

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW025q_080_As_Built				Issued on Date	22/11/2021
Assessment Reference	001	Prop Type Ref	MFF			
Property						
SAP Rating	85 B	DER	15.69	TER	16.72	
Environmental	89 B	% DER<TER	6.17			
CO ₂ Emissions (t/year)	0.90	DFEE	35.83	TFEE	39.11	
General Requirements Compliance	Pass	% DFEE<TFEE	8.38			
Assessor Details	Mr. Stephen Smith, Southern Energy Consultants Limited, Tel: 01635261582, info@southernenergyconsultants.co.uk				Assessor ID	d168-0001
Client	Bellway Homes Thames Valley					

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 70 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.72 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.69 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)39.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)35.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.29 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.24 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.04 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing East: 9.04 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.0 m³/m²h

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2400 (1b)	x 2.4000 (2b)	= 168.5760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.5760 (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					3.0400
Infiltration rate					0.1520 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1178 (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	0.1502	0.1473	0.1443	0.1296	0.1266	0.1119	0.1119	0.1090	0.1178	0.1266	0.1325	0.1384 (22b)
Mechanical extract ventilation - decentralised												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
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			9.0400	1.2357	11.1711		(27)
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060		(29a)
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184		(29a)
WT-I-11	12.7200		12.7200	0.2719	3.4586		(29a)
Total net area of external elements Aum(A, m ²)				76.0800			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4741		(33)
Party Wall 1				11.5200	0.0000	0.0000	(32)
Party Floor 1				70.2400			(32d)
Party Ceilings 1				70.2400			(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
7.6840 (36)
(33) + (36) = 37.1581 (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	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150 (38)
Heat transfer coeff	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731 (39)
Average = Sum(39)m / 12 =	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250 (40)
HLP (average)	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250 (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)

2.2519 (42)
87.6835 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Energy content (annual)												Total = Sum(45)m = 1379.6031 (45)
Distribution loss (46)m = 0.15 x (45)m												

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772 (61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779 (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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2771	17.1218	13.9244	10.5416	7.8800	6.6526	7.1884	9.3438	12.5412	15.9239	18.5855	19.8129 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775 (71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370 (72)
Total internal gains	345.5702	343.4351	330.8470	310.7192	290.4325	270.8998	258.2562	264.0621	274.4619	294.7900	318.0529	335.3555 (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					9.0400	19.6403	0.4500	0.0000			0.7700			61.5204 (76)

Solar gains	61.5204	120.3469	198.1942	289.0544	354.2471	362.6349	345.2432	296.5588	230.5081	142.8017	76.7087	50.5914	(83)	
Total gains	407.0906	463.7820	529.0413	599.7736	644.6796	633.5347	603.4994	560.6209	504.9700	437.5918	394.7616	385.9469	(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	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738
alpha	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049
util living area	0.9983	0.9958	0.9860	0.9451	0.8280	0.6374	0.4709	0.5273	0.8016	0.9728	0.9961	0.9987 (86)
MIT	20.0538	20.1854	20.4138	20.6942	20.9018	20.9832	20.9976	20.9955	20.9393	20.6514	20.2891	20.0156 (87)
Th 2	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463 (88)
util rest of house	0.9977	0.9944	0.9813	0.9269	0.7801	0.5604	0.3811	0.4325	0.7318	0.9603	0.9945	0.9983 (89)
MIT 2	19.2771	19.4082	19.6340	19.9026	20.0823	20.1388	20.1457	20.1450	20.1138	19.8674	19.5119	19.2390 (90)
Living area fraction	19.5237	19.6549	19.8815	20.1539	20.3425	20.4069	20.4162	20.4150	20.3759	20.1163	19.7586	19.4855 (92)
Temperature adjustment	19.3737	19.5049	19.7315	20.0039	20.1925	20.2569	20.2662	20.2650	20.2259	19.9663	19.6086	19.3355 (93)
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	405.8665	460.5401	517.6367	553.8065	504.7268	361.5467	237.6581	250.0029	373.1281	418.7568	392.0879	385.0928 (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	979.3848	948.9289	859.6951	721.4578	551.7839	367.5472	238.2016	251.1224	398.0162	608.5580	812.7236	983.4027 (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	426.6976	328.1973	254.4914	120.7090	35.0105	0.0000	0.0000	0.0000	0.0000	141.2121	302.8577	445.1426 (98)
Space heating												2054.3181 (98)
Space heating per m2												29.2471 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2269.9648	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	426.6976	328.1973	254.4914	120.7090	35.0105	0.0000	0.0000	0.0000	0.0000	141.2121	302.8577	445.1426	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	471.4891	362.6489	281.2060	133.3801	38.6856	0.0000	0.0000	0.0000	0.0000	156.0355	334.6494	491.8702	(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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)	
Efficiency of water heater (217)m	89.6159	89.5295	89.3215	88.8363	87.9940	87.3000	87.3000	87.3000	87.3000	88.9321	89.4575	89.6610	(216)	
Fuel for water heating, kWh/month	175.3293	153.9201	160.2361	141.9352	138.6004	122.1950	114.8586	129.4869	130.3466	147.1526	157.7927	170.1959	(219)	
Water heating fuel used												1742.0495	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2269.9648	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)														
mechanical ventilation fans (SFP = 0.1840)													37.8419	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													112.8419	(231)
Electricity for lighting (calculated in Appendix L)													340.4401	(232)
Total delivered energy for all uses													4465.2964	(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	2269.9648	0.2160	490.3124	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1742.0495	0.2160	376.2827	(264)
Space and water heating			866.5951	(265)
Pumps and fans	112.8419	0.5190	58.5650	(267)
Energy for lighting	340.4401	0.5190	176.6884	(268)
Total CO2, kg/year			1101.8485	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.6900	(273)

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

DER			15.6900	ZC1
Total Floor Area		TFA	70.2400	
Assumed number of occupants		N	2.2519	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.6921	ZC2
CO2 emissions from cooking, equation (L16)			2.4636	ZC3
Total CO2 emissions			34.8458	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			34.8458	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2400 (1b)	x 2.4000 (2b)	= 168.5760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.5760 (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) = 0.1780 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4280 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3317 (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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897 (22b)
	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			9.0400	1.3258	11.9848		(27)
WT-E-01	35.5700	9.0400	26.5300	0.1800	4.7754		(29a)
WT-I-01	27.7900	2.1200	25.6700	0.1800	4.6206		(29a)
WT-I-11	12.7200		12.7200	0.1800	2.2896		(29a)
Total net area of external elements Aum, m ²			76.0800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 25.7904		(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)							6.4795 (36)
Total fabric heat loss							(33) + (36) = 32.2699 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	32.7891	32.5960	32.4066	31.5174	31.3510	30.5765	30.5765	30.4331	30.8748	31.3510	31.6876	32.0395 (38)
Heat transfer coeff	65.0591	64.8659	64.6766	63.7873	63.6210	62.8465	62.8465	62.7030	63.1448	63.6210	63.9575	64.3094 (39)
Average = Sum(39)m / 12 =												63.7865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9262	0.9235	0.9208	0.9081	0.9058	0.8947	0.8947	0.8927	0.8990	0.9058	0.9106	0.9156 (40)
HLP (average)												0.9081 (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												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Energy content (annual)										Total = Sum(45)m =		1379.6031 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (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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Combi loss	49.1508	42.7799	45.5762	42.3764	42.0016	38.9171	40.2143	42.0016	42.3764	45.5762	45.8357	49.1508 (61)
Total heat required for water heating calculated for each month	192.1861	167.8796	174.6678	154.9215	149.9914	132.1040	126.5657	141.0911	142.6493	162.4347	173.3958	187.6729 (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	192.1861	167.8796	174.6678	154.9215	149.9914	132.1040	126.5657	141.0911	142.6493	162.4347	173.3958	187.6729 (64)
Heat gains from water heating, kWh/month	59.8470	52.2906	54.3170	48.0154	46.4070	40.7139	38.7654	43.4477	43.9349	50.2495	53.8727	58.3463 (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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2771	17.1218	13.9244	10.5416	7.8800	6.6526	7.1884	9.3438	12.5412	15.9239	18.5855	19.8129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	80.4394	77.8134	73.0067	66.6880	62.3750	56.5471	52.1041	58.3974	61.0206	67.5396	74.8232	78.4224	(72)
Total internal gains	357.3522	354.6239	341.4460	320.7301	299.8517	279.7288	267.0916	273.4872	284.4816	305.3978	329.2468	347.1410	(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				9.0400	19.6403	0.6300	0.7000	0.7700	54.2610 (76)			
Solar gains	54.2610	106.1460	174.8073	254.9460	312.4459	319.8440	304.5045	261.5649	203.3081	125.9511	67.6571	44.6216 (83)
Total gains	411.6132	460.7699	516.2533	575.6761	612.2976	599.5728	571.5961	535.0520	487.7897	431.3490	396.9038	391.7626 (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	74.9746	75.1979	75.4180	76.4694	76.6693	77.6142	77.6142	77.7917	77.2475	76.6693	76.2659	75.8486	
alpha	5.9983	6.0132	6.0279	6.0980	6.1113	6.1743	6.1743	6.1861	6.1498	6.1113	6.0844	6.0566	
util living area	0.9982	0.9959	0.9875	0.9514	0.8442	0.6509	0.4809	0.5336	0.8072	0.9732	0.9959	0.9986	(86)
MIT	20.0582	20.1835	20.4028	20.6865	20.8954	20.9833	20.9977	20.9959	20.9412	20.6616	20.3097	20.0374	(87)
Th 2	20.1453	20.1476	20.1499	20.1606	20.1626	20.1720	20.1720	20.1737	20.1684	20.1626	20.1585	20.1543	(88)
util rest of house	0.9976	0.9946	0.9833	0.9350	0.7986	0.5751	0.3920	0.4407	0.7391	0.9610	0.9943	0.9982	(89)
MIT 2	18.8789	19.0634	19.3830	19.7918	20.0614	20.1609	20.1711	20.1720	20.1219	19.7653	19.2564	18.8554	(90)
Living area fraction	19.2534	19.4190	19.7068	20.0759	20.3261	20.4220	20.4335	20.4335	20.3820	20.0499	19.5908	19.2306	(91)
MIT	19.2534	19.4190	19.7068	20.0759	20.3261	20.4220	20.4335	20.4335	20.3820	20.0499	19.5908	19.2306	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2534	19.4190	19.7068	20.0759	20.3261	20.4220	20.4335	20.4335	20.3820	20.0499	19.5908	19.2306	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9967	0.9930	0.9804	0.9331	0.8083	0.5986	0.4203	0.4703	0.7580	0.9590	0.9928	0.9975	(94)
Ext temp.	410.2456	457.5512	506.1434	537.1350	494.9160	358.9331	240.2507	251.6152	369.7639	413.6607	394.0525	390.7797	(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	972.8513	941.7894	854.1707	712.8781	548.8039	365.8924	240.9244	252.9152	396.6757	601.2101	798.8836	966.6119	(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	(98)
Space heating per m ²	418.5786	325.4081	258.9323	126.5351	40.0926	0.0000	0.0000	0.0000	0.0000	139.5368	291.4784	428.4192	(99)
												2028.9810	(98)
												28.8864	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2172.3565 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	418.5786	325.4081	258.9323	126.5351	40.0926	0.0000	0.0000	0.0000	0.0000	139.5368	291.4784	428.4192	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	448.1570	348.4026	277.2294	135.4765	42.9257	0.0000	0.0000	0.0000	0.0000	149.3970	312.0754	458.6929	(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	192.1861	167.8796	174.6678	154.9215	149.9914	132.1040	126.5657	141.0911	142.6493	162.4347	173.3958	187.6729	(64)
Efficiency of water heater	86.9584	86.6892	86.0405	84.5467	82.2380	80.3000	80.3000	80.3000	80.3000	84.6713	86.3490	87.0642	(217)
Fuel for water heating, kWh/month	221.0094	193.6568	203.0064	183.2379	182.3871	164.5131	157.6161	175.7050	177.6455	191.8415	200.8082	215.5569	(219)
Water heating fuel used												2266.9839	(219)
Annual totals kWh/year													
Space heating fuel - main system												2172.3565	(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)												340.4401	(232)
Total delivered energy for all uses												4854.7806	(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	2172.3565	0.2160	469.2290 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2266.9839	0.2160	489.6685 (264)
Space and water heating			958.8975 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	340.4401	0.5190	176.6884 (268)
Total CO2, kg/m2/year			1174.5110 (272)
Emissions per m2 for space and water heating			13.6517 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5155 (272b)
Emissions per m2 for pumps and fans			0.5542 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6517 * 1.00) + 2.5155 + 0.5542, rounded to 2 d.p.			16.7200 (273)

FULL SAP CALCULATION PRINTOUT

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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	70.2400 (1b)	x 2.4000 (2b)	= 168.5760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.5760 (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) = 0.1780 (8)
Measured/design AP50					Yes
Infiltration rate					3.0400
Number of sides sheltered					0.3300 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2557 (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												
	0.3260	0.3196	0.3133	0.2813	0.2749	0.2429	0.2429	0.2365	0.2557	0.2749	0.2877	0.3005 (22b)
Effective ac	0.5532	0.5511	0.5491	0.5396	0.5378	0.5295	0.5295	0.5280	0.5327	0.5378	0.5414	0.5451 (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
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			9.0400	1.2357	11.1711		(27)
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060		(29a)
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184		(29a)
WT-I-11	12.7200		12.7200	0.2719	3.4586		(29a)
Total net area of external elements Aum (m ²)			76.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4741		(33)
Party Wall 1			11.5200	0.0000	0.0000		(32)
Party Floor 1			70.2400				(32d)
Party Ceilings 1			70.2400				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6840 (36)
Total fabric heat loss						(33) + (36) =	37.1581 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	30.7719	30.6571	30.5445	30.0159	29.9170	29.4566	29.4566	29.3713	29.6339	29.9170	30.1171	30.3263 (38)
Heat transfer coeff	67.9300	67.8152	67.7026	67.1740	67.0751	66.6147	66.6147	66.5294	66.7920	67.0751	67.2752	67.4844 (39)
Average = Sum(39)m / 12 =												67.1735 (39)
HLP	0.9671	0.9655	0.9639	0.9563	0.9549	0.9484	0.9484	0.9472	0.9509	0.9549	0.9578	0.9608 (40)
HLP (average)												0.9563 (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												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Energy content (annual)												Total = Sum(45)m = 1379.6031 (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												

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 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	30.3950	26.5837	27.4320	23.9159	22.9478	19.8022	18.3497	21.0565	21.3080	24.8324	27.1065	29.4359 (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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2771	17.1218	13.9244	10.5416	7.8800	6.6526	7.1884	9.3438	12.5412	15.9239	18.5855	19.8129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	40.8535	39.5590	36.8709	33.2165	30.8439	27.5031	24.6635	28.3018	29.5945	33.3769	37.6480	39.5644	(72)
Total internal gains	314.7663	313.3696	302.3102	284.2586	265.3205	247.6848	236.6511	240.3915	250.0554	268.2351	289.0716	305.2830	(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				9.0400	19.6403	0.4500	0.0000			0.7700			61.5204 (76)
Solar gains	61.5204	120.3469	198.1942	289.0544	354.2471	362.6349	345.2432	296.5588	230.5081	142.8017	76.7087	50.5914	(83)
Total gains	376.2866	433.7165	500.5044	573.3130	619.5676	610.3197	581.8943	536.9504	480.5635	411.0368	365.7802	355.8744	(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	71.8060	71.9275	72.0471	72.6141	72.7211	73.2237	73.2237	73.3176	73.0293	72.7211	72.5049	72.2801	
alpha	5.7871	5.7952	5.8031	5.8409	5.8481	5.8816	5.8816	5.8878	5.8686	5.8481	5.8337	5.8187	
util living area	0.9989	0.9971	0.9901	0.9578	0.8569	0.6707	0.4992	0.5608	0.8359	0.9809	0.9974	0.9992	(86)
MIT	19.9508	20.0877	20.3272	20.6345	20.8712	20.9764	20.9964	20.9932	20.9179	20.5918	20.2098	19.9224	(87)
Th 2	20.1108	20.1122	20.1135	20.1199	20.1211	20.1266	20.1266	20.1276	20.1244	20.1211	20.1187	20.1162	(88)
util rest of house	0.9985	0.9962	0.9866	0.9428	0.8117	0.5906	0.4026	0.4592	0.7691	0.9715	0.9964	0.9989	(89)
MIT 2	19.1450	19.2827	19.5214	19.8244	20.0352	20.1159	20.1256	20.1256	20.0790	19.7893	19.4101	19.1210	(90)
Living area fraction									fLA = Living area / (4) =			0.3175	(91)
MIT	19.4008	19.5383	19.7772	20.0816	20.3006	20.3891	20.4021	20.4011	20.3453	20.0441	19.6640	19.3755	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4008	19.5383	19.7772	20.0816	20.3006	20.3891	20.4021	20.4011	20.3453	20.0441	19.6640	19.3755	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9981	0.9953	0.9849	0.9420	0.8218	0.6155	0.4334	0.4917	0.7877	0.9705	0.9957	0.9986	(94)
Ext temp.	375.5672	431.6965	492.9463	540.0576	509.1760	375.6741	252.1976	264.0152	378.5526	398.9058	364.2086	355.3788	(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	1025.7972	992.6960	898.9003	751.1128	576.8873	385.6366	253.2744	266.1880	417.1386	633.4641	845.2465	1024.1060	(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	483.7712	376.9917	302.0298	151.9597	50.3773	0.0000	0.0000	0.0000	0.0000	174.5114	346.3473	497.5331	(98)
Space heating per m2												2383.5214	(98)
												33.9340	(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	626.1781	492.9488	505.6237	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9362	0.9715	0.9573	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	586.2159	478.8831	484.0428	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	797.7512	762.8934	711.9518	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	152.3054	211.3036	169.5642	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												533.1733	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF 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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.0764	52.8259	42.3911	0.0000	0.0000	0.0000 (107)
Space cooling											133.2933 (107)
Space cooling per m2											1.8977 (108)
Energy for space heating											33.9340 (99)
Energy for space cooling											1.8977 (108)
Total											35.8316 (109)
Dwelling Fabric Energy Efficiency (DFEE)											35.8 (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	70.2400 (1b)	x 2.4000 (2b)	= 168.5760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.5760 (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) = 0.1780 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4280 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3317 (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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897 (22b)
	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			9.0400	1.3258	11.9848		(27)
WT-E-01	35.5700	9.0400	26.5300	0.1800	4.7754		(29a)
WT-I-01	27.7900	2.1200	25.6700	0.1800	4.6206		(29a)
WT-I-11	12.7200		12.7200	0.1800	2.2896		(29a)
Total net area of external elements Aum, m ²			76.0800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 25.7904		(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)							6.4795 (36)
Total fabric heat loss							(33) + (36) = 32.2699 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	32.7891	32.5960	32.4066	31.5174	31.3510	30.5765	30.5765	30.4331	30.8748	31.3510	31.6876	32.0395 (38)
Heat transfer coeff	65.0591	64.8659	64.6766	63.7873	63.6210	62.8465	62.8465	62.7030	63.1448	63.6210	63.9575	64.3094 (39)
Average = Sum(39)m / 12 =												63.7865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9262	0.9235	0.9208	0.9081	0.9058	0.8947	0.8947	0.8927	0.8990	0.9058	0.9106	0.9156 (40)
HLP (average)												0.9081 (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												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Energy content (annual)										Total = Sum(45)m =		1379.6031 (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 Built)

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	30.3950	26.5837	27.4320	23.9159	22.9478	19.8022	18.3497	21.0565	21.3080	24.8324	27.1065	29.4359 (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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2771	17.1218	13.9244	10.5416	7.8800	6.6526	7.1884	9.3438	12.5412	15.9239	18.5855	19.8129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	40.8535	39.5590	36.8709	33.2165	30.8439	27.5031	24.6635	28.3018	29.5945	33.3769	37.6480	39.5644	(72)
Total internal gains	314.7663	313.3696	302.3102	284.2586	265.3205	247.6848	236.6511	240.3915	250.0554	268.2351	289.0716	305.2830	(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					9.0400	19.6403		0.6300	0.7000		0.7700		54.2610 (76)
Solar gains	54.2610	106.1460	174.8073	254.9460	312.4459	319.8440	304.5045	261.5649	203.3081	125.9511	67.6571	44.6216	(83)
Total gains	369.0272	419.5155	477.1175	539.2046	577.7665	567.5288	541.1556	501.9564	453.3636	394.1862	356.7286	349.9046	(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	74.9746	75.1979	75.4180	76.4694	76.6693	77.6142	77.6142	77.7917	77.2475	76.6693	76.2659	75.8486	
alpha	5.9983	6.0132	6.0279	6.0980	6.1113	6.1743	6.1743	6.1861	6.1498	6.1113	6.0844	6.0566	
util living area	0.9990	0.9975	0.9916	0.9633	0.8694	0.6818	0.5070	0.5665	0.8425	0.9825	0.9977	0.9993	(86)
MIT	19.9994	20.1272	20.3516	20.6470	20.8749	20.9786	20.9970	20.9943	20.9247	20.6161	20.2547	19.9794	(87)
Th 2	20.1453	20.1476	20.1499	20.1606	20.1626	20.1720	20.1720	20.1737	20.1684	20.1626	20.1585	20.1543	(88)
util rest of house	0.9986	0.9967	0.9886	0.9501	0.8273	0.6046	0.4138	0.4690	0.7787	0.9740	0.9968	0.9990	(89)
MIT 2	19.2220	19.3514	19.5762	19.8725	20.0781	20.1621	20.1712	20.1720	20.1261	19.8485	19.4880	19.2095	(90)
Living area fraction									fLA = Living area / (4) =			0.3175	(91)
MIT	19.4688	19.5977	19.8223	20.1184	20.3311	20.4213	20.4333	20.4331	20.3797	20.0922	19.7314	19.4539	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4688	19.5977	19.8223	20.1184	20.3311	20.4213	20.4333	20.4331	20.3797	20.0922	19.7314	19.4539	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9960	0.9871	0.9493	0.8366	0.6287	0.4435	0.5002	0.7966	0.9731	0.9961	0.9987	(94)
Ext temp.	368.3939	417.8232	470.9837	511.8767	483.3652	356.8210	240.0059	251.0676	361.1318	383.5795	355.3462	349.4670	(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	986.8699	953.3773	861.6440	715.5896	549.1170	365.8504	240.9122	252.8869	396.5276	603.9034	807.8742	980.9697	(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	460.1461	359.8923	290.6512	146.6732	48.9193	0.0000	0.0000	0.0000	0.0000	163.9210	325.8202	469.8381	(98)
Space heating per m2												2265.8614	(98)
												(98) / (4) =	32.2588 (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	590.7566	465.0637	476.5430	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9399	0.9743	0.9619	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	555.2624	453.1170	458.3670	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	747.7359	715.2767	671.0498	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	138.5809	195.0469	158.2359	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												491.8637	(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 Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	34.6452	48.7617	39.5590	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													122.9659 (107)
Space cooling per m2													1.7507 (108)
Energy for space heating													32.2588 (99)
Energy for space cooling													1.7507 (108)
Total													34.0095 (109)
Target Fabric Energy Efficiency (TFEE)													39.1 (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	70.2400 (1b)	x 2.4000 (2b)	= 168.5760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.5760 (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					3.0400
Infiltration rate					0.1520 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1178 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1237	0.1178	0.1178	0.1090	0.1090	0.0972	0.1001	0.0942	0.0972	0.1031	0.1031	0.1119 (22b)
Mechanical extract ventilation - decentralised												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
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			9.0400	1.2357	11.1711		(27)
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060		(29a)
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184		(29a)
WT-I-11	12.7200		12.7200	0.2719	3.4586		(29a)
Total net area of external elements Aum(A, m ²)				76.0800			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4741		(33)
Party Wall 1				11.5200	0.0000	0.0000	(32)
Party Floor 1				70.2400			(32d)
Party Ceilings 1				70.2400			(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
7.6840 (36)
(33) + (36) = 37.1581 (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	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150 (38)
Heat transfer coeff	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731 (39)
Average = Sum(39)m / 12 =	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250 (40)
HLP (average)												0.9250 (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)

2.2519 (42)
87.6835 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Energy content (annual)												Total = Sum(45)m = 1379.6031 (45)
Distribution loss (46)m = 0.15 x (45)m												

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 HEAT DEMAND 09 Jan 2014

	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772 (61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779 (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	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.1928	42.8044	34.8109	26.3541	19.7000	16.6316	17.9710	23.3594	31.3529	39.8097	46.4638	49.5323 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775 (71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370 (72)
Total internal gains	510.9609	506.6040	486.6715	456.0445	424.9173	397.1072	380.9674	388.9951	406.7394	437.5666	471.6701	497.2500 (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					9.0400	22.3313	0.4500	0.0000			0.7700	69.9497 (76)
-----	-----											
Solar gains	69.9497	123.0867	199.8710	299.5493	356.9257	390.7204	368.0744	323.8182	251.6920	155.8605	89.3522	56.9651 (83)
Total gains	580.9106	629.6906	686.5425	755.5939	781.8430	787.8276	749.0419	712.8133	658.4313	593.4271	561.0223	554.2151 (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	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738
alpha	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049
util living area	0.9860	0.9761	0.9409	0.8365	0.6445	0.4112	0.2688	0.2916	0.5636	0.8693	0.9695	0.9888 (86)
MIT	20.3582	20.4619	20.6687	20.8757	20.9778	20.9987	20.9999	20.9999	20.9920	20.8677	20.5807	20.3238 (87)
Th 2	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463 (88)
util rest of house	0.9817	0.9691	0.9242	0.7978	0.5830	0.3416	0.1948	0.2138	0.4847	0.8273	0.9590	0.9854 (89)
MIT 2	19.5784	19.6794	19.8762	20.0585	20.1345	20.1459	20.1463	20.1463	20.1432	20.0566	19.7961	19.5447 (90)
Living area fraction									fLA = Living area / (4) =			0.3175 (91)
MIT	19.8260	19.9278	20.1278	20.3180	20.4022	20.4166	20.4173	20.4173	20.4127	20.3141	20.0452	19.7920 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.6760	19.7778	19.9778	20.1680	20.2522	20.2666	20.2673	20.2673	20.2627	20.1641	19.8952	19.6420 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9788	0.9654	0.9203	0.7988	0.5909	0.3514	0.2053	0.2249	0.4957	0.8282	0.9552	0.9828 (94)
Useful gains	568.5752	607.8819	631.8432	603.5984	461.9848	276.8777	153.8016	160.2907	326.3663	491.4988	535.8955	544.6799 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	947.0470	921.1766	817.2205	667.1429	471.1993	277.2173	153.8107	160.3067	328.9364	556.4349	772.8687	944.8420 (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	281.5830	210.5340	137.9207	45.7520	6.8556	0.0000	0.0000	0.0000	0.0000	48.3125	170.6207	297.7206 (98)
Space heating												1199.2991 (98)
RHI space heating demand												1199 (98)

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	70.2400 (1b)	x 2.4000 (2b)	= 168.5760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.5760 (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					3.0400
Infiltration rate					0.1520 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1178 (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	0.1502	0.1473	0.1443	0.1296	0.1266	0.1119	0.1119	0.1090	0.1178	0.1266	0.1325	0.1384 (22b)
Mechanical extract ventilation - decentralised												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
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			9.0400	1.2357	11.1711		(27)
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060		(29a)
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184		(29a)
WT-I-11	12.7200		12.7200	0.2719	3.4586		(29a)
Total net area of external elements Aum(A, m ²)			76.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4741		(33)
Party Wall 1			11.5200	0.0000	0.0000		(32)
Party Floor 1			70.2400				(32d)
Party Ceilings 1			70.2400				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
7.6840 (36)
(33) + (36) = 37.1581 (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	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150 (38)
Heat transfer coeff	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731 (39)
Average = Sum(39)m / 12 =												64.9731 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250 (40)
HLP (average)												0.9250 (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)

2.2519 (42)
87.6835 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Energy content (annual)												Total = Sum(45)m = 1379.6031 (45)
Distribution loss (46)m = 0.15 x (45)m												

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 ENERGY RATINGS 09 Jan 2014

	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772 (61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779 (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	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.1928	42.8044	34.8109	26.3541	19.7000	16.6316	17.9710	23.3594	31.3529	39.8097	46.4638	49.5323	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370	(72)
Total internal gains	510.9609	506.6040	486.6715	456.0445	424.9173	397.1072	380.9674	388.9951	406.7394	437.5666	471.6701	497.2500	(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					9.0400	19.6403	0.4500	0.0000			0.7700			61.5204 (76)
Solar gains	61.5204	120.3469	198.1942	289.0544	354.2471	362.6349	345.2432	296.5588	230.5081	142.8017	76.7087	50.5914	(83)	
Total gains	572.4813	626.9509	684.8657	745.0990	779.1644	759.7421	726.2107	685.5539	637.2474	580.3684	548.3787	547.8414	(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	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	
alpha	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	
util living area	0.9897	0.9809	0.9549	0.8792	0.7300	0.5406	0.3928	0.4343	0.6759	0.9136	0.9797	0.9920	(86)
MIT	20.2772	20.3990	20.5983	20.8172	20.9506	20.9929	20.9991	20.9984	20.9755	20.7972	20.4899	20.2359	(87)
Th 2	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	(88)
util rest of house	0.9867	0.9755	0.9423	0.8487	0.6766	0.4715	0.3171	0.3546	0.6031	0.8841	0.9729	0.9896	(89)
MIT 2	19.4984	19.6178	19.8098	20.0092	20.1161	20.1433	20.1461	20.1459	20.1344	19.9969	19.7083	19.4576	(90)
Living area fraction	19.7456	19.8658	20.0602	20.2658	20.3811	20.4130	20.4169	20.4165	20.4014	20.2510	19.9565	19.7047	(92)
Temperature adjustment	19.5956	19.7158	19.9102	20.1158	20.2311	20.2630	20.2669	20.2665	20.2514	20.1010	19.8065	19.5547	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9842	0.9721	0.9381	0.8475	0.6821	0.4811	0.3278	0.3659	0.6124	0.8823	0.9695	0.9875	(94)
Ext temp.	563.4475	609.4316	642.5012	631.5038	531.4910	365.4883	238.0508	250.8359	390.2696	512.0506	531.6434	540.9855	(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	993.8052	962.6322	871.3010	728.7228	554.2895	367.9432	238.2494	251.2198	399.6770	617.3081	825.5782	997.6440	(97)
Space heating kWh	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 per m2	320.1862	237.3508	170.2270	69.9977	16.9620	0.0000	0.0000	0.0000	0.0000	78.3116	211.6331	339.7540	(98)
												1444.4224	(98)
												20.5641	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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 %)	90.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	1596.0468 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	320.1862	237.3508	170.2270	69.9977	16.9620	0.0000	0.0000	0.0000	0.0000	78.3116	211.6331	339.7540 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	353.7969	262.2661	188.0961	77.3455	18.7426	0.0000	0.0000	0.0000	0.0000	86.5321	233.8487	375.4187 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
Efficiency of water heater (217)m	89.4210	89.2977	89.0098	88.4160	87.6785	87.3000	87.3000	87.3000	87.3000	88.4712	89.1919	87.3000 (216)
Fuel for water heating, kWh/month	175.7115	154.3198	160.7973	142.6100	139.0990	122.1950	114.8586	129.4869	130.3466	147.9193	158.2627	170.5337 (219)
Water heating fuel used												1746.1403 (219)
Annual totals kWh/year												
Space heating fuel - main system												1596.0468 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)												
mechanical ventilation fans (SFP = 0.1840)												37.8419 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												112.8419 (231)
Electricity for lighting (calculated in Appendix L)												340.4401 (232)
Total delivered energy for all uses												3795.4692 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1596.0468	3.4800	55.5424 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1746.1403	3.4800	60.7657 (247)
Mechanical ventilation fans	37.8419	13.1900	4.9914 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	340.4401	13.1900	44.9041 (250)
Additional standing charges			120.0000 (251)
Total energy cost			296.0960 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.0791 (257)
SAP value	84.9460
SAP rating (Section 12)	85 (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	1596.0468	0.2160	344.7461 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1746.1403	0.2160	377.1663 (264)
Space and water heating			721.9124 (265)
Pumps and fans	112.8419	0.5190	58.5650 (267)
Energy for lighting	340.4401	0.5190	176.6884 (268)
Total kg/year			957.1658 (272)
CO2 emissions per m2			13.6300 (273)
EI value			88.8702
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8835 = 3.939$, stars = 4
Water heating environmental impact	$0.216 / 0.8835 = 0.2445$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	70.2400 (1b)	x 2.4000 (2b)	= 168.5760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.5760 (5)

2. Ventilation rate

	main		secondary		other		total		m3 per hour			
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)			
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)			
Number of intermittent fans							0 * 10 =	0.0000	(7a)			
Number of passive vents							0 * 10 =	0.0000	(7b)			
Number of flueless gas fires							0 * 40 =	0.0000	(7c)			
										Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000	(8)			
Pressure test							Yes					
Measured/design AP50								3.0400				
Infiltration rate								0.1520	(18)			
Number of sides sheltered								3	(19)			
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750	(20)			
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.1178	(21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.1237	0.1178	0.1178	0.1090	0.1090	0.0972	0.1001	0.0942	0.0972	0.1031	0.1031	0.1119 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1			2.1200	1.0000	2.1200		(26)					
Opening Type 2 (Uw = 1.30)			9.0400	1.2357	11.1711		(27)					
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060		(29a)					
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184		(29a)					
WT-I-11	12.7200		12.7200	0.2719	3.4586		(29a)					
Total net area of external elements Aum(A, m2)			76.0800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4741		(33)					
Party Wall 1			11.5200	0.0000	0.0000		(32)					
Party Floor 1			70.2400				(32d)					
Party Ceilings 1			70.2400				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6840 (36)					
Total fabric heat loss						(33) + (36) =	37.1581 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 27.8150	Feb 27.8150	Mar 27.8150	Apr 27.8150	May 27.8150	Jun 27.8150	Jul 27.8150	Aug 27.8150	Sep 27.8150	Oct 27.8150	Nov 27.8150	Dec 27.8150 (38)
Heat transfer coeff	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731 (39)
Average = Sum(39)m / 12 =												64.9731 (39)
HLP	Jan 0.9250	Feb 0.9250	Mar 0.9250	Apr 0.9250	May 0.9250	Jun 0.9250	Jul 0.9250	Aug 0.9250	Sep 0.9250	Oct 0.9250	Nov 0.9250	Dec 0.9250 (40)
HLP (average)												0.9250 (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												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
Daily hot water use	Jan 96.4519	Feb 92.9445	Mar 89.4372	Apr 85.9298	May 82.4225	Jun 78.9152	Jul 78.9152	Aug 82.4225	Sep 85.9298	Oct 89.4372	Nov 92.9445	Dec 96.4519 (44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Energy content (annual)										Total = Sum(45)m =		1379.6031 (45)
Distribution loss (46)m = 0.15 x (45)m												

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

	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772 (61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1544.5074 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.1928	42.8044	34.8109	26.3541	19.7000	16.6316	17.9710	23.3594	31.3529	39.8097	46.4638	49.5323 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775 (71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370 (72)
Total internal gains	510.9609	506.6040	486.6715	456.0445	424.9173	397.1072	380.9674	388.9951	406.7394	437.5666	471.6701	497.2500 (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	
-----	-----												
East					9.0400	22.3313	0.4500	0.0000	0.7700			69.9497 (76)	
-----	-----												
Solar gains	69.9497	123.0867	199.8710	299.5493	356.9257	390.7204	368.0744	323.8182	251.6920	155.8605	89.3522	56.9651 (83)	
Total gains	580.9106	629.6906	686.5425	755.5939	781.8430	787.8276	749.0419	712.8133	658.4313	593.4271	561.0223	554.2151 (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	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738
alpha	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049
util living area	0.9860	0.9761	0.9409	0.8365	0.6445	0.4112	0.2688	0.2916	0.5636	0.8693	0.9695	0.9888 (86)
MIT	20.3582	20.4619	20.6687	20.8757	20.9778	20.9987	20.9999	20.9999	20.9920	20.8677	20.5807	20.3238 (87)
Th 2	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463 (88)
util rest of house	0.9817	0.9691	0.9242	0.7978	0.5830	0.3416	0.1948	0.2138	0.4847	0.8273	0.9590	0.9854 (89)
MIT 2	19.5784	19.6794	19.8762	20.0585	20.1345	20.1459	20.1463	20.1463	20.1432	20.0566	19.7961	19.5447 (90)
Living area fraction	19.8260	19.9278	20.1278	20.3180	20.4022	20.4166	20.4173	20.4173	20.4127	20.3141	20.0452	19.7920 (92)
Temperature adjustment	19.6760	19.7778	19.9778	20.1680	20.2522	20.2666	20.2673	20.2673	20.2627	20.1641	19.8952	19.6420 (93)
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9788	0.9654	0.9203	0.7988	0.5909	0.3514	0.2053	0.2249	0.4957	0.8282	0.9552	0.9828 (94)
Ext temp.	568.5752	607.8819	631.8432	603.5984	461.9848	276.8777	153.8016	160.2907	326.3663	491.4988	535.8955	544.6799 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	947.0470	921.1766	817.2205	667.1429	471.1993	277.2173	153.8107	160.3067	328.9364	556.4349	772.8687	944.8420 (97)
Space heating kWh	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 per m2	281.5830	210.5340	137.9207	45.7520	6.8556	0.0000	0.0000	0.0000	0.0000	48.3125	170.6207	297.7206 (98)
												1199.2991 (98)
												17.0743 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1325.1923 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	281.5830	210.5340	137.9207	45.7520	6.8556	0.0000	0.0000	0.0000	0.0000	48.3125	170.6207	297.7206	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	311.1414	232.6343	152.3985	50.5547	7.5752	0.0000	0.0000	0.0000	0.0000	53.3840	188.5311	328.9730	(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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
Efficiency of water heater (217)m	89.3273	89.2064	88.8416	88.1297	87.4646	87.3000	87.3000	87.3000	87.3000	88.1403	89.0226	89.3897	(216)
Fuel for water heating, kWh/month	175.8958	154.4776	161.1016	143.0734	139.4392	122.1950	114.8586	129.4869	130.3466	148.4745	158.5637	170.7125	(219)
Water heating fuel used												1748.6254	(219)
Annual totals kWh/year													
Space heating fuel - main system												1325.1923	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													37.8419 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													112.8419 (231)
Electricity for lighting (calculated in Appendix L)													340.4401 (232)
Total delivered energy for all uses													3527.0998 (238)

10a. Fuel costs - using BEDF prices (485)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1325.1923	3.7400	49.5622 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1748.6254	3.7400	65.3986 (247)
Mechanical ventilation fans	37.8419	19.1200	7.2354 (249)
Pumps and fans for heating	75.0000	19.1200	14.3400 (249)
Energy for lighting	340.4401	19.1200	65.0922 (250)
Additional standing charges			94.0000 (251)
Total energy cost			295.6283 (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	1325.1923	0.2160	286.2415 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1748.6254	0.2160	377.7031 (264)
Space and water heating			663.9446 (265)
Pumps and fans	112.8419	0.5190	58.5650 (267)
Energy for lighting	340.4401	0.5190	176.6884 (268)
Total kg/year			899.1980 (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	1325.1923	1.2200	1616.7347 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1748.6254	1.2200	2133.3229 (264)
Space and water heating			3750.0576 (265)
Pumps and fans	112.8419	3.0700	346.4248 (267)
Energy for lighting	340.4401	3.0700	1045.1512 (268)
Primary energy kWh/year			5141.6336 (272)
Primary energy kWh/m2/year			73.2009 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 89

FULL SAP CALCULATION PRINTOUT

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

(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 efficiency	Environmental impact
(none)			
	Total Savings £0		0.00 kg/m²
Potential energy efficiency rating:		B 85	
Potential environmental impact rating:			B 89

Fuel prices for cost data on this page from database revision number 485 TEST (29 Oct 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	£87	£87	£0
Mains gas	£209	£209	£0
Space heating	£165	£165	£0
Water heating	£65	£65	£0
Lighting	£65	£65	£0
Total cost of fuels	£296	£296	£0
Total cost of uses	£295	£295	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	73 kWh/m²	73 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

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	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	166.89 (P1)
Transmission heat loss coefficient	37.16 (37)
Summer heat loss coefficient	204.05 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
East	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
East	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
East	9.0400	117.5071	0.4500 0.0000
total:			0.9000 430.2169

	Jun	Jul	Aug	
Solar gains	457	430	378	(P4)
Internal gains	394	378	386	
Total summer gains	851	808	764	(P5)
Summer gain/loss ratio	4.17	3.96	3.75	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	20.42	22.11	21.80	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			