.7000	0.7700	12.4816 (77)			
South				7.7200	46.7521	0.6300	0.7000	0.7700	110.3037 (78)			
Southwest				1.1100	36.7938	0.6300	0.7000	0.7700	12.4816 (79)			

Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705 (83)
Total gains	500.2935	609.7663	693.3434	753.0812	777.4608	750.7337	723.0339	694.0708	663.8114	587.7728	503.4454	467.0132 (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	75.6757	75.8717	76.0648	76.9852	77.1599	77.9836	77.9836	78.1381	77.6643	77.1599	76.8073	76.4422	
alpha	6.0450	6.0581	6.0710	6.1323	6.1440	6.1989	6.1989	6.2092	6.1776	6.1440	6.1205	6.0961	
util living area	0.9993	0.9976	0.9919	0.9701	0.9005	0.7375	0.5517	0.5959	0.8415	0.9808	0.9981	0.9996	(86)
MIT	19.9729	20.1334	20.3556	20.6237	20.8449	20.9678	20.9953	20.9927	20.9262	20.6295	20.2438	19.9457	(87)
Th 2	19.9277	19.9301	19.9326	19.9439	19.9461	19.9560	19.9560	19.9579	19.9522	19.9461	19.9418	19.9372	(88)
util rest of house	0.9991	0.9966	0.9880	0.9552	0.8529	0.6375	0.4247	0.4672	0.7579	0.9684	0.9971	0.9994	(89)
MIT 2	18.9969	19.1590	19.3813	19.6507	19.8489	19.9437	19.9552	19.9563	19.9176	19.6619	19.2791	18.9777	(90)
Living area fraction									fLA = Living area / (4) =			0.2942	(91)
MIT	19.2841	19.4456	19.6680	19.9369	20.1419	20.2450	20.2612	20.2612	20.2143	19.9465	19.5629	19.2625	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2841	19.4456	19.6680	19.9369	20.1419	20.2450	20.2612	20.2612	20.2143	19.9465	19.5629	19.2625	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	499.6950	607.2675	684.1902	719.2863	670.9821	500.7332	334.4188	350.9816	518.6842	569.2304	501.7285	466.6425	(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	1417.0051	1371.9887	1238.8900	1025.9799	782.9751	518.0304	335.9798	353.6376	563.4099	866.8771	1161.2214	1410.1363	(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	682.4788	513.8926	412.6966	220.8194	83.3229	0.0000	0.0000	0.0000	0.0000	221.4492	474.8348	701.9594	(98)
Space heating												3311.4537	(98)
Space heating per m2												41.6850	(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	862.6261	679.0887	696.0636	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9059	0.9581	0.9461	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	781.4243	650.6163	658.5662	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	969.0631	934.8130	902.5501	0.0000	0.0000	0.0000	0.0000	(103)

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Month fraction	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	135.0999	211.4424	181.5240	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												528.0663 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.7750	52.8606	45.3810	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												132.0166 (107)
Space cooling per m2												1.6618 (108)
Energy for space heating												41.6850 (99)
Energy for space cooling												1.6618 (108)
Total												43.3468 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.3 (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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (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) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1420 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3920 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	53.9800	13.9300	40.0500	0.1800	7.2090		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8870		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2826 (36)
Total fabric heat loss						(33) + (36) =	52.1696 (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	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	93.3276	93.0833	92.8438	91.7190	91.5085	90.5288	90.5288	90.3474	90.9062	91.5085	91.9342	92.3793 (39)
Average = Sum(39)m / 12 =												91.7179 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1748	1.1717	1.1687	1.1546	1.1519	1.1396	1.1396	1.1373	1.1443	1.1519	1.1573	1.1629 (40)
HLP (average)												1.1546 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (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)

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Primary loss	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	32.0433	28.0253	28.9196	25.2128	24.1923	20.8761	19.3448	22.1984	22.4635	26.1791	28.5765	31.0322 (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	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607 (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)												
	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)
Water heating gains (Table 5)												
	43.0690	41.7043	38.8704	35.0178	32.5165	28.9946	26.0010	29.8366	31.1993	35.1869	39.6896	41.7100 (72)
Total internal gains	341.0775	339.7460	327.8939	308.3880	287.7928	268.5845	256.5152	260.3175	270.6985	290.3393	312.9359	330.6428 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
East					3.9900	19.6403	0.6300	0.7000	0.7700	23.9493 (76)		
Southeast					1.1100	36.7938	0.6300	0.7000	0.7700	12.4816 (77)		
South					7.7200	46.7521	0.6300	0.7000	0.7700	110.3037 (78)		
Southwest					1.1100	36.7938	0.6300	0.7000	0.7700	12.4816 (79)		
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705 (83)
Total gains	500.2935	609.7663	693.3434	753.0812	777.4608	750.7337	723.0339	694.0708	663.8114	587.7728	503.4454	467.0132 (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	59.1108	59.2659	59.4188	60.1475	60.2858	60.9382	60.9382	61.0606	60.6853	60.2858	60.0067	59.7175
alpha	4.9407	4.9511	4.9613	5.0098	5.0191	5.0625	5.0625	5.0707	5.0457	5.0191	5.0004	4.9812
util living area	0.9975	0.9931	0.9816	0.9490	0.8692	0.7119	0.5385	0.5801	0.8101	0.9640	0.9942	0.9982 (86)
MIT	19.7530	19.9483	20.2157	20.5332	20.7928	20.9467	20.9894	20.9847	20.8941	20.5449	20.0822	19.7194 (87)
Th 2	19.9402	19.9427	19.9451	19.9565	19.9587	19.9686	19.9686	19.9705	19.9648	19.9587	19.9543	19.9498 (88)
util rest of house	0.9967	0.9907	0.9752	0.9304	0.8218	0.6202	0.4187	0.4596	0.7319	0.9471	0.9919	0.9976 (89)
MIT 2	18.8092	19.0052	19.2710	19.5863	19.8206	19.9444	19.9660	19.9662	19.9088	19.6044	19.1487	18.7833 (90)
Living area fraction									fLA = Living area / (4) =			0.2942 (91)
MIT	19.0868	19.2827	19.5489	19.8649	20.1066	20.2393	20.2670	20.2658	20.1987	19.8811	19.4233	19.0587 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0868	19.2827	19.5489	19.8649	20.1066	20.2393	20.2670	20.2658	20.1987	19.8811	19.4233	19.0587 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9958	0.9888	0.9722	0.9284	0.8294	0.6458	0.4543	0.4954	0.7516	0.9455	0.9903	0.9969 (94)
Useful gains	498.1676	602.9395	674.0475	699.1978	644.8405	484.8522	328.4519	343.8513	498.8933	555.7444	498.5626	465.5774 (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	1380.0195	1338.7839	1211.5120	1005.6857	769.2783	510.5188	331.9728	349.2687	554.4065	849.2998	1132.9333	1372.6323 (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	656.0978	494.4874	399.8736	220.6713	92.5818	0.0000	0.0000	0.0000	0.0000	218.4052	456.7469	674.8489 (98)
Space heating												3213.7128 (98)
Space heating per m2										(98) / (4) =		40.4546 (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	850.9709	669.9132	686.6402	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8842	0.9395	0.9262	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	752.4491	629.3998	635.9373	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	969.0631	934.8130	902.5501	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	155.9621	227.2275	198.3599	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												581.5494 (104)

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Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.9905	56.8069	49.5900	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												145.3874 (107)
Space cooling per m2												1.8302 (108)
Energy for space heating												40.4546 (99)
Energy for space cooling												1.8302 (108)
Total												42.2847 (109)
Target Fabric Energy Efficiency (TFEE)												48.6 (109)

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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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.4201	0.4014	0.4107	0.3734	0.3734	0.3454	0.3454	0.3174	0.3454	0.3641	0.3547	0.3827 (22b)
Effective ac	0.5882	0.5806	0.5844	0.5697	0.5697	0.5596	0.5596	0.5504	0.5596	0.5663	0.5629	0.5732 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	42.8758			(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (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	41.0188	40.4841	40.7484	39.7275	39.7275	39.0257	39.0257	38.3785	39.0257	39.4875	39.2536	39.9737 (38)
Heat transfer coeff	94.4284	93.8936	94.1579	93.1371	93.1371	92.4352	92.4352	91.7881	92.4352	92.8970	92.6631	93.3832 (39)
Average = Sum(39)m / 12 =												93.0659 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1887	1.1819	1.1853	1.1724	1.1724	1.1636	1.1636	1.1554	1.1636	1.1694	1.1665	1.1755 (40)
HLP (average)												1.1715 (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	2.4521 (42)
Average daily hot water use (litres/day)	92.4386 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	(59)
Total heat required for water heating calculated for each month													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month													
86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	85.0223	(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	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
49.9002	44.3209	36.0442	27.2878	20.3979	17.2208	18.6077	24.1869	32.4637	41.2201	48.1099	51.2870	51.2870	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
325.7704	329.1509	320.6322	302.4969	279.6043	258.0886	243.7147	240.3342	248.8529	266.9882	289.8808	311.3965	311.3965	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	(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)													
-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)													
116.4036	114.2683	109.8341	103.8059	99.8921	94.3813	89.6973	95.6988	97.8311	104.0705	111.1159	114.2772	114.2772	(72)
Total internal gains													
593.2822	588.9481	567.7185	534.7985	501.1024	470.8987	453.2277	461.4280	480.3558	513.4869	550.3146	578.1689	578.1689	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W		
East					3.9900	22.3313	0.6300	0.7000	0.7700	27.2307 (76)		
Southeast					1.1100	40.4699	0.6300	0.7000	0.7700	13.7286 (77)		
South					7.7200	50.9848	0.6300	0.7000	0.7700	120.2901 (78)		
Southwest					1.1100	40.4699	0.6300	0.7000	0.7700	13.7286 (79)		
Solar gains	174.9781	266.7895	360.5110	452.1503	484.4895	511.9300	489.3815	460.4763	416.5881	313.7384	208.9242	148.4801 (83)
Total gains	768.2603	855.7376	928.2295	986.9489	985.5919	982.8288	942.6092	921.9043	896.9438	827.2253	759.2388	726.6490 (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	78.1240	78.5690	78.3484	79.2072	79.2072	79.8086	80.3713	79.8086	79.4118	79.6123	78.9984	78.9984	
alpha	6.2083	6.2379	6.2232	6.2805	6.2805	6.3206	6.3206	6.3581	6.3206	6.2941	6.3075	6.2666	
util living area													
0.9930	0.9851	0.9601	0.8887	0.7332	0.4863	0.3137	0.3383	0.6067	0.8931	0.9814	0.9947	0.9947	(86)
MIT	20.2882	20.4224	20.6297	20.8369	20.9618	20.9975	20.9999	20.9998	20.9903	20.8576	20.5462	20.2653	(87)
Th 2	19.9291	19.9345	19.9318	19.9421	19.9421	19.9492	19.9492	19.9558	19.9492	19.9446	19.9469	19.9396	(88)
util rest of house													
0.9901	0.9790	0.9437	0.8475	0.6552	0.3896	0.2108	0.2345	0.5065	0.8445	0.9723	0.9924	0.9924	(89)
MIT 2	19.0209	19.2174	19.5055	19.7821	19.9157	19.9484	19.9492	19.9558	19.9449	19.8148	19.4060	18.9962	(90)
Living area fraction													
MIT	19.3937	19.5719	19.8362	20.0924	20.2234	20.2570	20.2583	20.2629	20.2524	20.1215	19.7414	19.3696	(91)
Temperature adjustment													
adjusted MIT	19.3937	19.5719	19.8362	20.0924	20.2234	20.2570	20.2583	20.2629	20.2524	20.1215	19.7414	19.3696	(92)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9881	0.9763	0.9419	0.8541	0.6771	0.4182	0.2410	0.2651	0.5361	0.8538	0.9700	0.9908	0.9908	(94)
Useful gains	759.0876	835.4563	874.2783	842.9585	667.3059	411.0027	227.2133	244.3858	480.8545	706.2613	736.4804	719.9307	(95)
Ext temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	(96)
Heat loss rate W													
1378.0634	1330.6498	1180.3817	967.9171	691.3961	411.9869	227.2348	244.4246	485.5076	810.2056	1115.7958	1360.5526	1360.5526	(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													
460.5180	332.7700	227.7409	89.9702	17.9231	0.0000	0.0000	0.0000	0.0000	0.0000	77.3345	273.1071	476.6227	(98)
Space heating													
RHI space heating demand													
1955.9865												1956	(98)

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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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3734 (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												
	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	42.8758			(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (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	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	96.1784	95.8716	95.5708	94.1579	93.8936	92.6631	92.6631	92.4352	93.1371	93.8936	94.4284	94.9874 (39)
Average = Sum(39)m / 12 =												94.1567 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2107	1.2068	1.2031	1.1853	1.1819	1.1665	1.1665	1.1636	1.1724	1.1819	1.1887	1.1957 (40)
HLP (average)												1.1853 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

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Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Total heat required for water heating calculated for each month													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(64)
Total per year (kWh/year) = Sum(64)m =												1991.1144	(64)
Heat gains from water heating, kWh/month													
86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	85.0223	(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	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
49.9002	44.3209	36.0442	27.2878	20.3979	17.2208	18.6077	24.1869	32.4637	41.2201	48.1099	51.2870	51.2870	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
325.7704	329.1509	320.6322	302.4969	279.6043	258.0886	243.7147	240.3342	248.8529	266.9882	289.8808	311.3965	311.3965	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	(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)													
-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)													
116.4036	114.2683	109.8341	103.8059	99.8921	94.3813	89.6973	95.6988	97.8311	104.0705	111.1159	114.2772	114.2772	(72)
Total internal gains													
593.2822	588.9481	567.7185	534.7985	501.1024	470.8987	453.2277	461.4280	480.3558	513.4869	550.3146	578.1689	578.1689	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
East					3.9900	19.6403	0.6300	0.7000	0.7700				23.9493 (76)
Southeast					1.1100	36.7938	0.6300	0.7000	0.7700				12.4816 (77)
South					7.7200	46.7521	0.6300	0.7000	0.7700				110.3037 (78)
Southwest					1.1100	36.7938	0.6300	0.7000	0.7700				12.4816 (79)

Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705 (83)	
Total gains	752.4983	858.9684	933.1680	979.4917	990.7703	953.0480	919.7464	895.1813	873.4687	810.9204	740.8241	714.5393 (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	76.7025	76.9480	77.1902	78.3484	78.5690	79.6123	79.6123	79.8086	79.2072	78.5690	78.1240	77.6642	
alpha	6.1135	6.1299	6.1460	6.2232	6.2379	6.3075	6.3075	6.3206	6.2805	6.2379	6.2083	6.1776	
util living area	0.9948	0.9876	0.9694	0.9176	0.8020	0.6101	0.4418	0.4727	0.7041	0.9280	0.9873	0.9961	(86)
MIT	20.2065	20.3564	20.5543	20.7766	20.9269	20.9892	20.9987	20.9981	20.9742	20.7919	20.4606	20.1803	(87)
Th 2	19.9114	19.9145	19.9176	19.9318	19.9345	19.9469	19.9469	19.9492	19.9421	19.9345	19.9291	19.9234	(88)
util rest of house	0.9926	0.9825	0.9570	0.8855	0.7366	0.5158	0.3370	0.3661	0.6105	0.8930	0.9811	0.9945	(89)
MIT 2	18.8889	19.1070	19.3893	19.6987	19.8755	19.9416	19.9466	19.9487	19.9273	19.7272	19.2703	18.8601	(90)
Living area fraction									fLA = Living area / (4) =			0.2942	(91)
MIT	19.2765	19.4746	19.7321	20.0158	20.1848	20.2498	20.2562	20.2575	20.2353	20.0404	19.6204	19.2485	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2765	19.4746	19.7321	20.0158	20.1848	20.2498	20.2562	20.2575	20.2353	20.0404	19.6204	19.2485	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9909	0.9799	0.9543	0.8884	0.7532	0.5436	0.3679	0.3976	0.6377	0.8971	0.9788	0.9931	(94)
Useful gains	745.6440	841.6631	890.5376	870.1967	746.2019	518.0691	338.3967	355.9257	557.0185	727.4602	725.0926	709.5754	(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													
1440.4159	1397.2866	1264.5988	1046.6415	796.6680	523.5298	338.7902	356.5643	571.4267	886.3953	1182.2836	1429.4153	1429.4153	(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													
516.9103	373.3790	278.3016	127.0402	37.5468	0.0000	0.0000	0.0000	0.0000	0.0000	118.2477	329.1776	535.5608	(98)
Space heating												2316.1640	(98)
Space heating per m2												29.1561	(99)

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2316.1640 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2431.9722 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1991.1144 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702 (310a)
Electricity used for heat distribution	45.2264 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	352.5010 (332)
Total delivered energy for all uses	4875.1434 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2431.9722	4.2400	103.1156 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2090.6702	4.2400	88.6444 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	352.5010	13.1900	46.4949 (350)
Additional standing charges			120.0000 (351)
Total energy cost			358.2549 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200 (356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.2092 (357)
SAP value	83.1323
SAP rating (Section 12)	83 (358)
SAP band	B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1507.5475	0.5190	782.4171 (367)
Electrical energy for heat distribution	45.2264	0.5190	23.4725 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			805.8896 (373)
Space and water heating			805.8896 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	0.5190	182.9480 (379)
Total kg/year			988.8377 (383)
CO2 emissions per m2			12.4500 (384)
EI value			89.3520 (384a)
EI rating			89 (385)
EI band			B

Calculation of stars for heating and DHW

Space heating energy efficiency	1.00 x 4.240 x 1.05
= 4.452, stars = 4	
Space heating environmental impact	1.00 x 0.519 x 1.05 / 3.0000
= 0.1817, stars = 5	
Water heating energy efficiency	4.452, stars = 4
Water heating environmental impact	0.1817, stars = 5

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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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.4201	0.4014	0.4107	0.3734	0.3734	0.3454	0.3454	0.3174	0.3454	0.3641	0.3547	0.3827 (22b)
Effective ac	0.5882	0.5806	0.5844	0.5697	0.5697	0.5596	0.5596	0.5504	0.5596	0.5663	0.5629	0.5732 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	42.8758			(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (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	41.0188	40.4841	40.7484	39.7275	39.7275	39.0257	39.0257	38.3785	39.0257	39.4875	39.2536	39.9737 (38)
Heat transfer coeff	94.4284	93.8936	94.1579	93.1371	93.1371	92.4352	92.4352	91.7881	92.4352	92.8970	92.6631	93.3832 (39)
Average = Sum(39)m / 12 =												93.0659 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1887	1.1819	1.1853	1.1724	1.1724	1.1636	1.1636	1.1554	1.1636	1.1694	1.1665	1.1755 (40)
HLP (average)												1.1715 (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	2.4521 (42)
Average daily hot water use (litres/day)	92.4386 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(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													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)
Output from w/h													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(64)
Heat gains from water heating, kWh/month													
86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	85.0223	(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	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
49.9002	44.3209	36.0442	27.2878	20.3979	17.2208	18.6077	24.1869	32.4637	41.2201	48.1099	51.2870	51.2870	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
325.7704	329.1509	320.6322	302.4969	279.6043	258.0886	243.7147	240.3342	248.8529	266.9882	289.8808	311.3965	311.3965	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	(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)													
-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)													
116.4036	114.2683	109.8341	103.8059	99.8921	94.3813	89.6973	95.6988	97.8311	104.0705	111.1159	114.2772	114.2772	(72)
Total internal gains													
593.2822	588.9481	567.7185	534.7985	501.1024	470.8987	453.2277	461.4280	480.3558	513.4869	550.3146	578.1689	578.1689	(73)

6. Solar gains

[Jan]													
	Area	Solar flux	Specific data	g	Specific data	FF	Access	Gains					
	m2	Table 6a	or Table 6b	W/m2	or Table 6c		factor	W					
							Table 6d						
East	3.9900	22.3313	0.6300	0.7000	0.7700	27.2307	(76)						
Southeast	1.1100	40.4699	0.6300	0.7000	0.7700	13.7286	(77)						
South	7.7200	50.9848	0.6300	0.7000	0.7700	120.2901	(78)						
Southwest	1.1100	40.4699	0.6300	0.7000	0.7700	13.7286	(79)						
Solar gains	174.9781	266.7895	360.5110	452.1503	484.4895	511.9300	489.3815	460.4763	416.5881	313.7384	208.9242	148.4801	(83)
Total gains	768.2603	855.7376	928.2295	986.9489	985.5919	982.8288	942.6092	921.9043	896.9438	827.2253	759.2388	726.6490	(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	78.1240	78.5690	78.3484	79.2072	79.2072	79.8086	79.8086	80.3713	79.8086	79.4118	79.6123	78.9984	
alpha	6.2083	6.2379	6.2232	6.2805	6.2805	6.3206	6.3206	6.3581	6.3206	6.2941	6.3075	6.2666	
util living area	0.9930	0.9851	0.9601	0.8887	0.7332	0.4863	0.3137	0.3383	0.6067	0.8931	0.9814	0.9947	(86)
MIT	20.2882	20.4224	20.6297	20.8369	20.9618	20.9975	20.9999	20.9998	20.9903	20.8576	20.5462	20.2653	(87)
Th 2	19.9291	19.9345	19.9318	19.9421	19.9421	19.9492	19.9492	19.9558	19.9492	19.9446	19.9469	19.9396	(88)
util rest of house	0.9901	0.9790	0.9437	0.8475	0.6552	0.3896	0.2108	0.2345	0.5065	0.8445	0.9723	0.9924	(89)
MIT 2	19.0209	19.2174	19.5055	19.7821	19.9157	19.9484	19.9492	19.9558	19.9449	19.8148	19.4060	18.9962	(90)
Living area fraction									fLA = Living area / (4) =			0.2942	(91)
MIT	19.3937	19.5719	19.8362	20.0924	20.2234	20.2570	20.2583	20.2629	20.2524	20.1215	19.7414	19.3696	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3937	19.5719	19.8362	20.0924	20.2234	20.2570	20.2583	20.2629	20.2524	20.1215	19.7414	19.3696	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9881	0.9763	0.9419	0.8541	0.6771	0.4182	0.2410	0.2651	0.5361	0.8538	0.9700	0.9908	(94)
Useful gains	759.0876	835.4563	874.2783	842.9585	667.3059	411.0027	227.2133	244.3858	480.8545	706.2613	736.4804	719.9307	(95)
Ext temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	(96)
Heat loss rate W													
1378.0634	1330.6498	1180.3817	967.9171	691.3961	411.9869	227.2348	244.4246	485.5076	810.2056	1115.7958	1360.5526	1360.5526	(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													
460.5180	332.7700	227.7409	89.9702	17.9231	0.0000	0.0000	0.0000	0.0000	0.0000	77.3345	273.1071	476.6227	(98)
Space heating												1955.9865	(98)
Space heating per m2												(98) / (4) =	24.6222 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	1955.9865 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2053.7858 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1991.1144 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702 (310a)
Electricity used for heat distribution	41.4446 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	352.5010 (332)
Total delivered energy for all uses	4496.9570 (338)

10b. Fuel costs - using BEDF prices (482)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2053.7858	4.5600	93.6526 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2090.6702	4.5600	95.3346 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	352.5010	19.1200	67.3982 (350)
Additional standing charges			94.0000 (351)
Total energy cost			350.3854 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1381.4853	0.5190	716.9909 (367)
Electrical energy for heat distribution	41.4446	0.5190	21.5097 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			738.5006 (373)
Space and water heating			738.5006 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	0.5190	182.9480 (379)
Total kg/year			921.4486 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1381.4853	3.0700	4241.1600 (367)
Electrical energy for heat distribution	41.4446	3.0700	127.2348 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			4368.3948 (373)
Space and water heating			4368.3948 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	3.0700	1082.1781 (379)
Primary energy kWh/year			5450.5729 (383)
Primary energy kWh/m2/year			68.6124 (384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 89

(For testing purposes):

A Not considered
B Not considered
C Not considered

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures: SAP change Cost change CO2 change
 (none)

Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 482 TEST (31 Aug 2021)
 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	£67	£67	£0
Community scheme	£283	£283	£0
Space heating	£188	£188	£0
Water heating	£95	£95	£0
Lighting	£67	£67	£0
Total cost of fuels	£350	£350	£0
Total cost of uses	£350	£350	£0
Delivered energy	57 kWh/m²	57 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	334.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	278.93 (P1)
Transmission heat loss coefficient	53.41 (37)
Summer heat loss coefficient	332.34 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South	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
East	3.9900	117.5071	0.6300	0.7000	0.9000	167.4791
South East	1.1100	119.9223	0.6300	0.7000	0.9000	47.5496
South	7.7200	112.2060	0.6300	0.7000	0.9000	309.4261
South West	1.1100	119.9223	0.6300	0.7000	0.9000	47.5496
total:						572.0043

	Jun	Jul	Aug	
Solar gains	598	572	541	(P3)
Internal gains	471	453	461	
Total summer gains	1069	1025	1003	(P5)
Summer gain/loss ratio	3.22	3.08	3.02	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 334.3)	0.00	0.00	0.00	
Threshold temperature	19.22	20.98	20.82	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-06			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT Mid		
Property	Plot 6, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	13.91	TER	24.52
Environmental	89 B	% DER<TER	43.28		
CO ₂ Emissions (t/year)	0.93	DFEE	42.60	TFEE	44.96
General Requirements Compliance	Pass	% DFEE<TFEE	5.25		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 79 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 (c)
 Fuel factor:1.55 (electricity)
 Target Carbon Dioxide Emission Rate (TER) 24.52 kgCO₂/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 13.91 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)45.0 kWh/m²/yr
 Dwelling Fabric Energy Efficiency (DFEE)42.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.150

3 Air permeability

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

4 Heating efficiency

Main heating system: Community heating scheme -
 Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day
 Permitted by DBSCG 2.10 OK
 Primary pipework insulated: Yes (assumed) OK

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK
 Hot water controls: Cylinderstat OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
 Based on:
 Overshading: Average
 Windows facing South East: 1.00 m², No overhang
 Windows facing South: 7.02 m², No overhang
 Windows facing South West: 1.00 m², No overhang
 Windows facing West: 3.80 m², No overhang
 Air change rate: 4.00 ach
 Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (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	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1700	6.9972	9.0000	370.4400 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
PIJ	29.8500		29.8500	0.1300	3.8805	9.0000	268.6500 (30)
Total net area of external elements Aum (m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1462		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Floor 1			79.4400			40.0000	3177.6000 (32d)
Party Ceilings 1			49.5900			30.0000	1487.7000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19115.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 240.6261 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 16.1445 (36)
Total fabric heat loss (33) + (36) = 51.2907 (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	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	94.0596	93.7527	93.4519	92.0391	91.7748	90.5443	90.5443	90.3164	91.0182	91.7748	92.3095	92.8686 (39)
Average = Sum(39)m / 12 =												92.0379 (39)
HLP	1.1840	1.1802	1.1764	1.1586	1.1553	1.1398	1.1398	1.1369	1.1457	1.1553	1.1620	1.1690 (40)
HLP (average)												1.1586 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy content (annual)	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)

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Water storage loss:													
Store volume												180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.7200 (55)	
Total storage loss													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)
If cylinder contains dedicated solar storage													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(62)
Solar input												0.0000 (63)	
												0.0000	
												0.0000	
												0.0000	
												0.0000	
												0.0000	
Solar input (sum of months) = Sum (63)m =												0.0000 (63)	
Output from w/h													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(64)
												1991.1144 (64)	
Total per year (kWh/year) = Sum (64)m =													
Heat gains from water heating, kWh/month													
	86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9913	0.9815	0.9608	0.9115	0.8085	0.6246	0.4382	0.4745	0.7222	0.9245	0.9821	0.9933 (94)
Useful gains	555.4431	647.5710	705.4083	716.3991	651.5141	485.8958	328.5260	344.0477	504.3528	584.2013	548.9276	524.6386 (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	1358.4612	1321.2170	1199.7994	998.8769	767.5998	509.9799	331.9424	349.0788	553.9253	843.7998	1116.9503	1347.5856 (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	597.4455	452.6902	367.8270	203.3841	86.3677	0.0000	0.0000	0.0000	0.0000	193.1413	408.9764	612.2726 (98)
Space heating												2922.1047 (98)
Space heating per m2												36.7838 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2922.1047	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3068.2099	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1991.1144	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702	(310a)
Electricity used for heat distribution	51.5888	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	357.9139	(332)
Total delivered energy for all uses	5516.7940	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1719.6267	0.5190	892.4863 (367)
Electrical energy for heat distribution	51.5888	0.5190	26.7746 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			919.2608 (373)
Space and water heating			919.2608 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	357.9139	0.5190	185.7573 (379)
Total CO2, kg/year			1105.0182 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9100 (384)

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

DER		13.9100	ZC1
Total Floor Area	TFA	79.4400	
Assumed number of occupants	N	2.4521	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2815	ZC2
CO2 emissions from cooking, equation (L16)		2.2388	ZC3
Total CO2 emissions		32.4303	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		32.4303	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1800	7.4088		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
PIJ	29.8500		29.8500	0.1300	3.8805		(30)
Total net area of external elements Aum(A, m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.1685		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1105 (36)
Total fabric heat loss						(33) + (36) =	46.2790 (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	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	87.4370	87.1927	86.9532	85.8284	85.6179	84.6382	84.6382	84.4568	85.0156	85.6179	86.0436	86.4887 (39)
Average = Sum(39)m / 12 =												85.8274 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1007	1.0976	1.0946	1.0804	1.0778	1.0654	1.0654	1.0632	1.0702	1.0778	1.0831	1.0887 (40)
HLP (average)												1.0804 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy content (annual)	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1454.4184 (45)
Water storage loss:	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)

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Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (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	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Heat gains from water heating, kWh/month	89.5325	79.4331	84.6448	77.5740	77.2479	70.7883	69.6630	74.1281	73.2722	80.3567	82.8372	87.9505 (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	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2666	18.0006	14.6391	11.0827	8.2845	6.9941	7.5574	9.8233	13.1849	16.7412	19.5395	20.8298 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607 (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)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)	
Water heating gains (Table 5)	120.3394	118.2041	113.7699	107.7416	103.8279	98.3171	93.6331	99.6346	101.7669	108.0063	115.0517	118.2130 (72)	
Total internal gains	421.6544	419.5180	406.0147	384.2795	362.2295	341.0128	327.2616	333.2641	344.4655	366.4119	391.5935	410.4608 (73)	

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c		Access factor Table 6d	Gains W		
Southeast				1.0000	36.7938	0.6300	0.7000		0.7700	11.2447 (77)		
South				7.0200	46.7521	0.6300	0.7000		0.7700	100.3020 (78)		
Southwest				1.0000	36.7938	0.6300	0.7000		0.7700	11.2447 (79)		
West				3.8000	19.6403	0.6300	0.7000		0.7700	22.8088 (80)		
Solar gains	145.6002	247.1954	335.1446	408.6086	450.5251	443.8337	429.3531	398.7971	360.8006	272.4616	174.2691	124.6732 (83)
Total gains	567.2546	666.7134	741.1593	792.8881	812.7546	784.8465	756.6147	732.0612	705.2661	638.8735	565.8626	535.1340 (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	63.0931	63.2699	63.4441	64.2756	64.4336	65.1794	65.1794	65.3194	64.8901	64.4336	64.1147	63.7848	
alpha	5.2062	5.2180	5.2296	5.2850	5.2956	5.3453	5.3453	5.3546	5.3260	5.2956	5.2743	5.2523	
util living area	0.9955	0.9891	0.9734	0.9304	0.8324	0.6576	0.4865	0.5222	0.7555	0.9444	0.9897	0.9967 (86)	
MIT	19.9317	20.1115	20.3559	20.6398	20.8566	20.9693	20.9948	20.9925	20.9355	20.6561	20.2389	19.9005 (87)	
Th 2	20.0003	20.0028	20.0053	20.0169	20.0190	20.0292	20.0292	20.0310	20.0253	20.0190	20.0146	20.0100 (88)	
util rest of house	0.9941	0.9856	0.9648	0.9076	0.7809	0.5711	0.3822	0.4166	0.6757	0.9213	0.9858	0.9956 (89)	
MIT 2	18.5870	18.8495	19.2019	19.6056	19.8829	20.0093	20.0273	20.0281	19.9774	19.6368	19.0446	18.5486 (90)	
Living area fraction									fLA = Living area / (4) =			0.2942 (91)	
MIT	18.9826	19.2207	19.5414	19.9098	20.1694	20.2918	20.3119	20.3118	20.2593	19.9367	19.3960	18.9463 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.9826	19.2207	19.5414	19.9098	20.1694	20.2918	20.3119	20.3118	20.2593	19.9367	19.3960	18.9463 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	562.7201	654.7098	711.2740	717.3242	641.7339	467.3963	312.4890	327.8008	491.0742	587.1014	555.9645	531.8753 (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	1283.8004	1248.6634	1133.9881	944.9567	725.1286	481.7396	314.1695	330.3765	523.6351	799.3868	1057.9891	1275.3862 (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	536.4837	399.1368	314.4993	163.8954	62.0456	0.0000	0.0000	0.0000	0.0000	157.9404	361.4577	553.1721 (98)	
Space heating												2548.6311 (98)	
Space heating per m2												(98) / (4) =	32.0825 (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												2725.8086 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	536.4837	399.1368	314.4993	163.8954	62.0456	0.0000	0.0000	0.0000	0.0000	157.9404	361.4577	553.1721 (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)	573.7794	426.8843	336.3629	175.2892	66.3590	0.0000	0.0000	0.0000	0.0000	168.9202	386.5858	591.6279 (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	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Efficiency of water heater (217)m	87.3201	86.9281	86.2136	84.7750	82.4878	79.8000	79.8000	79.8000	79.8000	84.5807	86.6090	79.8000 (216)
Fuel for water heating, kWh/month	229.0822	202.8814	214.9716	196.1694	197.7125	182.8254	175.7856	192.6138	192.1866	203.8744	210.2921	223.3241 (219)
Water heating fuel used												2421.7191 (219)
Annual totals kWh/year												
Space heating fuel - main system												2725.8086 (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)												357.9139 (232)
Total delivered energy for all uses												5580.4417 (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	2725.8086	0.2160	588.7747 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2421.7191	0.2160	523.0913 (264)
Space and water heating			1111.8660 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	357.9139	0.5190	185.7573 (268)
Total CO2, kg/m2/year			1336.5483 (272)
Emissions per m2 for space and water heating			13.9963 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3383 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9963 * 1.55) + 2.3383 + 0.4900, rounded to 2 d.p.			24.5200 (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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1420 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3920 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1700	6.9972	9.0000	370.4400 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
PIJ	29.8500		29.8500	0.1300	3.8805	9.0000	268.6500 (30)
Total net area of external elements Aum, m ²			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1462		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Floor 1			79.4400			40.0000	3177.6000 (32d)
Party Ceilings 1			49.5900			20.0000	991.8000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18619.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 234.3837 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 16.1445 (36)
Total fabric heat loss (33) + (36) = 51.2907 (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	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	92.4487	92.2043	91.9649	90.8400	90.6296	89.6499	89.6499	89.4685	90.0273	90.6296	91.0553	91.5004 (39)
Average = Sum(39)m / 12 =												90.8390 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1638	1.1607	1.1577	1.1435	1.1409	1.1285	1.1285	1.1262	1.1333	1.1409	1.1462	1.1518 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy content (annual)	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	32.0433	28.0253	28.9196	25.2128	24.1923	20.8761	19.3448	22.1984	22.4635	26.1791	28.5765	31.0322	(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	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2666	18.0006	14.6391	11.0827	8.2845	6.9941	7.5574	9.8233	13.1849	16.7412	19.5395	20.8298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(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)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	43.0690	41.7043	38.8704	35.0178	32.5165	28.9946	26.0010	29.8366	31.1993	35.1869	39.6896	41.7100	(72)
Total internal gains	341.3840	340.0182	328.1153	308.5556	287.9181	268.6903	256.6295	260.4661	270.8979	290.5925	313.2314	330.9578	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W		
Southeast				1.0000	36.7938	0.6300	0.7000		0.7700		11.2447	(77)	
South				7.0200	46.7521	0.6300	0.7000		0.7700		100.3020	(78)	
Southwest				1.0000	36.7938	0.6300	0.7000		0.7700		11.2447	(79)	
West				3.8000	19.6403	0.6300	0.7000		0.7700		22.8088	(80)	
Solar gains	145.6002	247.1954	335.1446	408.6086	450.5251	443.8337	429.3531	398.7971	360.8006	272.4616	174.2691	124.6732	(83)
Total gains	486.9841	587.2137	663.2599	717.1643	738.4432	712.5239	685.9826	659.2632	631.6986	563.0541	487.5005	455.6310	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	55.9453	56.0935	56.2396	56.9360	57.0682	57.6918	57.6918	57.8088	57.4500	57.0682	56.8014	56.5251		
alpha	4.7297	4.7396	4.7493	4.7957	4.8045	4.8461	4.8461	4.8539	4.8300	4.8045	4.7868	4.7683		
util living area	0.9971	0.9925	0.9814	0.9510	0.8775	0.7288	0.5576	0.5988	0.8214	0.9643	0.9936	0.9979	(86)	
MIT	19.6873	19.8809	20.1524	20.4806	20.7573	20.9320	20.9851	20.9791	20.8724	20.5022	20.0276	19.6542	(87)	
Th 2	19.9491	19.9516	19.9540	19.9655	19.9676	19.9776	19.9776	19.9795	19.9738	19.9676	19.9633	19.9587	(88)	
util rest of house	0.9961	0.9901	0.9753	0.9339	0.8337	0.6399	0.4367	0.4781	0.7476	0.9484	0.9912	0.9972	(89)	
MIT 2	18.7563	18.9508	19.2208	19.5478	19.8011	19.9450	19.9736	19.9732	19.9032	19.5752	19.1069	18.7310	(90)	
Living area fraction										fLA = Living area / (4) =		0.2942	(91)	
MIT	19.0302	19.2244	19.4949	19.8222	20.0824	20.2353	20.2711	20.2691	20.1883	19.8479	19.3778	19.0026	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0302	19.2244	19.4949	19.8222	20.0824	20.2353	20.2711	20.2691	20.1883	19.8479	19.3778	19.0026	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9880	0.9719	0.9311	0.8392	0.6640	0.4726	0.5139	0.7649	0.9461	0.9893	0.9963	(94)
Useful gains	484.5616	580.1491	644.6148	667.7178	619.7367	473.1367	324.1761	338.7831	483.1929	532.7089	482.2838	453.9514	(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	1361.7870	1320.7726	1195.0729	992.1748	759.6928	505.2066	329.1167	346.1621	548.1148	838.1348	1117.9578	1354.4405	(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	652.6557	497.6990	409.5409	233.6090	104.1273	0.0000	0.0000	0.0000	0.0000	227.2369	457.6853	669.9639	(98)
Space heating												3252.5180	(98)
Space heating per m2												(98) / (4) =	40.9431 (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	842.7091	663.4093	679.9605	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8650	0.9257	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	728.9099	614.1436	619.4862	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	924.5431	891.6585	862.0637	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	140.8559	206.4711	180.4776	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												527.8046 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	35.2140	51.6178	45.1194	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												131.9512 (107)
Space cooling per m2												1.6610 (108)
Energy for space heating												40.9431 (99)
Energy for space cooling												1.6610 (108)
Total												42.6041 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.6 (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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1800	7.4088		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
PIJ	29.8500		29.8500	0.1300	3.8805		(30)
Total net area of external elements Aum(A, m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.1685		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1105 (36)
Total fabric heat loss							(33) + (36) = 46.2790 (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	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	87.4370	87.1927	86.9532	85.8284	85.6179	84.6382	84.6382	84.4568	85.0156	85.6179	86.0436	86.4887 (39)
Average = Sum(39)m / 12 =												85.8274 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1007	1.0976	1.0946	1.0804	1.0778	1.0654	1.0654	1.0632	1.0702	1.0778	1.0831	1.0887 (40)
HLP (average)												1.0804 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (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)

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 (59)
Heat gains from water heating, kWh/month	32.0433	28.0253	28.9196	25.2128	24.1923	20.8761	19.3448	22.1984	22.4635	26.1791	28.5765	31.0322 (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	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2666	18.0006	14.6391	11.0827	8.2845	6.9941	7.5574	9.8233	13.1849	16.7412	19.5395	20.8298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607 (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)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)
Water heating gains (Table 5)	43.0690	41.7043	38.8704	35.0178	32.5165	28.9946	26.0010	29.8366	31.1993	35.1869	39.6896	41.7100 (72)
Total internal gains	341.3840	340.0182	328.1153	308.5556	287.9181	268.6903	256.6295	260.4661	270.8979	290.5925	313.2314	330.9578 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				1.0000	36.7938	0.6300	0.7000	0.7700	11.2447 (77)			
South				7.0200	46.7521	0.6300	0.7000	0.7700	100.3020 (78)			
Southwest				1.0000	36.7938	0.6300	0.7000	0.7700	11.2447 (79)			
West				3.8000	19.6403	0.6300	0.7000	0.7700	22.8088 (80)			
Solar gains	145.6002	247.1954	335.1446	408.6086	450.5251	443.8337	429.3531	398.7971	360.8006	272.4616	174.2691	124.6732 (83)
Total gains	486.9841	587.2137	663.2599	717.1643	738.4432	712.5239	685.9826	659.2632	631.6986	563.0541	487.5005	455.6310 (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 _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	63.0931	63.2699	63.4441	64.2756	64.4336	65.1794	65.1794	65.3194	64.8901	64.4336	64.1147	63.7848
alpha	5.2062	5.2180	5.2296	5.2850	5.2956	5.3453	5.3453	5.3546	5.3260	5.2956	5.2743	5.2523
util living area	0.9978	0.9938	0.9832	0.9515	0.8711	0.7092	0.5332	0.5745	0.8092	0.9656	0.9948	0.9984 (86)
MIT	19.8377	20.0210	20.2731	20.5736	20.8167	20.9563	20.9920	20.9883	20.9095	20.5846	20.1490	19.8067 (87)
Th 2	20.0003	20.0028	20.0053	20.0169	20.0190	20.0292	20.0292	20.0310	20.0253	20.0190	20.0146	20.0100 (88)
util rest of house	0.9971	0.9918	0.9774	0.9341	0.8256	0.6215	0.4206	0.4610	0.7339	0.9497	0.9927	0.9979 (89)
MIT 2	18.9419	19.1261	19.3770	19.6765	19.8961	20.0091	20.0271	20.0277	19.9771	19.6936	19.2639	18.9188 (90)
Living area fraction									fLA = Living area / (4) =			0.2942 (91)
MIT	19.2054	19.3894	19.6406	19.9404	20.1669	20.2878	20.3110	20.3103	20.2514	19.9557	19.5243	19.1800 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2054	19.3894	19.6406	19.9404	20.1669	20.2878	20.3110	20.3103	20.2514	19.9557	19.5243	19.1800 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9963	0.9901	0.9747	0.9325	0.8333	0.6462	0.4540	0.4947	0.7531	0.9485	0.9913	0.9973 (94)
Useful gains	485.1665	581.3948	646.5091	668.7647	615.3326	460.4642	311.4561	326.1336	475.7592	534.0348	483.2534	454.4086 (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	1303.2850	1263.3660	1142.6186	947.5822	724.9211	481.4035	314.0912	330.2535	522.9631	801.0148	1069.0304	1295.6050 (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	608.6802	458.2846	369.1055	200.7486	81.5338	0.0000	0.0000	0.0000	0.0000	198.6331	421.7595	625.8502 (98)
Space heating												2964.5954 (98)
Space heating per m2										(98) / (4) =		37.3187 (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	795.5993	626.3229	641.8717	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8983	0.9496	0.9378	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	714.6912	594.7550	601.9518	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	924.5431	891.6585	862.0637	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	151.0933	220.8962	193.5232	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												565.5128 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	37.7733	55.2241	48.3808	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												141.3782 (107)
Space cooling per m2												1.7797 (108)
Energy for space heating												37.3187 (99)
Energy for space cooling												1.7797 (108)
Total												39.0984 (109)
Target Fabric Energy Efficiency (TFEE)												45.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.4201	0.4014	0.4107	0.3734	0.3734	0.3454	0.3454	0.3174	0.3454	0.3641	0.3547	0.3827 (22b)
Effective ac	0.5882	0.5806	0.5844	0.5697	0.5697	0.5596	0.5596	0.5504	0.5596	0.5663	0.5629	0.5732 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1700	6.9972	9.0000	370.4400 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
PIJ	29.8500		29.8500	0.1300	3.8805	9.0000	268.6500 (30)
Total net area of external elements Aum (m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1462		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Floor 1			79.4400			40.0000	3177.6000 (32d)
Party Ceilings 1			49.5900			30.0000	1487.7000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19115.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 240.6261 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 16.1445 (36)
Total fabric heat loss (33) + (36) = 51.2907 (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	41.0188	40.4841	40.7484	39.7275	39.7275	39.0257	39.0257	38.3785	39.0257	39.4875	39.2536	39.9737 (38)
Heat transfer coeff	92.3095	91.7748	92.0391	91.0182	91.0182	90.3164	90.3164	89.6692	90.3164	90.7782	90.5443	91.2643 (39)
Average = Sum(39)m / 12 =												90.9471 (39)
HLP	1.1620	1.1553	1.1586	1.1457	1.1457	1.1369	1.1369	1.1288	1.1369	1.1427	1.1398	1.1488 (40)
HLP (average)												1.1449 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)

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Water storage loss:													
Store volume												180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.7200 (55)	
Total storage loss													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	22.3200	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165 (64)	
								Total per year (kWh/year) = Sum(64)m =					1991.1144 (64)
												1991 (64)	
RHI water heating demand													
Heat gains from water heating, kWh/month													
	86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290	147.1290 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.6664	45.0015	36.5977	27.7068	20.7111	17.4852	18.8934	24.5583	32.9622	41.8530	48.8487	52.0746 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	325.7704	329.1509	320.6322	302.4969	279.6043	258.0886	243.7147	240.3342	248.8529	266.9882	289.8808	311.3965 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650	52.1650 (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)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)
Water heating gains (Table 5)	116.4036	114.2683	109.8341	103.8059	99.8921	94.3813	89.6973	95.6988	97.8311	104.0705	111.1159	114.2772 (72)
Total internal gains	594.0485	589.6287	568.2720	535.2176	501.4156	471.1632	453.5135	461.7994	480.8543	514.1198	551.0534	578.9564 (73)

[Jan				Area	Solar flux		g		FF		Access		Gains
				m2	Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
Southeast				1.0000	40.4699		0.6300		0.7000		0.7700		12.3681 (77)
South				7.0200	50.9848		0.6300		0.7000		0.7700		109.3830 (78)
Southwest				1.0000	40.4699		0.6300		0.7000		0.7700		12.3681 (79)
West				3.8000	22.3313		0.6300		0.7000		0.7700		25.9340 (80)
Solar gains	160.0533	244.3072	330.7215	415.5852	445.8659	471.3406	450.4912	423.4835	382.4689	287.4845	191.1630	135.7756	(83)
Total gains	754.1018	833.9359	898.9935	950.8027	947.2815	942.5038	904.0047	885.2829	863.3232	801.6044	742.2163	714.7320	(84)

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	57.5219	57.8570	57.6909	58.3379	58.3379	58.7913	58.7913	59.2156	58.7913	58.4922	58.6433	58.1806
alpha	4.8348	4.8571	4.8461	4.8892	4.8892	4.9194	4.9194	4.9477	4.9194	4.8995	4.9096	4.8787
util living area	0.9816	0.9684	0.9354	0.8611	0.7188	0.4900	0.3189	0.3432	0.6024	0.8632	0.9622	0.9849 (86)
MIT	20.0820	20.2404	20.4890	20.7442	20.9202	20.9905	20.9991	20.9987	20.9734	20.7810	20.4018	20.0561 (87)
Th 2	19.9505	19.9559	19.9533	19.9636	19.9636	19.9708	19.9708	19.9774	19.9708	19.9661	19.9685	19.9611 (88)
util rest of house	0.9761	0.9593	0.9166	0.8228	0.6495	0.3970	0.2168	0.2406	0.5098	0.8176	0.9495	0.9803 (89)
MIT 2	18.7710	19.0007	19.3465	19.6924	19.8979	19.9663	19.9707	19.9772	19.9550	19.7477	19.2424	18.7421 (90)
Living area fraction									fLA = Living area / (4) =			0.2942 (91)
MIT	19.1567	19.3654	19.6826	20.0018	20.1987	20.2676	20.2732	20.2777	20.2546	20.0517	19.5835	19.1287 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1567	19.3654	19.6826	20.0018	20.1987	20.2676	20.2732	20.2777	20.2546	20.0517	19.5835	19.1287 (93)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (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	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1700	6.9972	9.0000	370.4400 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
PIJ	29.8500		29.8500	0.1300	3.8805	9.0000	268.6500 (30)
Total net area of external elements Aum, m ²			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1462		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Floor 1			79.4400			40.0000	3177.6000 (32d)
Party Ceilings 1			49.5900			30.0000	1487.7000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19115.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 240.6261 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 16.1445 (36)
Total fabric heat loss (33) + (36) = 51.2907 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	94.0596	93.7527	93.4519	92.0391	91.7748	90.5443	90.5443	90.3164	91.0182	91.7748	92.3095	92.8686 (39)
Average = Sum(39)m / 12 =												92.0379 (39)
HLP	1.1840	1.1802	1.1764	1.1586	1.1553	1.1398	1.1398	1.1369	1.1457	1.1553	1.1620	1.1690 (40)
HLP (average)												1.1586 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

 8c. Space cooling requirement

Not applicable

 9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2308.8589 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2424.3018 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1991.1144 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702 (310a)
Electricity used for heat distribution	45.1497 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	357.9139 (332)
Total delivered energy for all uses	4872.8859 (338)

 10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2424.3018	4.2400	102.7904 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2090.6702	4.2400	88.6444 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	357.9139	13.1900	47.2088 (350)
Additional standing charges			120.0000 (351)
Total energy cost			358.6437 (355)

 11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200 (356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.2105 (357)
SAP value	83.1140
SAP rating (Section 12)	83 (358)
SAP band	B

 12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1504.9907	0.5190	781.0902 (367)
Electrical energy for heat distribution	45.1497	0.5190	23.4327 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			804.5229 (373)
Space and water heating			804.5229 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	357.9139	0.5190	185.7573 (379)
Total kg/year			990.2802 (383)
CO2 emissions per m2			12.4700 (384)
EI value			89.3364 (384a)
EI rating			89 (385)
EI band			B

 Calculation of stars for heating and DHW

Space heating energy efficiency	1.00 x 4.240 x 1.05
= 4.452, stars = 4	
Space heating environmental impact	1.00 x 0.519 x 1.05 / 3.0000
= 0.1817, stars = 5	
Water heating energy efficiency	4.452, stars = 4
Water heating environmental impact	0.1817, 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	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.4201	0.4014	0.4107	0.3734	0.3734	0.3454	0.3454	0.3174	0.3454	0.3641	0.3547	0.3827 (22b)
Effective ac	0.5882	0.5806	0.5844	0.5697	0.5697	0.5596	0.5596	0.5504	0.5596	0.5663	0.5629	0.5732 (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
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1700	6.9972	9.0000	370.4400 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
PIJ	29.8500		29.8500	0.1300	3.8805	9.0000	268.6500 (30)
Total net area of external elements Aum, m ²			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1462		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Floor 1			79.4400			40.0000	3177.6000 (32d)
Party Ceilings 1			49.5900			30.0000	1487.7000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19115.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 240.6261 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 16.1445 (36)
Total fabric heat loss (33) + (36) = 51.2907 (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	41.0188	40.4841	40.7484	39.7275	39.7275	39.0257	39.0257	38.3785	39.0257	39.4875	39.2536	39.9737 (38)
Heat transfer coeff	92.3095	91.7748	92.0391	91.0182	91.0182	90.3164	90.3164	89.6692	90.3164	90.7782	90.5443	91.2643 (39)
Average = Sum(39)m / 12 =												90.9471 (39)
HLP	1.1620	1.1553	1.1586	1.1457	1.1457	1.1369	1.1369	1.1288	1.1369	1.1427	1.1398	1.1488 (40)
HLP (average)												1.1449 (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												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)

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Water storage loss:													
Store volume												180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.7200 (55)	
Total storage loss													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)
If cylinder contains dedicated solar storage													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(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													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(62)
Solar input												0.0000 (63)	
												0.0000	
												0.0000	
												0.0000	
												0.0000	
Solar input (sum of months) = Sum (63)m =												0.0000 (63)	
Output from w/h													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(64)
Total per year (kWh/year) = Sum (64)m =												1991.1144 (64)	
Heat gains from water heating, kWh/month													
	86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9707	0.9529	0.9108	0.8244	0.6661	0.4243	0.2469	0.2709	0.5363	0.8219	0.9436	0.9755 (94)
Useful gains	731.9975	794.6390	818.8240	783.8096	631.0219	399.9232	223.1981	239.8315	462.9848	658.8347	700.3676	697.2211 (95)
Ext temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000 (96)
Heat loss rate W	1325.2598	1281.6713	1139.6834	937.6559	673.4138	403.5002	223.3715	240.1066	474.5771	785.3867	1075.9812	1307.6974 (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	441.3871	327.2857	238.7193	110.7693	31.5395	0.0000	0.0000	0.0000	0.0000	94.1547	270.4418	454.1944 (98)
Space heating												1968.4920 (98)
Space heating per m2												24.7796 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	1968.4920 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2066.9166 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1991.1144 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702 (310a)
Electricity used for heat distribution	41.5759 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	357.9139 (332)
Total delivered energy for all uses	4515.5006 (338)

10b. Fuel costs - using BEDF prices (482)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2066.9166	4.5600	94.2514 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2090.6702	4.5600	95.3346 (342a)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	357.9139	19.1200	68.4331 (350)
Additional standing charges			94.0000 (351)
Total energy cost			352.0191 (355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1385.8622	0.5190	719.2625 (367)
Electrical energy for heat distribution	41.5759	0.5190	21.5779 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			740.8404 (373)
Space and water heating			740.8404 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	357.9139	0.5190	185.7573 (379)
Total kg/year			926.5977 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1385.8622	3.0700	4254.5971 (367)
Electrical energy for heat distribution	41.5759	3.0700	127.6379 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			4382.2350 (373)
Space and water heating			4382.2350 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	357.9139	3.0700	1098.7957 (379)
Primary energy kWh/year			5481.0307 (383)
Primary energy kWh/m2/year			68.9959 (384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 89

(For testing purposes):

A Not considered
B Not considered

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures: (none)	SAP change	Cost change	CO2 change
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Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings £0		0.00 kg/m²

Potential energy efficiency rating: B 83
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 482 TEST (31 Aug 2021)
 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	£68	£68	£0
Community scheme	£284	£284	£0
Space heating	£188	£188	£0
Water heating	£95	£95	£0
Lighting	£68	£68	£0
Total cost of fuels	£352	£352	£0
Total cost of uses	£351	£351	£0
Delivered energy	57 kWh/m²	57 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 kWh/m²	0 kWh/m²

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	240.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	278.93 (P1)
Transmission heat loss coefficient	51.29 (37)
Summer heat loss coefficient	330.22 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	1.0000	119.9223	0.6300	0.7000	0.9000	42.8375
South	7.0200	112.2060	0.6300	0.7000	0.9000	281.3694
South West	1.0000	119.9223	0.6300	0.7000	0.9000	42.8375
West	3.8000	117.5071	0.6300	0.7000	0.9000	159.5039
total:						526.5481

	Jun	Jul	Aug	
Solar gains	551	527	498	(P3)
Internal gains	471	454	462	
Total summer gains	1022	980	960	(P5)
Summer gain/loss ratio	3.10	2.97	2.91	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 240.6)	0.32	0.32	0.32	
Threshold temperature	19.41	21.18	21.02	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			