

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW026n_062_As_Built				Issued on Date	07/05/2021
Assessment Reference	001	Prop Type Ref	MFF			
Property						
SAP Rating	84 B	DER	16.69	TER	18.30	
Environmental	87 B	% DER<TER	8.82			
CO ₂ Emissions (t/year)	1.02	DFEE	40.08	TFEE	47.57	
General Requirements Compliance	Pass	% DFEE<TFEE	15.76			
Assessor Details	Mr. Robert Price, Robert Price, Tel: 01635 261582, keith@southernenergyconsultants.co.uk				Assessor ID	P865-0001
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 71 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.30 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.69 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)47.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.25 (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: 3.26 (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): Slight OK
Based on:
Overshading: Average
Windows facing South: 10.22 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.3 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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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					3.2600
Infiltration rate					0.1630 (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) =				0.1263 (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	0.1611	0.1579	0.1547	0.1390	0.1358	0.1200	0.1200	0.1169	0.1263	0.1358	0.1421	0.1484 (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)			10.2200	1.2357	12.6293		(27)
FT-03			70.8000	0.1300	9.2040		(28b)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum(A, m ²)					138.7000		(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	34.7226	(33)
Party Wall 1				15.8400	0.0000	0.0000	(32)
Party Ceilings 1				70.8000			(32b)

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

100.0000 (35)
15.6847 (36)
(33) + (36) = 50.4073 (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	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368 (38)
Heat transfer coeff	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441 (39)
Average = Sum(39)m / 12 =												78.4441 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080 (40)
HLP (average)												1.1080 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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	14.0901	12.7064	14.0357	13.5466	13.9717	13.4906	13.9213	13.9540	13.5211	14.0092	13.5994	14.0796 (61)
Total heat required for water heating calculated for each month	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (64)
Heat gains from water heating, kWh/month	51.2551	44.9238	46.5883	40.9443	39.5304	34.4702	32.2968	36.5558	36.8425	42.4993	45.9681	49.7463 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9223	16.8066	13.6680	10.3476	7.7349	6.5302	7.0561	9.1717	12.3103	15.6308	18.2434	19.4482 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.1570	201.2236	196.0158	184.9289	170.9337	157.7803	148.9929	146.9263	152.1341	163.2210	177.2161	190.3696 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269 (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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156 (71)
Water heating gains (Table 5)	68.8912	66.8509	62.6186	56.8670	53.1322	47.8753	43.4097	49.1342	51.1702	57.1227	63.8447	66.8633 (72)
Total internal gains	346.9513	344.8619	332.2833	312.1244	291.7817	272.1665	259.4395	265.2130	275.5954	295.9553	319.2850	336.6619 (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			
South				10.2200	46.7521	0.4500	0.0000	0.7700	165.5598 (78)			
Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589 (83)
Total gains	512.5111	616.0062	677.6730	702.4898	698.5666	663.6417	641.9345	636.6687	636.3958	588.4099	515.5299	479.7209 (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	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709
alpha	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714
util living area	0.9487	0.9189	0.8809	0.8261	0.7432	0.6201	0.4849	0.5052	0.6664	0.8333	0.9239	0.9562 (86)
MIT	18.8906	19.2155	19.6159	20.0555	20.4614	20.7683	20.9132	20.8997	20.7000	20.1666	19.4275	18.7999 (87)
Th 2	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943 (88)
util rest of house	0.9415	0.9079	0.8643	0.8002	0.7013	0.5517	0.3907	0.4134	0.6040	0.8036	0.9115	0.9499 (89)
MIT 2	18.0774	18.3944	18.7835	19.2052	19.5827	19.8483	19.9547	19.9463	19.7946	19.3180	18.6076	17.9885 (90)
Living area fraction	18.3703	18.6902	19.0833	19.5115	19.8992	20.1797	20.3000	20.2897	20.1207	19.6236	18.9029	18.2808 (92)
Temperature adjustment	18.2203	18.5402	18.9333	19.3615	19.7492	20.0297	20.1500	20.1397	19.9707	19.4736	18.7529	18.1308 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9250	0.8882	0.8435	0.7814	0.6899	0.5543	0.4061	0.4275	0.6024	0.7855	0.8925	0.9346 (94)
Ext temp.	474.0655	547.1418	571.6240	548.9604	481.9434	367.8699	260.7095	272.1604	383.3516	462.2240	460.0869	448.3532 (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	1091.9628	1069.9902	975.3225	820.6395	631.4099	425.9260	278.4735	293.3540	460.5217	696.0854	914.0993	1092.7876 (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 m ²	459.7156	351.3541	300.3517	195.6090	111.2030	0.0000	0.0000	0.0000	0.0000	173.9928	326.8890	479.4592 (98)
												2398.5743 (98)
												33.8782 (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													2650.3584 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	459.7156	351.3541	300.3517	195.6090	111.2030	0.0000	0.0000	0.0000	0.0000	173.9928	326.8890	479.4592	(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)	507.9730	388.2366	331.8803	216.1425	122.8763	0.0000	0.0000	0.0000	0.0000	192.2573	361.2033	529.7891	(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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064	(64)
Efficiency of water heater (217)m	89.6608	89.5728	89.4396	89.2157	88.7949	87.3000	87.3000	87.3000	87.3000	89.0955	89.5082	89.7041	(216)
Fuel for water heating, kWh/month	175.8256	154.3568	160.5527	141.7933	137.7951	122.5854	115.2203	129.9021	130.7668	147.3627	158.2250	170.6792	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													2650.3584 (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)													38.1436 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													113.1436 (231)
Electricity for lighting (calculated in Appendix L)													334.1731 (232)
Total delivered energy for all uses													4842.7402 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	2650.3584	0.2160	572.4774 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1745.0651	0.2160	376.9341 (264)
Space and water heating			949.4115 (265)
Pumps and fans	113.1436	0.5190	58.7215 (267)
Energy for lighting	334.1731	0.5190	173.4359 (268)
Total CO ₂ , kg/year			1181.5689 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.6900 (273)

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

DER			16.6900 ZC1
Total Floor Area		TFA	70.8000
Assumed number of occupants		N	2.2654
CO ₂ emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO ₂ emissions from appliances, equation (L14)			16.6690 ZC2
CO ₂ emissions from cooking, equation (L16)			2.4487 ZC3
Total CO ₂ emissions			35.8077 ZC4
Residual CO ₂ emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000 ZC6
Resulting CO ₂ emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO ₂ emissions			35.8077 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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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				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) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4266 (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) =				0.3306 (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	0.4215	0.4132	0.4050	0.3636	0.3554	0.3141	0.3141	0.3058	0.3306	0.3554	0.3719	0.3884 (22b)
Effective ac	0.5888	0.5854	0.5820	0.5661	0.5631	0.5493	0.5493	0.5468	0.5546	0.5631	0.5692	0.5754 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200			(26)				
TER Opening Type (Uw = 1.40)			10.2200	1.3258	13.5492			(27)				
FT-03			70.8000	0.1300	9.2040			(28b)				
WT-E-03	28.0100	10.2200	17.7900	0.1800	3.2022			(29a)				
WT-I-02	22.8000	2.1200	20.6800	0.1800	3.7224			(29a)				
WT-I-11	17.0900		17.0900	0.1800	3.0762			(29a)				
Total net area of external elements Aum(A, m2)			138.7000					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.8740			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								13.9754 (36)				
Total fabric heat loss						(33) + (36) =		48.8494 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	33.0176	32.8242	32.6346	31.7442	31.5776	30.8020	30.8020	30.6584	31.1007	31.5776	31.9146	32.2669 (38)
Heat transfer coeff	81.8670	81.6736	81.4841	80.5936	80.4270	79.6514	79.6514	79.5078	79.9502	80.4270	80.7640	81.1164 (39)
Average = Sum(39)m / 12 =												80.5928 (39)
HLP	1.1563	1.1536	1.1509	1.1383	1.1360	1.1250	1.1250	1.1230	1.1292	1.1360	1.1407	1.1457 (40)
HLP (average)												1.1383 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)										Total = Sum(45)m =		1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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												

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Combi 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)
Total heat required for water heating calculated for each month	49.3299	42.9358	45.7423	42.5308	42.1546	39.0589	40.3608	42.1546	42.5308	45.7423	46.0027	49.3299 (61)
Solar input	192.8864	168.4912	175.3042	155.4860	150.5379	132.5854	127.0269	141.6052	143.1691	163.0265	174.0276	188.3567 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	192.8864	168.4912	175.3042	155.4860	150.5379	132.5854	127.0269	141.6052	143.1691	163.0265	174.0276	188.3567 (64)
	60.0650	52.4811	54.5149	48.1903	46.5761	40.8623	38.9067	43.6060	44.0949	50.4326	54.0690	58.5589 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9223	16.8066	13.6680	10.3476	7.7349	6.5302	7.0561	9.1717	12.3103	15.6308	18.2434	19.4482	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.1570	201.2236	196.0158	184.9289	170.9337	157.7803	148.9929	146.9263	152.1341	163.2210	177.2161	190.3696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	(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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	(71)
Water heating gains (Table 5)	80.7325	78.0969	73.2727	66.9310	62.6023	56.7532	52.2939	58.6102	61.2430	67.7857	75.0958	78.7082	(72)
Total internal gains	358.7926	356.1079	342.9374	322.1883	301.2518	281.0444	268.3237	274.6891	285.6682	306.6183	330.5362	348.5068	(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
South					10.2200	46.7521	0.6300	0.7000			0.7700			146.0238 (78)
Solar gains	146.0238	239.1493	304.6338	344.3023	358.7843	345.2811	337.3606	327.6239	318.2259	257.9449	173.0879			126.1780 (83)
Total gains	504.8164	595.2572	647.5711	666.4906	660.0361	626.3255	605.6844	602.3129	603.8942	564.5632	503.6241			474.6848 (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	60.0567	60.1989	60.3390	61.0057	61.1320	61.7273	61.7273	61.8388	61.4966	61.1320	60.8769	60.6125	(86)
alpha	5.0038	5.0133	5.0226	5.0670	5.0755	5.1152	5.1152	5.1226	5.0998	5.0755	5.0585	5.0408	(87)
util living area	0.9957	0.9896	0.9773	0.9489	0.8829	0.7401	0.5632	0.5878	0.7960	0.9513	0.9904	0.9968	(88)
MIT	19.8545	20.0378	20.2724	20.5444	20.7803	20.9384	20.9876	20.9844	20.9056	20.6019	20.1711	19.8190	(89)
Th 2	19.9551	19.9573	19.9595	19.9697	19.9716	19.9805	19.9805	19.9821	19.9770	19.9716	19.9677	19.9637	(90)
util rest of house	0.9943	0.9862	0.9697	0.9304	0.8387	0.6498	0.4406	0.4674	0.7168	0.9300	0.9866	0.9957	(91)
MIT 2	18.4420	18.7094	19.0488	19.4400	19.7540	19.9384	19.9758	19.9757	19.9049	19.5261	18.9122	18.3965	(92)
Living area fraction													(93)
MIT	18.9507	19.1879	19.4895	19.8378	20.1236	20.2986	20.3402	20.3390	20.2653	19.9136	19.3656	18.9088	(94)
Temperature adjustment													(95)
adjusted MIT	18.9507	19.1879	19.4895	19.8378	20.1236	20.2986	20.3402	20.3390	20.2653	19.9136	19.3656	18.9088	(96)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9923	0.9829	0.9653	0.9276	0.8461	0.6800	0.4851	0.5110	0.7412	0.9285	0.9837	0.9942	(97)
Ext temp.	500.9463	585.0979	625.0940	618.2194	558.4618	425.9261	293.8442	307.8103	447.6338	524.2196	495.4052	471.9304	(98)
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	(99)
Month fracti	1199.4109	1166.9411	1058.4386	881.5150	677.4875	453.9001	297.9134	313.1821	492.9148	749.0643	990.6201	1193.1265	(100)
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	(101)
Space heating	519.6576	390.9986	322.4084	189.5728	88.5551	0.0000	0.0000	0.0000	0.0000	167.2845	356.5547	536.5699	(102)
Space heating per m2													(103)

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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2753.3208 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	519.6576	390.9986	322.4084	189.5728	88.5551	0.0000	0.0000	0.0000	0.0000	167.2845	356.5547	536.5699	(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)	556.3786	418.6281	345.1910	202.9687	94.8127	0.0000	0.0000	0.0000	0.0000	179.1054	381.7502	574.4859	(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	192.8864	168.4912	175.3042	155.4860	150.5379	132.5854	127.0269	141.6052	143.1691	163.0265	174.0276	188.3567	(64)
Efficiency of water heater													80.3000 (216)
(217)m	87.4234	87.1008	86.5650	85.5512	83.7663	80.3000	80.3000	80.3000	80.3000	85.1161	86.8184	87.5391	(217)
Fuel for water heating, kWh/month	220.6348	193.4440	202.5116	181.7461	179.7117	165.1125	158.1904	176.3452	178.2928	191.5343	200.4502	215.1685	(219)
Water heating fuel used													2263.1421 (219)
Annual totals kWh/year													
Space heating fuel - main system													2753.3208 (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)													334.1731 (232)
Total delivered energy for all uses													5425.6360 (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	2753.3208	0.2160	594.7173 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2263.1421	0.2160	488.8387 (264)
Space and water heating			1083.5560 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	334.1731	0.5190	173.4359 (268)
Total CO2, kg/m2/year			1295.9168 (272)
Emissions per m2 for space and water heating			15.3045 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4497 (272b)
Emissions per m2 for pumps and fans			0.5498 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3045 * 1.00) + 2.4497 + 0.5498, rounded to 2 d.p.			18.3000 (273)

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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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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				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) =
Measured/design AP50					Yes
Infiltration rate					3.2600
Number of sides sheltered					0.3396 (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) =				0.2632 (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	0.3355	0.3289	0.3224	0.2895	0.2829	0.2500	0.2500	0.2434	0.2632	0.2829	0.2960	0.3092 (22b)
	0.5563	0.5541	0.5520	0.5419	0.5400	0.5312	0.5312	0.5296	0.5346	0.5400	0.5438	0.5478 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293		(27)
FT-03			70.8000	0.1300	9.2040		(28b)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum(A, m ²)			138.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.7226		(33)
Party Wall 1			15.8400	0.0000	0.0000		(32)
Party Ceilings 1			70.8000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.6847 (36)
Total fabric heat loss						(33) + (36) =	50.4073 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.1930	31.0705	30.9503	30.3861	30.2805	29.7890	29.7890	29.6980	29.9784	30.2805	30.4941	30.7174 (38)
Heat transfer coeff	81.6004	81.4778	81.3577	80.7934	80.6878	80.1964	80.1964	80.1054	80.3857	80.6878	80.9014	81.1247 (39)
Average = Sum(39)m / 12 =												80.7929 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1525	1.1508	1.1491	1.1411	1.1397	1.1327	1.1327	1.1314	1.1354	1.1397	1.1427	1.1458 (40)
HLP (average)												1.1411 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (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												

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)
	30.5058	26.6805	27.5319	24.0030	23.0314	19.8744	18.4165	21.1332	21.3856	24.9229	27.2053	29.5432 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9223	16.8066	13.6680	10.3476	7.7349	6.5302	7.0561	9.1717	12.3103	15.6308	18.2434	19.4482	(67)
Appliances gains (calculated in Appendix L13, equation L13a), also see Table 5	199.1570	201.2236	196.0158	184.9289	170.9337	157.7803	148.9929	146.9263	152.1341	163.2210	177.2161	190.3696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	(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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	(71)
Water heating gains (Table 5)	41.0024	39.7032	37.0053	33.3375	30.9562	27.6033	24.7534	28.4049	29.7023	33.4985	37.7851	39.7086	(72)
Total internal gains	316.0624	314.7142	303.6699	285.5948	266.6058	248.8946	237.7832	241.4838	251.1275	269.3311	290.2255	306.5072	(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		
South				10.2200	46.7521	0.4500	0.0000			0.7700	165.5598 (78)		
Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589	(83)
Total gains	481.6222	585.8585	649.0597	675.9602	673.3907	640.3697	620.2783	612.9394	611.9279	561.7857	486.4704	449.5662	(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	24.1012	24.1375	24.1731	24.3419	24.3738	24.5231	24.5231	24.5510	24.4654	24.3738	24.3094	24.2425	
alpha	2.6067	2.6092	2.6115	2.6228	2.6249	2.6349	2.6349	2.6367	2.6310	2.6249	2.6206	2.6162	
util living area	0.9560	0.9286	0.8932	0.8410	0.7621	0.6408	0.5052	0.5268	0.6881	0.8496	0.9337	0.9625	(86)
MIT	18.7251	19.0631	19.4856	19.9644	20.3993	20.7387	20.8997	20.8842	20.6612	20.0836	19.3042	18.6494	(87)
Th 2	19.9581	19.9595	19.9609	19.9674	19.9686	19.9742	19.9742	19.9752	19.9720	19.9686	19.9661	19.9636	(88)
util rest of house	0.9495	0.9184	0.8776	0.8161	0.7208	0.5714	0.4072	0.4315	0.6254	0.8212	0.9225	0.9569	(89)
MIT 2	17.8898	18.2215	18.6344	19.1004	19.5081	19.8090	19.9284	19.9196	19.7455	19.2225	18.4682	17.8191	(90)
Living area fraction									fLA = Living area / (4) =			0.3602	(91)
MIT	18.1907	18.5246	18.9409	19.4116	19.8291	20.1439	20.2783	20.2671	20.0753	19.5327	18.7693	18.1181	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1907	18.5246	18.9409	19.4116	19.8291	20.1439	20.2783	20.2671	20.0753	19.5327	18.7693	18.1181	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	450.4488	527.8764	557.7425	541.2106	481.1692	373.8453	271.5875	282.1184	386.9337	453.4682	440.8438	424.3435	(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	1133.4822	1110.1041	1012.1657	849.2668	655.9184	444.5979	294.9836	309.7722	480.3307	720.7571	944.0617	1129.1039	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	508.1769	391.2570	338.0909	221.8005	130.0134	0.0000	0.0000	0.0000	0.0000	198.8629	362.3169	524.3417	(98)
Space heating												2674.8602	(98)
Space heating per m2										(98) / (4) =		37.7805	(99)

8c. Space cooling requirement

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

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	753.8459	593.4531	608.8007	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7601	0.8254	0.8156	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	572.9827	489.8182	496.5483	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	833.1555	808.0087	800.9617	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling						187.3244	236.7337	226.4836	0.0000	0.0000	0.0000	0.0000	(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	46.8311	59.1834	56.6209	0.0000	0.0000	0.0000 (107)
Space cooling											162.6354 (107)
Space cooling per m2											2.2971 (108)
Energy for space heating											37.7805 (99)
Energy for space cooling											2.2971 (108)
Total											40.0776 (109)
Dwelling Fabric Energy Efficiency (DFEE)											40.1 (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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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) = 0.1766 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4266 (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) =				0.3306 (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	0.4215	0.4132	0.4050	0.3636	0.3554	0.3141	0.3141	0.3058	0.3306	0.3554	0.3719	0.3884 (22b)
Effective ac	0.5888	0.5854	0.5820	0.5661	0.5631	0.5493	0.5493	0.5468	0.5546	0.5631	0.5692	0.5754 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1200	1.0000	2.1200			(26)					
TER Opening Type (Uw = 1.40)			10.2200	1.3258	13.5492			(27)					
FT-03			70.8000	0.1300	9.2040			(28b)					
WT-E-03	28.0100	10.2200	17.7900	0.1800	3.2022			(29a)					
WT-I-02	22.8000	2.1200	20.6800	0.1800	3.7224			(29a)					
WT-I-11	17.0900		17.0900	0.1800	3.0762			(29a)					
Total net area of external elements Aum(A, m2)			138.7000					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.8740			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.9754	(36)					
Total fabric heat loss						(33) + (36) =	48.8494	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.0176	32.8242	32.6346	31.7442	31.5776	30.8020	30.8020	30.6584	31.1007	31.5776	31.9146	32.2669	(38)
Heat transfer coeff	81.8670	81.6736	81.4841	80.5936	80.4270	79.6514	79.6514	79.5078	79.9502	80.4270	80.7640	81.1164	(39)
Average = Sum(39)m / 12 =												80.5928	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1563	1.1536	1.1509	1.1383	1.1360	1.1250	1.1250	1.1230	1.1292	1.1360	1.1407	1.1457	(40)
HLP (average)												1.1383	(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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)										Total = Sum(45)m =		1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As 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	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	0.0000 (59)
	30.5058	26.6805	27.5319	24.0030	23.0314	19.8744	18.4165	21.1332	21.3856	24.9229	27.2053	29.5432	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9223	16.8066	13.6680	10.3476	7.7349	6.5302	7.0561	9.1717	12.3103	15.6308	18.2434	19.4482	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.1570	201.2236	196.0158	184.9289	170.9337	157.7803	148.9929	146.9263	152.1341	163.2210	177.2161	190.3696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	(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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	(71)
Water heating gains (Table 5)	41.0024	39.7032	37.0053	33.3375	30.9562	27.6033	24.7534	28.4049	29.7023	33.4985	37.7851	39.7086	(72)
Total internal gains	316.0624	314.7142	303.6699	285.5948	266.6058	248.8946	237.7832	241.4838	251.1275	269.3311	290.2255	306.5072	(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		
South					10.2200	46.7521		0.6300		0.7000		0.7700		146.0238 (78)	
Solar gains	146.0238	239.1493	304.6338	344.3023	358.7843	345.2811	337.3606	327.6239	318.2259	257.9449	173.0879	126.1780	(83)		
Total gains	462.0862	553.8635	608.3037	629.8971	625.3900	594.1756	575.1438	569.1077	569.3535	527.2760	463.3135	432.6852	(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	60.0567	60.1989	60.3390	61.0057	61.1320	61.7273	61.7273	61.8388	61.4966	61.1320	60.8769	60.6125	
alpha	5.0038	5.0133	5.0226	5.0670	5.0755	5.1152	5.1152	5.1226	5.0998	5.0755	5.0585	5.0408	
util living area	0.9971	0.9924	0.9824	0.9584	0.9003	0.7664	0.5895	0.6171	0.8226	0.9622	0.9933	0.9979	(86)
MIT	19.7990	19.9855	20.2255	20.5062	20.7541	20.9275	20.9848	20.9806	20.8891	20.5623	20.1198	19.7641	(87)
Th 2	19.9551	19.9573	19.9595	19.9697	19.9716	19.9805	19.9805	19.9821	19.9770	19.9716	19.9677	19.9637	(88)
util rest of house	0.9961	0.9898	0.9762	0.9427	0.8601	0.6775	0.4630	0.4931	0.7468	0.9447	0.9906	0.9972	(89)
MIT 2	18.8668	19.0538	19.2925	19.5730	19.8022	19.9458	19.9765	19.9766	19.9175	19.6316	19.1967	18.8390	(90)
Living area fraction									fLA = Living area / (4) =			0.3602	(91)
MIT	19.2026	19.3894	19.6286	19.9091	20.1450	20.2994	20.3396	20.3382	20.2674	19.9668	19.5292	19.1722	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2026	19.3894	19.6286	19.9091	20.1450	20.2994	20.3396	20.3382	20.2674	19.9668	19.5292	19.1722	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9952	0.9880	0.9738	0.9416	0.8679	0.7077	0.5091	0.5383	0.7707	0.9446	0.9891	0.9965	(94)
Ext temp.	459.8504	547.2441	592.3697	593.0904	542.7541	420.4692	292.8175	306.3428	438.7773	498.0621	458.2727	431.1495	(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	1220.0298	1183.4006	1069.7691	887.2654	679.2085	453.9664	297.8679	313.1165	493.0886	753.3462	1003.8289	1214.4877	(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	565.5735	427.4972	355.1852	211.8060	101.5221	0.0000	0.0000	0.0000	0.0000	189.9313	392.8005	582.8037	(98)
Space heating												2827.1193	(98)
Space heating per m2										(98) / (4) =		39.9311	(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	748.7236	589.4207	604.2594	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8527	0.9208	0.9123	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	638.4157	542.7612	551.2848	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	779.1624	755.2542	749.7298	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	101.3376	158.0948	147.6431	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												407.0755	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													
													fC = cooled area / (4) =

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	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	25.3344	39.5237	36.9108	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												101.7689 (107)
Energy for space heating												1.4374 (108)
Energy for space cooling												39.9311 (99)
Total												1.4374 (108)
Target Fabric Energy Efficiency (TFEE)												41.3685 (109)
												47.6 (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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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					0 * 10 = 0.0000 (7a)							
Number of passive vents					0 * 10 = 0.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour							
Pressure test					0.0000 / (5) = 0.0000 (8)							
Measured/design AP50					Yes							
Infiltration rate					3.2600							
Number of sides sheltered					0.1630 (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) =	0.1263 (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)
Adj infilt rate	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)
	0.1326	0.1263	0.1263	0.1169	0.1169	0.1042	0.1074	0.1011	0.1042	0.1105	0.1105	0.1200 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293		(27)
FT-03			70.8000	0.1300	9.2040		(28b)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum(A, m ²)			138.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.7226		(33)
Party Wall 1			15.8400	0.0000	0.0000		(32)
Party Ceilings 1			70.8000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.6847 (36)
Total fabric heat loss							(33) + (36) = 50.4073 (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	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368 (38)
Heat transfer coeff	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441 (39)
Average = Sum(39)m / 12 =	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441 (39)
HLP	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080 (40)
HLP (average)	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
Daily hot water use	Jan 96.8033	Feb 93.2832	Mar 89.7631	Apr 86.2429	May 82.7228	Jun 79.2027	Jul 79.2027	Aug 82.7228	Sep 86.2429	Oct 89.7631	Nov 93.2832	Dec 96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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	14.0901	12.7064	14.0357	13.5466	13.9717	13.4906	13.9213	13.9540	13.5211	14.0092	13.5994	14.0796 (61)
Total heat required for water heating calculated for each month	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (64)
								Total per year (kWh/year) = Sum(64)m =				1549.5555 (64)
RHI water heating demand												1550 (64)
Heat gains from water heating, kWh/month	51.2551	44.9238	46.5883	40.9443	39.5304	34.4702	32.2968	36.5558	36.8425	42.4993	45.9681	49.7463 (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	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3057	42.0165	34.1701	25.8690	19.3373	16.3254	17.6402	22.9294	30.7757	39.0769	45.6085	48.6204 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.2492	300.3337	292.5608	276.0133	255.1250	235.4929	222.3775	219.2930	227.0659	243.6134	264.5017	284.1338 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577 (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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156 (71)
Water heating gains (Table 5)	68.8912	66.8509	62.6186	56.8670	53.1322	47.8753	43.4097	49.1342	51.1702	57.1227	63.8447	66.8633 (72)
Total internal gains	512.6116	508.3665	488.5151	457.9148	426.7601	398.8591	382.5928	390.5220	408.1773	438.9785	473.1204	498.7830 (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	
South	10.2200				50.9848		0.4500		0.0000		0.7700		180.5490 (78)	
Solar gains	180.5490	265.3663	333.3669	389.6318	398.2891	411.8829	397.3472	392.0371	377.7133	305.2939	219.0656	154.6394	(83)	
Total gains	693.1606	773.7329	821.8819	847.5466	825.0491	810.7420	779.9401	782.5592	785.8906	744.2725	692.1860	653.4224	(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	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709
alpha	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714
util living area	0.8954	0.8642	0.8144	0.7374	0.6223	0.4452	0.3021	0.3102	0.5135	0.7242	0.8497	0.9066 (86)
MIT	19.3955	19.6188	19.9821	20.3706	20.7078	20.9199	20.9807	20.9787	20.8684	20.4921	19.8947	19.3231 (87)
Th 2	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943 (88)
util rest of house	0.8818	0.8472	0.7907	0.7024	0.5685	0.3672	0.2080	0.2169	0.4412	0.6817	0.8278	0.8942 (89)
MIT 2	18.5676	18.7814	19.1286	19.4912	19.7905	19.9543	19.9891	19.9883	19.9192	19.6074	19.0522	18.4986 (90)
Living area fraction									fLA = Living area / (4) =			0.3602 (91)
MIT	18.8658	19.0830	19.4360	19.8079	20.1209	20.3021	20.3463	20.3450	20.2611	19.9260	19.3557	18.7956 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7158	18.9330	19.2860	19.6579	19.9709	20.1521	20.1963	20.1950	20.1111	19.7760	19.2057	18.6456 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8610	0.8262	0.7718	0.6896	0.5672	0.3799	0.2274	0.2360	0.4501	0.6715	0.8078	0.8738 (94)
Useful gains	596.7992	639.2626	634.2900	584.4656	467.9435	308.0354	177.3532	184.7009	353.7004	499.7951	559.1486	570.9372 (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	1068.0788	1045.8974	932.3851	765.4533	546.8230	325.7051	180.1282	187.8751	385.2443	641.3610	879.0181	1062.5702 (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	350.6320	273.2585	221.7828	130.3111	58.6864	0.0000	0.0000	0.0000	0.0000	105.3250	230.3061	365.7749 (98)
Space heating												1736.0768 (98)
RHI space heating demand												1736 (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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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					3.2600
Infiltration rate					0.1630 (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) =				0.1263 (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	0.1611	0.1579	0.1547	0.1390	0.1358	0.1200	0.1200	0.1169	0.1263	0.1358	0.1421	0.1484 (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)			10.2200	1.2357	12.6293		(27)
FT-03			70.8000	0.1300	9.2040		(28b)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum(A, m ²)					138.7000		(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	34.7226	(33)
Party Wall 1				15.8400	0.0000	0.0000	(32)
Party Ceilings 1				70.8000			(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.6847 (36)
Total fabric heat loss							(33) + (36) = 50.4073 (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	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368 (38)
Heat transfer coeff	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441 (39)
Average = Sum(39)m / 12 =												78.4441 (39)
HLP	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080 (40)
HLP (average)												1.1080 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

Elmhurst Energy Systems
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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	14.0901	12.7064	14.0357	13.5466	13.9717	13.4906	13.9213	13.9540	13.5211	14.0092	13.5994	14.0796 (61)
Total heat required for water heating calculated for each month	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (64)
Heat gains from water heating, kWh/month	51.2551	44.9238	46.5883	40.9443	39.5304	34.4702	32.2968	36.5558	36.8425	42.4993	45.9681	49.7463 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	47.3057	42.0165	34.1701	25.8690	19.3373	16.3254	17.6402	22.9294	30.7757	39.0769	45.6085	48.6204 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	297.2492	300.3337	292.5608	276.0133	255.1250	235.4929	222.3775	219.2930	227.0659	243.6134	264.5017	284.1338 (68)
Pumps, fans	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156 (71)
Total internal gains	68.8912	66.8509	62.6186	56.8670	53.1322	47.8753	43.4097	49.1342	51.1702	57.1227	63.8447	66.8633 (72)
	512.6116	508.3665	488.5151	457.9148	426.7601	398.8591	382.5928	390.5220	408.1773	438.9785	473.1204	498.7830 (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	

South					10.2200	46.7521	0.4500	0.0000			0.7700	165.5598 (78)	

Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589	(83)
Total gains	678.1714	779.5109	833.9048	848.2802	833.5450	790.3342	765.0879	761.9777	768.9777	731.4331	669.3652	641.8419	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709
util living area	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714
	0.9088	0.8729	0.8288	0.7671	0.6775	0.5502	0.4199	0.4374	0.5913	0.7660	0.8742	0.9192 (86)
MIT	19.2236	19.5084	19.8571	20.2358	20.5781	20.8280	20.9389	20.9294	20.7783	20.3457	19.7062	19.1361 (87)
Th 2	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943 (88)
util rest of house	0.8972	0.8574	0.8077	0.7369	0.6326	0.4833	0.3342	0.3532	0.5284	0.7303	0.8561	0.9087 (89)
MIT 2	18.3998	18.6738	19.0084	19.3664	19.6785	19.8888	19.9673	19.9615	19.8509	19.4752	18.8717	18.3151 (90)
Living area fraction	18.6965	18.9744	19.3141	19.6795	20.0025	20.2271	20.3172	20.3101	20.1849	19.7887	19.1723	18.6108 (92)
MIT	18.5465	18.8244	19.1641	19.5295	19.8525	20.0771	20.1672	20.1601	20.0349	19.6387	19.0223	18.4608 (93)
Temperature adjustment												-0.1500
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8768	0.8363	0.7878	0.7213	0.6258	0.4891	0.3495	0.3677	0.5311	0.7162	0.8355	0.8889 (94)
Ext temp.	594.6061	651.8862	656.9524	611.8996	521.5962	386.5598	267.4329	280.1833	408.4345	523.8622	559.2401	570.5465 (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	1117.5545	1092.2882	993.4216	833.8249	639.5170	429.6432	279.8259	294.9605	465.5577	709.0348	935.2307	1118.6773 (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	389.0736	295.9501	250.3331	159.7862	87.7330	0.0000	0.0000	0.0000	0.0000	137.7684	270.7132	407.8093 (98)
Space heating per m2												1999.1670 (98)
										(98) / (4) =		28.2368 (99)

8c. Space cooling requirement

Not applicable

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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													2209.0243 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	389.0736	295.9501	250.3331	159.7862	87.7330	0.0000	0.0000	0.0000	0.0000	137.7684	270.7132	407.8093	(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)	429.9156	327.0167	276.6111	176.5593	96.9426	0.0000	0.0000	0.0000	0.0000	152.2303	299.1306	450.6181	(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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064	(64)
Efficiency of water heater (217)m	89.5535	89.4559	89.3067	89.0576	88.6084	87.3000	87.3000	87.3000	87.3000	88.9097	89.3748	89.6035	(216)
Fuel for water heating, kWh/month	176.0363	154.5586	160.7915	142.0451	138.0851	122.5854	115.2203	129.9021	130.7668	147.6706	158.4612	170.8710	(219)
Water heating fuel used												1746.9941	(219)
Annual totals kWh/year													
Space heating fuel - main system												2209.0243	(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)													38.1436 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													113.1436 (231)
Electricity for lighting (calculated in Appendix L)													334.1731 (232)
Total delivered energy for all uses													4403.3351 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2209.0243	3.4800	76.8740 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1746.9941	3.4800	60.7954 (247)
Mechanical ventilation fans	38.1436	13.1900	5.0311 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	334.1731	13.1900	44.0774 (250)
Additional standing charges			120.0000 (251)
Total energy cost			316.6705 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.1485 (257)
SAP value		83.9778
SAP rating (Section 12)		84 (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	2209.0243	0.2160	477.1492 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1746.9941	0.2160	377.3507 (264)
Space and water heating			854.5000 (265)
Pumps and fans	113.1436	0.5190	58.7215 (267)
Energy for lighting	334.1731	0.5190	173.4359 (268)
Total kg/year			1086.6574 (272)
CO2 emissions per m2			15.3500 (273)
EI value			87.4256
EI rating			87 (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	$3.48 / 0.8859 = 3.928$, stars = 4
Water heating environmental impact	$0.216 / 0.8859 = 0.2438$, 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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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					0 * 10 = 0.0000 (7a)							
Number of passive vents					0 * 10 = 0.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour							
Pressure test					0.0000 / (5) = 0.0000 (8)							
Measured/design AP50					Yes							
Infiltration rate					3.2600							
Number of sides sheltered					0.1630 (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) =		0.1263 (21)							
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 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	0.1326	0.1263	0.1263	0.1169	0.1169	0.1042	0.1074	0.1011	0.1042	0.1105	0.1105	0.1200 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293		(27)
FT-03			70.8000	0.1300	9.2040		(28b)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum(A, m ²)			138.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 34.7226		(33)
Party Wall 1			15.8400	0.0000	0.0000		(32)
Party Ceilings 1			70.8000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.6847 (36)
Total fabric heat loss							(33) + (36) = 50.4073 (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	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368 (38)
Heat transfer coeff	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441 (39)
Average = Sum(39)m / 12 =	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441	78.4441 (39)
HLP	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080 (40)
HLP (average)	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080	1.1080 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
Daily hot water use	Jan 96.8033	Feb 93.2832	Mar 89.7631	Apr 86.2429	May 82.7228	Jun 79.2027	Jul 79.2027	Aug 82.7228	Sep 86.2429	Oct 89.7631	Nov 93.2832	Dec 96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

Elmhurst Energy Systems
 SAP2012 Calculator (Design
 System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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	14.0901	12.7064	14.0357	13.5466	13.9717	13.4906	13.9213	13.9540	13.5211	14.0092	13.5994	14.0796 (61)
Total heat required for water heating calculated for each month	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (64)
Heat gains from water heating, kWh/month	51.2551	44.9238	46.5883	40.9443	39.5304	34.4702	32.2968	36.5558	36.8425	42.4993	45.9681	49.7463 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	47.3057	42.0165	34.1701	25.8690	19.3373	16.3254	17.6402	22.9294	30.7757	39.0769	45.6085	48.6204 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	297.2492	300.3337	292.5608	276.0133	255.1250	235.4929	222.3775	219.2930	227.0659	243.6134	264.5017	284.1338 (68)
Pumps, fans	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156 (71)
Total internal gains	68.8912	66.8509	62.6186	56.8670	53.1322	47.8753	43.4097	49.1342	51.1702	57.1227	63.8447	66.8633 (72)
	512.6116	508.3665	488.5151	457.9148	426.7601	398.8591	382.5928	390.5220	408.1773	438.9785	473.1204	498.7830 (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			
South				10.2200	50.9848	0.4500	0.0000	0.7700	180.5490 (78)			
Solar gains	180.5490	265.3663	333.3669	389.6318	398.2891	411.8829	397.3472	392.0371	377.7133	305.2939	219.0656	154.6394 (83)
Total gains	693.1606	773.7329	821.8819	847.5466	825.0491	810.7420	779.9401	782.5592	785.8906	744.2725	692.1860	653.4224 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709	25.0709
util living area	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714	2.6714
	0.8954	0.8642	0.8144	0.7374	0.6223	0.4452	0.3021	0.3102	0.5135	0.7242	0.8497	0.9066 (86)
MIT	19.3955	19.6188	19.9821	20.3706	20.7078	20.9199	20.9807	20.9787	20.8684	20.4921	19.8947	19.3231 (87)
Th 2	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943	19.9943 (88)
util rest of house	0.8818	0.8472	0.7907	0.7024	0.5685	0.3672	0.2080	0.2169	0.4412	0.6817	0.8278	0.8942 (89)
MIT 2	18.5676	18.7814	19.1286	19.4912	19.7905	19.9543	19.9891	19.9883	19.9192	19.6074	19.0522	18.4986 (90)
Living area fraction	18.8658	19.0830	19.4360	19.8079	20.1209	20.3021	20.3463	20.3450	20.2611	19.9260	19.3557	18.7956 (91)
MIT	18.7158	18.9330	19.2860	19.6579	19.9709	20.1521	20.1963	20.1950	20.1111	19.7760	19.2057	18.6456 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8610	0.8262	0.7718	0.6896	0.5672	0.3799	0.2274	0.2360	0.4501	0.6715	0.8078	0.8738 (94)
Ext temp.	596.7992	639.2626	634.2900	584.4656	467.9435	308.0354	177.3532	184.7009	353.7004	499.7951	559.1486	570.9372 (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	1068.0788	1045.8974	932.3851	765.4533	546.8230	325.7051	180.1282	187.8751	385.2443	641.3610	879.0181	1062.5702 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	350.6320	273.2585	221.7828	130.3111	58.6864	0.0000	0.0000	0.0000	0.0000	105.3250	230.3061	365.7749 (98)
												1736.0768 (98)
												24.5209 (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													1918.3170 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	350.6320	273.2585	221.7828	130.3111	58.6864	0.0000	0.0000	0.0000	0.0000	105.3250	230.3061	365.7749	(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)	387.4387	301.9431	245.0639	143.9902	64.8468	0.0000	0.0000	0.0000	0.0000	116.3812	254.4819	404.1712	(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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064	(64)
Efficiency of water heater (217)m	89.4827	89.3990	89.2148	88.8949	88.3122	87.3000	87.3000	87.3000	87.3000	88.6960	89.2542	89.5316	(216)
Fuel for water heating, kWh/month	176.1755	154.6569	160.9572	142.3049	138.5482	122.5854	115.2203	129.9021	130.7668	148.0264	158.6753	171.0081	(219)
Water heating fuel used													1748.8272 (219)
Annual totals kWh/year													
Space heating fuel - main system													1918.3170 (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)													38.1436 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													113.1436 (231)
Electricity for lighting (calculated in Appendix L)													334.1731 (232)
Total delivered energy for all uses													4114.4609 (238)

10a. Fuel costs - using BEDF prices (476)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1918.3170	3.8700	74.2389 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1748.8272	3.8700	67.6796 (247)
Mechanical ventilation fans	38.1436	18.9000	7.2091 (249)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	334.1731	18.9000	63.1587 (250)
Additional standing charges			93.0000 (251)
Total energy cost			319.4613 (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	1918.3170	0.2160	414.3565 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1748.8272	0.2160	377.7467 (264)
Space and water heating			792.1031 (265)
Pumps and fans	113.1436	0.5190	58.7215 (267)
Energy for lighting	334.1731	0.5190	173.4359 (268)
Total kg/year			1024.2605 (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	1918.3170	1.2200	2340.3467 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1748.8272	1.2200	2133.5692 (264)
Space and water heating			4473.9159 (265)
Pumps and fans	113.1436	3.0700	347.3510 (267)
Energy for lighting	334.1731	3.0700	1025.9115 (268)
Primary energy kWh/year			5847.1783 (272)
Primary energy kWh/m2/year			82.5873 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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 84	
Potential environmental impact rating:			B 87

Fuel prices for cost data on this page from database revision number 476 TEST (01 Apr 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	£85	£85	£0
Mains gas	£235	£235	£0
Space heating	£189	£189	£0
Water heating	£68	£68	£0
Lighting	£63	£63	£0
Total cost of fuels	£320	£320	£0
Total cost of uses	£320	£320	£0
Delivered energy	58 kWh/m²	58 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	83 kWh/m²	83 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	North
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	336.44 (P1)
Transmission heat loss coefficient	50.41 (37)
Summer heat loss coefficient	386.85 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
South	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	10.2200	112.2060	0.4500 0.0000
total:			0.9000 464.4318

Solar gains	Jun	Jul	Aug	
Internal gains	481	464	458	(P4)
Total summer gains	396	380	388	
	877	844	846	(P5)
Summer gain/loss ratio	2.27	2.18	2.19	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.57	21.38	21.29	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			