

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	74278-07			Issued on Date	30/03/2023
Assessment Reference	001	Prop Type Ref	HT 2B3P (Mid)		
Property	Flat 7, 32 Brookstone Close, MANCHESTER, M21 7AE				
SAP Rating	89 B	DER	18.07	TER	20.07
Environmental	88 B	% DER<TER	9.98		
CO ₂ Emissions (t/year)	0.91	DFEE	18.51	TFEE	21.70
General Requirements Compliance	Pass	% DFEE<TFEE	14.69		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733 942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 61 m²

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

1a TER and DER

Fuel for main heating: Electricity
Fuel factor: 1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 20.07 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.07 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 21.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 18.5 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.35 (max. 2.00)	1.35 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.136

3 Air permeability

Air permeability at 50 pascals:	3.08 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Electric storage heaters with radiators or underfloor - Electric
High heat retention storage heaters	

Secondary heating system:	None
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5 Cylinder insulation

Hot water storage	Measured store loss: 1.13 kWh/day
Permitted by DBSCG 2.10	OK
Primary pipework insulated:	No primary pipework

6 Controls

Space heating controls:	Controls for high heat retention storage heaters	OK
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Hot water controls:	Cylinderstat	OK
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7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	0.32	
Maximum	0.7	OK

9 Summertime temperature

Overheating risk (West Pennines (England)): Not significant	OK
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Based on:

Overshading:	Average
Windows facing South West:	7.69 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Air permeability	3.1 m ³ /m ² h
Photovoltaic array	488.00 kWh/Year

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Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (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					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0800
Infiltration rate					0.1540 (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) =				0.1309 (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	0.1669	0.1636	0.1604	0.1440	0.1407	0.1244	0.1244	0.1211	0.1309	0.1407	0.1473	0.1538 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.35)			7.6900	1.2808	9.8496		(27)
Main	24.4100	7.6900	16.7200	0.1800	3.0096	110.0000	1839.2000 (29a)
Total net area of external elements Aum(A, m ²)			24.4100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				12.8592		(33)
Party Wall 1			53.2100	0.0000	0.0000	70.0000	3724.7000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			30.0000	1800.6000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10898.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		178.6000 (35)
Thermal bridges (User defined value 0.136 * total exposed area)		3.3198 (36)
Total fabric heat loss	(33) + (36) =	16.1790 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639 (38)
Average = Sum(39)m / 12 =	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611 (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													2.0103 (42)
Average daily hot water use (litres/day)													81.9452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)	
Energy conte	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)	
Energy content (annual)												Total = Sum(45)m = 1289.3164 (45)	
Distribution loss (46)m = 0.15 x (45)m	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)	

Anderson Goddard Ltd
eco-survey.com

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

Water storage loss:													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.1300 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.6780 (55)	
Total storage loss													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(56)
If cylinder contains dedicated solar storage	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(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)
Total heat required for water heating calculated for each month													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(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	(64)
Output from w/h	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
								Total per year (kWh/year) = Sum(64)m =				1536.7864	(65)
Heat gains from water heating, kWh/month													
	61.2612	54.0606	56.9283	51.2443	50.3711	45.2289	43.6472	47.6055	47.4308	53.1270	55.9100	59.8587	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	17.1800	15.2591	12.4096	9.3948	7.0227	5.9289	6.4064	8.3273	11.1768	14.1916	16.5636	17.6575 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	175.5119	177.3331	172.7436	162.9731	150.6395	139.0477	131.3036	129.4823	134.0719	143.8424	156.1760	167.7678 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516 (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)												
	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129 (71)
Water heating gains (Table 5)												
	82.3403	80.4474	76.5165	71.1726	67.7031	62.8179	58.6656	63.9858	65.8761	71.4072	77.6528	80.4553 (72)
Total internal gains												
	328.1870	326.1945	314.8245	296.6953	278.5202	260.9493	249.5305	254.9503	264.2797	282.5961	303.5473	319.0354 (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		
-----					7.6900	36.7938	0.6700		0.7000	0.7700	91.9618 (79)	

Solar gains	91.9618	156.6450	214.3285	265.5634	297.4531	295.3021	284.7027	260.9115	232.0724	173.1261	110.1490	78.7001 (83)
Total gains	420.1488	482.8394	529.1530	562.2587	575.9733	556.2514	534.2332	515.8618	496.3521	455.7221	413.6963	397.7356 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385
alpha	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026
util living area	0.9770	0.9505	0.8964	0.7902	0.6332	0.4617	0.3320	0.3592	0.5530	0.8195	0.9521	0.9827 (86)
MIT	20.4907	20.6213	20.7649	20.8850	20.9449	20.9613	20.9635	20.9633	20.9568	20.8809	20.6638	20.4482 (87)
Th 2	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753 (88)
util rest of house	0.9727	0.9419	0.8801	0.7625	0.5953	0.4175	0.2850	0.3107	0.5056	0.7885	0.9422	0.9794 (89)
MIT 2	19.6909	19.8760	20.0747	20.2321	20.3034	20.3203	20.3220	20.3219	20.3164	20.2301	19.9385	19.6299 (90)
Living area fraction									f _{liA} = Living area / (4) =			0.4012 (91)
MIT	20.0118	20.1750	20.3516	20.4940	20.5608	20.5774	20.5794	20.5792	20.5733	20.4912	20.2295	19.9582 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0118	20.1750	20.3516	20.4940	20.5608	20.5774	20.5794	20.5792	20.5733	20.4912	20.2295	19.9582 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9697	0.9389	0.8795	0.7679	0.6067	0.4319	0.3003	0.3266	0.5208	0.7946	0.9396	0.9767 (94)
Useful gains	407.4331	453.3227	465.3774	431.7778	349.4444	240.2390	160.4567	168.4643	258.5020	362.1061	388.7226	388.4698 (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	633.8589	616.2385	558.8136	467.7353	357.4695	241.1465	160.5392	168.6023	261.1525	399.0379	529.6820	635.7309 (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	168.4608	109.4795	69.5165	25.8894	5.9706	0.0000	0.0000	0.0000	0.0000	27.4773	101.4908	183.9622 (98)
Space heating												692.2471 (98)
Space heating per m2										(98) / (4) =		11.3446 (99)

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													692.2471 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	168.4608	109.4795	69.5165	25.8894	5.9706	0.0000	0.0000	0.0000	0.0000	27.4773	101.4908	183.9622	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	168.4608	109.4795	69.5165	25.8894	5.9706	0.0000	0.0000	0.0000	0.0000	27.4773	101.4908	183.9622	(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	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(219)
Water heating fuel used												1536.7864	(219)
Annual totals kWh/year													
Space heating fuel - main system												692.2471	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.4480)													
mechanical ventilation fans (SFP = 0.4480)													80.0426 (230a)
Total electricity for the above, kWh/year													80.0426 (231)
Electricity for lighting (calculated in Appendix L)													303.4043 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													2612.4804 (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	692.2471	0.5190	359.2763	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating	1536.7864	0.5190	797.5921	(264)
Space and water heating			1156.8684	(265)
Pumps and fans	80.0426	0.5190	41.5421	(267)
Energy for lighting	303.4043	0.5190	157.4668	(268)
Energy saving/generation technologies				
PV Unit (0.90*43.39 + 0.10*12.14)	-488.0000	0.5190	-253.2720	(269)
Total CO2, kg/year			1102.6053	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.0700	(273)

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

DER			18.0700	ZC1
Total Floor Area		TFA	61.0200	
Assumed number of occupants		N	2.0103	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.0444	ZC2
CO2 emissions from cooking, equation (L16)			2.7409	ZC3
Total CO2 emissions			37.8552	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			37.8552	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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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	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1366 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3866 (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) = 0.3286 (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	0.4189	0.4107	0.4025	0.3614	0.3532	0.3122	0.3122	0.3039	0.3286	0.3532	0.3697	0.3861 (22b)
Effective ac	0.5878	0.5843	0.5810	0.5653	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5683	0.5745 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			7.6900	1.3258	10.1951			(27)				
Main	24.4100	7.6900	16.7200	0.1800	3.0096			(29a)				
Total net area of external elements Aum(A, m2)			24.4100					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			13.2047		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								3.1793 (36)				
Total fabric heat loss						(33) + (36) =	16.3840	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.4050	28.2403	28.0789	27.3207	27.1788	26.5184	26.5184	26.3961	26.7728	27.1788	27.4658	27.7658 (38)
Heat transfer coeff	44.7890	44.6243	44.4629	43.7046	43.5628	42.9024	42.9024	42.7801	43.1568	43.5628	43.8498	44.1498 (39)
Average = Sum(39)m / 12 =												43.7040 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7340	0.7313	0.7287	0.7162	0.7139	0.7031	0.7031	0.7011	0.7073	0.7139	0.7186	0.7235 (40)
HLP (average)												0.7162 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												2.0103 (42)
												81.9452 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy conte	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Energy content (annual)										Total = Sum(45)m =		1289.3164 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	180.2694	158.9983	167.2382	150.2716	147.5174	132.1803	127.2951	139.1996	138.8025	155.8057	164.3040	176.0515 (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)
Output from w/h								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	180.2694	158.9983	167.2382	150.2716	147.5174	132.1803	127.2951	139.1996	138.8025	155.8057	164.3040	176.0515 (64)
	81.7227	72.5420	77.3898	71.0457	70.8327	65.0304	64.1088	68.0670	67.2323	73.5885	75.7115	80.3203 (65)
								Total per year (kWh/year) = Sum (64)m =				1837.9338 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1800	15.2591	12.4096	9.3948	7.0227	5.9289	6.4064	8.3273	11.1768	14.1916	16.5636	17.6575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5119	177.3331	172.7436	162.9731	150.6395	139.0477	131.3036	129.4823	134.0719	143.8424	156.1760	167.7678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	(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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	(71)
Water heating gains (Table 5)	109.8423	107.9494	104.0186	98.6746	95.2052	90.3200	86.1677	91.4879	93.3782	98.9093	105.1549	107.9573	(72)
Total internal gains	358.6891	356.6965	345.3266	327.1974	309.0222	291.4514	280.0325	285.4523	294.7817	313.0981	334.0493	349.5375	(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

Southwest					7.6900	36.7938	0.6300	0.7000			0.7700			86.4715 (79)

Solar gains	86.4715	147.2930	201.5327	249.7088	279.6947	277.6721	267.7055	245.3347	218.2173	162.7902	103.5730	74.0016	(83)	
Total gains	445.1606	503.9896	546.8593	576.9062	588.7169	569.1235	547.7380	530.7871	512.9990	475.8883	437.6223	423.5391	(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	94.6104	94.9595	95.3043	96.9576	97.2734	98.7707	98.7707	99.0530	98.1885	97.2734	96.6368	95.9801	
alpha	7.3074	7.3306	7.3536	7.4638	7.4849	7.5847	7.5847	7.6035	7.5459	7.4849	7.4425	7.3987	
util living area	0.9907	0.9766	0.9395	0.8401	0.6745	0.4815	0.3446	0.3706	0.5764	0.8593	0.9745	0.9931	(86)
MIT	20.4889	20.6230	20.7817	20.9262	20.9866	20.9991	20.9999	20.9999	20.9965	20.9263	20.6942	20.4642	(87)
Th 2	20.3109	20.3133	20.3156	20.3265	20.3286	20.3381	20.3381	20.3399	20.3344	20.3286	20.3244	20.3201	(88)
util rest of house	0.9881	0.9704	0.9249	0.8095	0.6303	0.4321	0.2928	0.3175	0.5226	0.8252	0.9667	0.9912	(89)
MIT 2	19.6347	19.8283	20.0507	20.2472	20.3167	20.3375	20.3381	20.3398	20.3320	20.2524	19.9407	19.6067	(90)
Living area fraction									fLA = Living area / (4) =			0.4012	(91)
MIT	19.9774	20.1471	20.3439	20.5196	20.5854	20.6029	20.6036	20.6046	20.5986	20.5227	20.2430	19.9507	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9774	20.1471	20.3439	20.5196	20.5854	20.6029	20.6036	20.6046	20.5986	20.5227	20.2430	19.9507	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	439.1949	488.2171	506.1399	472.2781	381.1600	257.1943	171.7464	179.8430	279.1162	397.6666	422.5776	419.2476	(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	702.1738	680.3925	615.5408	507.8299	387.0748	257.5393	171.7643	179.8747	280.4585	432.2613	576.3185	695.3902	(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	195.6563	129.1419	81.3943	25.5973	4.4006	0.0000	0.0000	0.0000	0.0000	25.7385	110.6935	205.4501	(98)
Space heating												778.0724	(98)
Space heating per m2												12.7511	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

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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												832.1630	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	195.6563	129.1419	81.3943	25.5973	4.4006	0.0000	0.0000	0.0000	0.0000	25.7385	110.6935	205.4501	(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)	209.2581	138.1196	87.0527	27.3768	4.7065	0.0000	0.0000	0.0000	0.0000	27.5278	118.3887	219.7327	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	180.2694	158.9983	167.2382	150.2716	147.5174	132.1803	127.2951	139.1996	138.8025	155.8057	164.3040	176.0515	(64)
Efficiency of water heater	85.0325	84.2653	83.0131	81.1973	80.0742	79.8000	79.8000	79.8000	79.8000	81.1604	83.7876	85.2265	(216)
(217)m	85.0325	84.2653	83.0131	81.1973	80.0742	79.8000	79.8000	79.8000	79.8000	81.1604	83.7876	85.2265	(217)
Fuel for water heating, kWh/month	212.0005	188.6878	201.4602	185.0698	184.2258	165.6395	159.5177	174.4356	173.9380	191.9725	196.0959	206.5690	(219)
Water heating fuel used												2239.6122	(219)
Annual totals kWh/year													
Space heating fuel - main system												832.1630	(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)												303.4043	(232)
Total delivered energy for all uses												3450.1795	(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	832.1630	0.2160	179.7472 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2239.6122	0.2160	483.7562 (264)
Space and water heating			663.5035 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	303.4043	0.5190	157.4668 (268)
Total CO2, kg/m2/year			859.8953 (272)
Emissions per m2 for space and water heating			10.8735 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.5806 (272b)
Emissions per m2 for pumps and fans			0.6379 (272c)
Target Carbon Dioxide Emission Rate (TER) = (10.8735 * 1.55) + 2.5806 + 0.6379, rounded to 2 d.p.			20.0700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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) =
Measured/design AP50					Yes
Infiltration rate					3.0800
Number of sides sheltered					0.2906 (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) =				0.2470 (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	0.3149	0.3087	0.3026	0.2717	0.2655	0.2346	0.2346	0.2285	0.2470	0.2655	0.2779	0.2902 (22b)
	0.5496	0.5477	0.5458	0.5369	0.5352	0.5275	0.5275	0.5261	0.5305	0.5352	0.5386	0.5421 (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
Window (Uw = 1.35)			7.6900	1.2808	9.8496		(27)
Main	24.4100	7.6900	16.7200	0.1800	3.0096	110.0000	1839.2000 (29a)
Total net area of external elements Aum(A, m ²)			24.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	12.8592		(33)
Party Wall 1			53.2100	0.0000	0.0000	70.0000	3724.7000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			20.0000	1200.4000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10297.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							168.7638 (35)
Thermal bridges (User defined value 0.136 * total exposed area)							3.3198 (36)
Total fabric heat loss						(33) + (36) =	16.1790 (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	26.5601	26.4671	26.3758	25.9475	25.8673	25.4942	25.4942	25.4251	25.6379	25.8673	26.0295	26.1990 (38)
Heat transfer coeff	42.7391	42.6460	42.5548	42.1264	42.0463	41.6732	41.6732	41.6041	41.8169	42.0463	42.2084	42.3779 (39)
Average = Sum(39)m / 12 =												42.1261 (39)
HLP	0.7004	0.6989	0.6974	0.6904	0.6891	0.6829	0.6829	0.6818	0.6853	0.6891	0.6917	0.6945 (40)
HLP (average)												0.6904 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy content (annual)	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1289.3164 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	28.4058	24.8439	25.6367	22.3507	21.4460	18.5063	17.1488	19.6785	19.9135	23.2073	25.3326	27.5095 (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	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1800	15.2591	12.4096	9.3948	7.0227	5.9289	6.4064	8.3273	11.1768	14.1916	16.5636	17.6575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5119	177.3331	172.7436	162.9731	150.6395	139.0477	131.3036	129.4823	134.0719	143.8424	156.1760	167.7678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	(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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	(71)
Water heating gains (Table 5)	38.1799	36.9701	34.4579	31.0426	28.8253	25.7032	23.0495	26.4496	27.6577	31.1926	35.1841	36.9752	(72)
Total internal gains	284.0266	282.7172	272.7659	256.5654	239.6424	223.8346	213.9143	217.4140	226.0612	242.3814	261.0786	275.5553	(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	
Southwest	7.6900		36.7938		0.6700		0.7000		0.7700		91.9618 (79)	
Solar gains	91.9618	156.6450	214.3285	265.5634	297.4531	295.3021	284.7027	260.9115	232.0724	173.1261	110.1490	78.7001 (83)
Total gains	375.9884	439.3622	487.0944	522.1287	537.0955	519.1367	498.6170	478.3256	458.1336	415.5075	371.2277	354.2555 (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	66.9305	67.0765	67.2203	67.9038	68.0333	68.6424	68.6424	68.7564	68.4065	68.0333	67.7719	67.5008	
alpha	5.4620	5.4718	5.4814	5.5269	5.5356	5.5762	5.5762	5.5838	5.5604	5.5356	5.5181	5.5001	
util living area	0.9855	0.9669	0.9265	0.8364	0.6890	0.5076	0.3669	0.3987	0.6111	0.8678	0.9690	0.9891	(86)
MIT	20.2011	20.3904	20.6139	20.8296	20.9510	20.9925	20.9990	20.9984	20.9799	20.8209	20.4705	20.1570	(87)
Th 2	20.3405	20.3418	20.3431	20.3493	20.3505	20.3559	20.3559	20.3569	20.3538	20.3505	20.3482	20.3457	(88)
util rest of house	0.9827	0.9608	0.9138	0.8113	0.6498	0.4587	0.3136	0.3436	0.5597	0.8413	0.9623	0.9869	(89)
MIT 2	19.6047	19.7913	20.0077	20.2123	20.3161	20.3518	20.3555	20.3563	20.3419	20.2094	19.8770	19.5656	(90)
Living area fraction	19.8440	20.0317	20.2509	20.4600	20.5708	20.6089	20.6137	20.6139	fLA = Living area / (4) =			0.4012	(91)
MIT	19.8440	20.0317	20.2509	20.4600	20.5708	20.6089	20.6137	20.6139	20.5979	20.4547	20.1151	19.8029	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8440	20.0317	20.2509	20.4600	20.5708	20.6089	20.6137	20.6139	20.5979	20.4547	20.1151	19.8029	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	368.5148	420.6979	444.1476	425.9542	356.3048	248.1659	167.0105	174.9050	265.4630	351.4410	356.2160	348.8483	(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	664.3364	645.3052	585.1670	486.9797	372.9853	250.4081	167.2623	175.3144	271.7214	414.3544	549.3460	661.2175	(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	220.0912	150.9361	104.9184	43.9384	12.4102	0.0000	0.0000	0.0000	0.0000	46.8076	139.0536	232.4027	(98)
Space heating												950.5583	(98)
Space heating per m2												15.5778	(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	391.7280	308.3816	316.1911	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9802	0.9921	0.9896	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	383.9770	305.9552	312.9178	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	682.4962	657.0891	634.7652	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	214.9339	261.2436	239.4545	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												715.6319	(104)
Cooled fraction												1.0000	(105)

$$fC = \text{cooled area} / (4) =$$

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	53.7335	65.3109	59.8636	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											178.9080 (107)
Space cooling per m2											2.9320 (108)
Energy for space heating											15.5778 (99)
Energy for space cooling											2.9320 (108)
Total											18.5098 (109)
Dwelling Fabric Energy Efficiency (DFEE)											18.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1366 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3866 (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) =		0.3286 (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												
	0.4189	0.4107	0.4025	0.3614	0.3532	0.3122	0.3122	0.3039	0.3286	0.3532	0.3697	0.3861 (22b)
Effective ac	0.5878	0.5843	0.5810	0.5653	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5683	0.5745 (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 Opening Type (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
Main	24.4100	7.6900	16.7200	0.1800	3.0096		(29a)
Total net area of external elements Aum(A, m ²)			24.4100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.2047		(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)							3.1793 (36)
Total fabric heat loss						(33) + (36) =	16.3840 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	28.4050	28.2403	28.0789	27.3207	27.1788	26.5184	26.5184
Heat transfer coeff	44.7890	44.6243	44.4629	43.7046	43.5628	42.9024	42.9024
Average = Sum(39)m / 12 =						42.7801	43.1568
	43.5628	43.8498	44.1498	44.7040			
HLP	0.7340	0.7313	0.7287	0.7162	0.7139	0.7031	0.7031
HLP (average)						0.7011	0.7073
Days in month	31	28	31	30	31	30	31
						30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy conte	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Energy content (annual)										Total = Sum(45)m =		1289.3164 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	28.4058	24.8439	25.6367	22.3507	21.4460	18.5063	17.1488	19.6785	19.9135	23.2073	25.3326	27.5095 (65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1800	15.2591	12.4096	9.3948	7.0227	5.9289	6.4064	8.3273	11.1768	14.1916	16.5636	17.6575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5119	177.3331	172.7436	162.9731	150.6395	139.0477	131.3036	129.4823	134.0719	143.8424	156.1760	167.7678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	(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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	(71)
Water heating gains (Table 5)	38.1799	36.9701	34.4579	31.0426	28.8253	25.7032	23.0495	26.4496	27.6577	31.1926	35.1841	36.9752	(72)
Total internal gains	284.0266	282.7172	272.7659	256.5654	239.6424	223.8346	213.9143	217.4140	226.0612	242.3814	261.0786	275.5553	(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	
Southwest	7.6900				36.7938		0.6300		0.7000		0.7700		86.4715 (79)	
Solar gains	86.4715	147.2930	201.5327	249.7088	279.6947	277.6721	267.7055	245.3347	218.2173	162.7902	103.5730	74.0016	(83)	
Total gains	370.4981	430.0103	474.2987	506.2742	519.3371	501.5067	481.6198	462.7488	444.2785	405.1716	364.6516	349.5570	(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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
tau	94.6104	94.9595	95.3043	96.9576	97.2734	98.7707	98.7707	99.0530	98.1885	97.2734	96.6368	95.9801	
alpha	7.3074	7.3306	7.3536	7.4638	7.4849	7.5847	7.5847	7.6035	7.5459	7.4849	7.4425	7.3987	
util living area	0.9970	0.9905	0.9700	0.9001	0.7497	0.5449	0.3918	0.4249	0.6591	0.9252	0.9911	0.9980	(86)
MIT	20.3696	20.5126	20.6922	20.8778	20.9736	20.9978	20.9998	20.9997	20.9917	20.8693	20.5856	20.3444	(87)
Th 2	20.3109	20.3133	20.3156	20.3265	20.3286	20.3381	20.3381	20.3399	20.3344	20.3286	20.3244	20.3201	(88)
util rest of house	0.9961	0.9878	0.9615	0.8757	0.7048	0.4897	0.3329	0.3641	0.6001	0.9010	0.9880	0.9974	(89)
MIT 2	19.7313	19.8750	20.0518	20.2329	20.3121	20.3372	20.3381	20.3398	20.3303	20.2303	19.9576	19.7142	(90)
Living area fraction									fLA = Living area / (4) =			0.4012	(91)
MIT	19.9873	20.1308	20.3087	20.4916	20.5774	20.6022	20.6036	20.6045	20.5957	20.4867	20.2095	19.9670	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9873	20.1308	20.3087	20.4916	20.5774	20.6022	20.6036	20.6045	20.5957	20.4867	20.2095	19.9670	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9869	0.9614	0.8821	0.7219	0.5119	0.3565	0.3885	0.6236	0.9073	0.9874	0.9969	(94)
Useful gains	368.8593	424.3768	456.0126	446.6049	374.8888	256.7079	171.7178	179.7874	277.0642	367.5934	360.0473	348.4890	(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	702.6199	679.6631	613.9760	506.6076	386.7262	257.5090	171.7622	179.8708	280.3318	430.6909	574.8499	696.1119	(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	248.3179	171.5524	117.5248	43.2019	8.8071	0.0000	0.0000	0.0000	0.0000	46.9445	154.6579	258.6315	(98)
Space heating												1049.6380	(98)
Space heating per m ²										(98) / (4) =		17.2015	(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	403.2827	317.4779	325.1290	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9908	0.9974	0.9963	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	399.5534	316.6681	323.9398	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	661.8898	637.2222	616.5586	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	188.8822	238.4923	217.7083	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												645.0828	(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	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	47.2206	0.0000	54.4271	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												101.6476	(107)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling per m2	1.6658 (108)
Energy for space heating	17.2015 (99)
Energy for space cooling	1.6658 (108)
Total	18.8673 (109)
Target Fabric Energy Efficiency (TFEE)	21.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (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					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0800
Infiltration rate					0.1540 (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) =				0.1309 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.1407	0.1374	0.1374	0.1276	0.1309	0.1113	0.1080	0.1080	0.1113	0.1244	0.1244	0.1276 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.35)			7.6900	1.2808	9.8496		(27)
Main	24.4100	7.6900	16.7200	0.1800	3.0096	110.0000	1839.2000 (29a)
Total net area of external elements Aum(A, m ²)			24.4100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				12.8592		(33)
Party Wall 1			53.2100	0.0000	0.0000	70.0000	3724.7000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			30.0000	1800.6000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10898.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		178.6000 (35)
Thermal bridges (User defined value 0.136 * total exposed area)		3.3198 (36)
Total fabric heat loss	(33) + (36) =	16.1790 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639 (38)
Average = Sum(39)m / 12 =	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy conte	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Energy content (annual)	Total = Sum(45)m =											1289.3164 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)

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Water storage loss:													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.1300 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.6780 (55)	
Total storage loss													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	20.3400	21.0180	20.3400	21.0180	(56)	
If cylinder contains dedicated solar storage													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	20.3400	21.0180	20.3400	21.0180	(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	(59)	
Total heat required for water heating calculated for each month													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746 (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													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746 (64)	
								Total per year (kWh/year) = Sum(64)m =					1536.7864 (64)
												1537 (64)	
RHI water heating demand													
Heat gains from water heating, kWh/month													
	61.2612	54.0606	56.9283	51.2443	50.3711	45.2289	43.6472	47.6055	47.4308	53.1270	55.9100	59.8587 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.9500	38.1478	31.0239	23.4871	17.5569	14.8222	16.0160	20.8182	27.9421	35.4789	41.4091	44.1437 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.9580	264.6763	257.8263	243.2434	224.8350	207.5338	195.9755	193.2572	200.1073	214.6902	233.0985	250.3997 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723 (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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129 (71)
Water heating gains (Table 5)	82.3403	80.4474	76.5165	71.1726	67.7031	62.8179	58.6656	63.9858	65.8761	71.4072	77.6528	80.4553 (72)
Total internal gains	476.5270	472.5502	454.6454	427.1818	399.3737	374.4527	359.9358	367.3399	383.2042	410.8550	441.4391	464.2775 (73)

[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
Southwest					7.6900	32.4665	0.6700	0.7000	0.7700			81.1462 (79)
Solar gains	81.1462	141.7883	202.7120	256.2691	280.0662	284.6815	267.8375	242.2640	225.5545	164.8574	99.8836	71.0264 (83)
Total gains	557.6732	614.3386	657.3575	683.4508	679.4400	659.1342	627.7734	609.6039	608.7587	575.7124	541.3227	535.3038 (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	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385
alpha	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026
util living area	0.9077	0.8564	0.7697	0.6364	0.4778	0.3241	0.2377	0.2580	0.4162	0.6567	0.8467	0.9240 (86)
MIT	20.7280	20.8073	20.8870	20.9406	20.9600	20.9634	20.9637	20.9637	20.9623	20.9400	20.8377	20.6927 (87)
Th 2	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753 (88)
util rest of house	0.8939	0.8378	0.7445	0.6047	0.4420	0.2860	0.1976	0.2167	0.3754	0.6200	0.8242	0.9121 (89)
MIT 2	20.0230	20.1292	20.2325	20.2976	20.3188	20.3220	20.3222	20.3222	20.3211	20.2980	20.1718	19.9747 (90)
Living area fraction									fLA = Living area / (4) =			0.4012 (91)
MIT	20.3058	20.4012	20.4951	20.5556	20.5760	20.5793	20.5795	20.5795	20.5784	20.5555	20.4389	20.2627 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3058	20.4012	20.4951	20.5556	20.5760	20.5793	20.5795	20.5795	20.5784	20.5555	20.4389	20.2627 (93)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (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					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0800
Infiltration rate					0.1540 (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) =	0.1309 (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	0.1669	0.1636	0.1604	0.1440	0.1407	0.1244	0.1244	0.1211	0.1309	0.1407	0.1473	0.1538 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.35)			7.6900	1.2808	9.8496		(27)
Main	24.4100	7.6900	16.7200	0.1800	3.0096	110.0000	1839.2000 (29a)
Total net area of external elements Aum(A, m ²)			24.4100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	12.8592			(33)
Party Wall 1			53.2100	0.0000	0.0000	70.0000	3724.7000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			30.0000	1800.6000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10898.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		178.6000 (35)
Thermal bridges (User defined value 0.136 * total exposed area)		3.3198 (36)
Total fabric heat loss	(33) + (36) =	16.1790 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639 (38)
Heat transfer coeff	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429 (39)
Average = Sum(39)m / 12 =												40.3429 (39)
HLP	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611 (40)
HLP (average)												0.6611 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
Daily hot water use	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy conte	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Energy content (annual)										Total = Sum(45)m =		1289.3164 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)

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Water storage loss:													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.1300 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.6780 (55)	
Total storage loss													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(56)
If cylinder contains dedicated solar storage													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(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)
Total heat required for water heating calculated for each month													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(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													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
Total per year (kWh/year) = Sum(64)m =													
												1536.7864	(64)
Heat gains from water heating, kWh/month													
	61.2612	54.0606	56.9283	51.2443	50.3711	45.2289	43.6472	47.6055	47.4308	53.1270	55.9100	59.8587	(65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													372.7933 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	96.4126	58.4251	33.7923	11.3136	2.3971	0.0000	0.0000	0.0000	0.0000	10.5847	50.8403	109.0276	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	96.4126	58.4251	33.7923	11.3136	2.3971	0.0000	0.0000	0.0000	0.0000	10.5847	50.8403	109.0276	(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	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(219)
Water heating fuel used												1536.7864	(219)
Annual totals kWh/year													
Space heating fuel - main system												372.7933	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.4480)													
mechanical ventilation fans (SFP = 0.4480)													80.0426 (230a)
Total electricity for the above, kWh/year													80.0426 (231)
Electricity for lighting (calculated in Appendix L)													303.4043 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													2293.0265 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (0.00*15.29 + 1.00*5.50)	372.7933	5.5000	20.5036 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (electric off-peak tariff)			
High-rate fraction			0.0993 (243)
Low-rate fraction			0.9007 (244)
High-rate cost	152.6495	15.2900	23.3401 (245)
Low-rate cost	1384.1369	5.5000	76.1275 (246)
Mechanical ventilation fans (0.71*15.29 + 0.29*5.50)	80.0426	12.4509	9.9660 (249)
Pumps and fans for heating (0.90*15.29 + 0.10*5.50)	0.0000	0.0000	0.0000 (249)
Energy for lighting (0.90*15.29 + 0.10*5.50)	303.4043	14.3110	43.4202 (250)
Additional standing charges			24.0000 (251)
Energy saving/generation technologies			
PV Unit (0.90*43.39 + 0.10*12.14)	0.0000	13.7505	0.0000 (252)
Total energy cost			197.3575 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7818 (257)
SAP value		89.0934
SAP rating (Section 12)		89 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	372.7933	0.5190	193.4797 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating	1536.7864	0.5190	797.5921 (264)
Space and water heating			991.0718 (265)
Pumps and fans	80.0426	0.5190	41.5421 (267)
Energy for lighting	303.4043	0.5190	157.4668 (268)
Energy saving/generation technologies			
PV Unit (0.90*43.39 + 0.10*12.14)	-488.0000	0.5190	-253.2720 (269)
Total kg/year			936.8088 (272)
CO2 emissions per m2			15.3500 (273)
EI value			88.1596
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$5.50 \times (1 + 0.29 \times 0.20) / 1.0000 = 5.819$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.20) / 1.0000 = 0.5491$, stars = 2
Water heating energy efficiency	$6.47 / 1.0000 = 6.472$, stars = 3
Water heating environmental impact	$0.519 / 1.0000 = 0.5190$, stars = 2

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (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					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0800
Infiltration rate					0.1540 (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) =				0.1309 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.1407	0.1374	0.1374	0.1276	0.1309	0.1113	0.1080	0.1080	0.1113	0.1244	0.1244	0.1276 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.35)			7.6900	1.2808	9.8496		(27)
Main	24.4100	7.6900	16.7200	0.1800	3.0096	110.0000	1839.2000 (29a)
Total net area of external elements Aum(A, m ²)			24.4100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				12.8592		(33)
Party Wall 1			53.2100	0.0000	0.0000	70.0000	3724.7000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			30.0000	1800.6000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10898.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		178.6000 (35)
Thermal bridges (User defined value 0.136 * total exposed area)		3.3198 (36)
Total fabric heat loss	(33) + (36) =	16.1790 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639 (38)
Average = Sum(39)m / 12 =	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429	40.3429 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611	0.6611 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy content (annual)	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)

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

Water storage loss:														
Store volume												150.0000 (47)		
a) If manufacturer declared loss factor is known (kWh/day):												1.1300 (48)		
Temperature factor from Table 2b												0.6000 (49)		
Enter (49) or (54) in (55)												0.6780 (55)		
Total storage loss														
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(56)	
If cylinder contains dedicated solar storage														
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(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)	
Total heat required for water heating calculated for each month														
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(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	(64)
Output from w/h														
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)	
												Total per year (kWh/year) = Sum(64)m =	1536.7864	(65)
Heat gains from water heating, kWh/month														
	61.2612	54.0606	56.9283	51.2443	50.3711	45.2289	43.6472	47.6055	47.4308	53.1270	55.9100	59.8587	(65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.9500	38.1478	31.0239	23.4871	17.5569	14.8222	16.0160	20.8182	27.9421	35.4789	41.4091	44.1437 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.9580	264.6763	257.8263	243.2434	224.8350	207.5338	195.9755	193.2572	200.1073	214.6902	233.0985	250.3997 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723 (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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129 (71)
Water heating gains (Table 5)	82.3403	80.4474	76.5165	71.1726	67.7031	62.8179	58.6656	63.9858	65.8761	71.4072	77.6528	80.4553 (72)
Total internal gains	476.5270	472.5502	454.6454	427.1818	399.3737	374.4527	359.9358	367.3399	383.2042	410.8550	441.4391	464.2775 (73)

[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			

Southwest				7.6900	32.4665	0.6700	0.7000	0.7700	81.1462 (79)			

Solar gains	81.1462	141.7883	202.7120	256.2691	280.0662	284.6815	267.8375	242.2640	225.5545	164.8574	99.8836	71.0264 (83)
Total gains	557.6732	614.3386	657.3575	683.4508	679.4400	659.1342	627.7734	609.6039	608.7587	575.7124	541.3227	535.3038 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385	75.0385
alpha	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026	6.0026
util living area	0.9077	0.8564	0.7697	0.6364	0.4778	0.3241	0.2377	0.2580	0.4162	0.6567	0.8467	0.9240 (86)
MIT	20.7280	20.8073	20.8870	20.9406	20.9600	20.9634	20.9637	20.9637	20.9623	20.9400	20.8377	20.6927 (87)
Th 2	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753	20.3753 (88)
util rest of house	0.8939	0.8378	0.7445	0.6047	0.4420	0.2860	0.1976	0.2167	0.3754	0.6200	0.8242	0.9121 (89)
MIT 2	20.0230	20.1292	20.2325	20.2976	20.3188	20.3220	20.3222	20.3222	20.3211	20.2980	20.1718	19.9747 (90)
Living area fraction									f1A = Living area / (4) =			0.4012 (91)
MIT	20.3058	20.4012	20.4951	20.5556	20.5760	20.5793	20.5795	20.5795	20.5784	20.5555	20.4389	20.2627 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3058	20.4012	20.4951	20.5556	20.5760	20.5793	20.5795	20.5795	20.5784	20.5555	20.4389	20.2627 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8923	0.8386	0.7494	0.6140	0.4535	0.2985	0.2107	0.2302	0.3887	0.6308	0.8266	0.9098 (94)
Useful gains	497.6028	515.1648	492.6490	419.6145	308.1594	196.7489	132.2974	140.3583	236.6451	363.1446	447.4501	487.0012 (95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000 (96)
Heat loss rate W	609.4115	589.0544	528.2929	429.8777	309.6733	196.8466	132.3065	140.3744	237.1506	373.3954	505.8569	615.7423 (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	83.1857	49.6539	26.5190	7.3895	1.1263	0.0000	0.0000	0.0000	0.0000	7.6266	42.0529	95.7834 (98)
Space heating												313.3373 (98)
Space heating per m2												5.1350 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													313.3373 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	83.1857	49.6539	26.5190	7.3895	1.1263	0.0000	0.0000	0.0000	0.0000	7.6266	42.0529	95.7834	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	83.1857	49.6539	26.5190	7.3895	1.1263	0.0000	0.0000	0.0000	0.0000	7.6266	42.0529	95.7834	(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	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(219)
Water heating fuel used													1536.7864 (219)
Annual totals kWh/year													
Space heating fuel - main system													313.3373 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.4480)													
mechanical ventilation fans (SFP = 0.4480)													80.0426 (230a)
Total electricity for the above, kWh/year													80.0426 (231)
Electricity for lighting (calculated in Appendix L)													303.4043 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													2233.5705 (238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (0.00*43.39 + 1.00*12.14)	313.3373	12.1400	38.0391	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (electric off-peak tariff)				
High-rate fraction			0.0993	(243)
Low-rate fraction			0.9007	(244)
High-rate cost	152.6495	43.3900	66.2346	(245)
Low-rate cost	1384.1369	12.1400	168.0342	(246)
Mechanical ventilation fans (0.71*43.39 + 0.29*12.14)	80.0426	34.3275	27.4766	(249)
Pumps and fans for heating (0.90*43.39 + 0.10*12.14)	0.0000	0.0000	0.0000	(249)
Energy for lighting (0.90*43.39 + 0.10*12.14)	303.4043	40.2650	122.1657	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit (0.90*43.39 + 0.10*12.14)	0.0000	38.5575	0.0000	(252)
Total energy cost			421.9503	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	313.3373	0.5190	162.6221	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating	1536.7864	0.5190	797.5921	(264)
Space and water heating			960.2142	(265)
Pumps and fans	80.0426	0.5190	41.5421	(267)
Energy for lighting	303.4043	0.5190	157.4668	(268)
Energy saving/generation technologies				
PV Unit (0.90*43.39 + 0.10*12.14)	-488.0000	0.5190	-253.2720	(269)
Total kg/year			905.9511	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	313.3373	3.0700	961.9455	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating	1536.7864	3.0700	4717.9341	(264)
Space and water heating			5679.8796	(265)
Pumps and fans	80.0426	3.0700	245.7308	(267)
Energy for lighting	303.4043	3.0700	931.4511	(268)
Energy saving/generation technologies				
PV Unit (0.90*43.39 + 0.10*12.14)	-488.0000	3.0700	-1498.1600	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

5358.9015 (272)
 87.8220 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
 Current environmental impact rating: B 88

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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 Typical annual savings Energy Environmental
 (none) efficiency impact
 Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 89
 Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£422	£422	£0
Space heating	£66	£66	£0
Water heating	£234	£234	£0
Lighting	£122	£122	£0
Total cost of fuels	£422	£422	£0
Total cost of uses	£422	£422	£0
Delivered energy	37 kWh/m ²	37 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	15 kg/m ²	15 kg/m ²	0 kg/m ²
Primary energy	88 kWh/m ²	88 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	West Pennines
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	178.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	193.31 (P1)
Transmission heat loss coefficient	16.18 (37)
Summer heat loss coefficient	209.49 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type	
Orientation				
South West	0.000	1.000	None	
Solar shading				
Orientation	Z blinds	Solar access	Z overhangs	Z summer
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
South West	7.6900	112.1012	0.6700	0.7000
total:				327.4873

Solar gains	Jun	Jul	Aug	
Internal gains	350	327	295	(P3)
Total summer gains	374	360	367	(P5)
	725	687	663	
Summer gain/loss ratio	3.46	3.28	3.16	(P6)
Summer external temperature	14.70	16.40	16.30	
Thermal mass temperature increment (TMP = 178.6)	0.75	0.75	0.75	
Threshold temperature	18.91	20.43	20.21	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			