

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW025t_143_As_Built			Issued on Date	01/03/2022
Assessment Reference	001	Prop Type Ref	TFF		
Property					
SAP Rating	84 B	DER	17.88	TER	18.80
Environmental	87 B	% DER<TER	4.91		
CO ₂ Emissions (t/year)	1.05	DFEE	47.02	TFEE	50.84
General Requirements Compliance	Pass	% DFEE<TFEE	7.51		
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

Top-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) 18.80 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.88 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.0 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.36 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
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: 4.81 (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: 2.88 m², No overhang
Windows facing South: 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

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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	70.7500 (1b)	x 2.4000 (2b)	= 169.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.8000 (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					4.8100
Infiltration rate					0.2405 (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) =				0.1864 (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	0.2376	0.2330	0.2283	0.2050	0.2004	0.1771	0.1771	0.1724	0.1864	0.2004	0.2097	0.2190 (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)			11.9200	1.2357	14.7300		(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260		(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099		(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196		(29a)
Flat Roof	70.7500		70.7500	0.1500	10.6125		(30)
Total net area of external elements Aum(A, m ²)			144.9800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	42.6180	(33)
Party Wall 1			13.2000	0.0000	0.0000		(32)
Party Floor 1			70.7500				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.9649 (36)
Total fabric heat loss							(33) + (36) = 58.5829 (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	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170 (38)
Heat transfer coeff	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999 (39)
Average = Sum(39)m / 12 =												86.5999 (39)
HLP	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240 (40)
HLP (average)												1.2240 (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												2.2642 (42)
Average daily hot water use (litres/day)												87.9746 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721 (44)
Energy content (annual)	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1384.1834 (45)

Southern Energy
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Energy & Sustainability Solutions

	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473 (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	14.0899	12.7062	14.0355	13.5464	13.9716	13.4905	13.9212	13.9539	13.5210	14.0091	13.5992	14.0793 (61)
Total heat required for water heating calculated for each month	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613 (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	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	Solar input (sum of months) = Sum(63)m =				0.0000 (63)
	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613 (64)
								Total per year (kWh/year) = Sum(64)m =				1549.1071 (64)
Heat gains from water heating, kWh/month	51.2396	44.9103	46.5743	40.9321	39.5187	34.4602	32.2875	36.5451	36.8317	42.4867	45.9544	49.7313 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3312	16.2816	13.2411	10.0244	7.4933	6.3262	6.8357	8.8853	11.9258	15.1425	17.6735	18.8407 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.0411	201.1066	195.9018	184.8214	170.8343	157.6885	148.9063	146.8409	152.0457	163.1261	177.1131	190.2589 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210 (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)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678 (71)
Water heating gains (Table 5)	68.8704	66.8308	62.5999	56.8502	53.1165	47.8613	43.3971	49.1198	51.1551	57.1058	63.8255	66.8432 (72)
Total internal gains	346.2057	344.1818	331.7057	311.6588	291.4071	271.8389	259.1020	264.8088	275.0895	295.3373	318.5751	335.9057 (73)

[Jan				Area	Solar flux	g		FF		Access		Gains
				m2	Table 6a	Table 6b		Table 6c		factor		W
					W/m2	or Table 6b		or Table 6c		Table 6d		
East				2.8800	19.6403	0.4500		0.0000		0.7700		19.5994 (76)
South				9.0400	46.7521	0.4500		0.0000		0.7700		146.4443 (78)
Solar gains	166.0437	278.1786	368.6526	437.3820	472.6750	461.8052	448.3212	423.0463	392.5786	304.1822	198.0246	142.6590 (83)
Total gains	512.2494	622.3605	700.3583	749.0408	764.0822	733.6441	707.4232	687.8552	667.6681	599.5194	516.5997	478.5647 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344
alpha	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823
util living area	0.9955	0.9882	0.9719	0.9331	0.8481	0.6952	0.5254	0.5605	0.7782	0.9472	0.9899	0.9967 (86)
MIT	19.7737	19.9794	20.2469	20.5430	20.7939	20.9421	20.9877	20.9832	20.8979	20.5642	20.0932	19.7192 (87)
Th 2	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008 (88)
util rest of house	0.9940	0.9843	0.9626	0.9099	0.7955	0.5991	0.4009	0.4358	0.6932	0.9239	0.9860	0.9956 (89)
MIT 2	18.7982	19.0017	19.2638	19.5457	19.7667	19.8752	19.8979	19.8964	19.8490	19.5714	19.1160	18.7440 (90)
Living area fraction												0.3713 (91)
MIT	19.1604	19.3647	19.6288	19.9160	20.1481	20.2714	20.3025	20.2999	20.2385	19.9400	19.4788	19.1061 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0104	19.2147	19.4788	19.7660	19.9981	20.1214	20.1525	20.1499	20.0885	19.7900	19.3288	18.9561 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9923	0.9812	0.9580	0.9065	0.8007	0.6198	0.4303	0.4651	0.7093	0.9210	0.9832	0.9943 (94)
Useful gains	508.3031	610.6589	670.9665	678.9956	611.8383	454.6814	304.3817	319.9451	473.5665	552.1541	507.9179	475.8245 (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	1273.9180	1239.6550	1123.9645	940.9967	718.6169	478.1506	307.6502	324.7419	518.6028	795.8530	1059.0173	1277.8762 (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	569.6175	422.6854	337.0305	188.6408	79.4433	0.0000	0.0000	0.0000	0.0000	181.3120	396.7916	596.7264 (98)
Space heating												2772.2476 (99)
Space heating per m2												39.1837 (99)
										(98) / (4) =		

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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													3063.2570 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	569.6175	422.6854	337.0305	188.6408	79.4433	0.0000	0.0000	0.0000	0.0000	181.3120	396.7916	596.7264	(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)	629.4116	467.0557	372.4094	208.4429	87.7827	0.0000	0.0000	0.0000	0.0000	200.3447	438.4437	659.3662	(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	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(64)
Efficiency of water heater (217)m	89.7868	89.6899	89.5198	89.1879	88.5326	87.3000	87.3000	87.3000	87.3000	89.1281	89.6359	87.3000	(216)
Fuel for water heating, kWh/month	175.5271	154.1101	160.3619	141.7964	138.1637	122.5508	115.1882	129.8653	130.7295	147.2661	157.9533	170.3941	(219)
Water heating fuel used												1743.9064	(219)
Annual totals kWh/year													
Space heating fuel - main system												3063.2570	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													38.1167 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													113.1167 (231)
Electricity for lighting (calculated in Appendix L)													323.7346 (232)
Total delivered energy for all uses													5244.0147 (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	3063.2570	0.2160	661.6635	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1743.9064	0.2160	376.6838	(264)
Space and water heating			1038.3473	(265)
Pumps and fans	113.1167	0.5190	58.7076	(267)
Energy for lighting	323.7346	0.5190	168.0183	(268)
Total CO2, kg/year			1265.0731	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8800	(273)

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

DER		17.8800	ZC1
Total Floor Area	TFA	70.7500	
Assumed number of occupants	N	2.2642	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6710	ZC2
CO2 emissions from cooking, equation (L16)		2.4500	ZC3
Total CO2 emissions		37.0011	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		37.0011	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	70.7500 (1b)	x 2.4000 (2b)	= 169.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.8000 (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) = 0.1767 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4267 (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) =				0.3307 (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	0.4216	0.4133	0.4051	0.3637	0.3555	0.3141	0.3141	0.3059	0.3307	0.3555	0.3720	0.3885 (22b)
Effective ac	0.5889	0.5854	0.5820	0.5662	0.5632	0.5493	0.5493	0.5468	0.5547	0.5632	0.5692	0.5755 (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)			11.9200	1.3258	15.8030			(27)				
WT-E-01	43.5500	11.9200	31.6300	0.1800	5.6934			(29a)				
WT-I-01	22.5700	2.1200	20.4500	0.1800	3.6810			(29a)				
WT-I-11	8.1100		8.1100	0.1800	1.4598			(29a)				
Flat Roof	70.7500		70.7500	0.1300	9.1975			(30)				
Total net area of external elements Aum(A, m2)			144.9800					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	37.9547			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								14.8740 (36)				
Total fabric heat loss						(33) + (36) =		52.8287 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.9972	Feb 32.8038	Mar 32.6143	Apr 31.7239	May 31.5573	Jun 30.7819	Jul 30.7819	Aug 30.6383	Sep 31.0806	Oct 31.5573	Nov 31.8943	Dec 32.2466 (38)
Heat transfer coeff	85.8259	85.6325	85.4430	84.5526	84.3861	83.6106	83.6106	83.4670	83.9093	84.3861	84.7230	85.0754 (39)
Average = Sum(39)m / 12 =												84.5518 (39)
HLP	Jan 1.2131	Feb 1.2104	Mar 1.2077	Apr 1.1951	May 1.1927	Jun 1.1818	Jul 1.1818	Aug 1.1797	Sep 1.1860	Oct 1.1927	Nov 1.1975	Dec 1.2025 (40)
HLP (average)												1.1951 (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												2.2642 (42)
Average daily hot water use (litres/day)												87.9746 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721 (44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820 (45)
Energy content (annual)											Total = Sum(45)m =	1384.1834 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473 (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	49.3140	42.9220	45.7275	42.5171	42.1410	39.0463	40.3478	42.1410	42.5171	45.7275	45.9878	49.3140 (61)
Solar input	192.8242	168.4369	175.2477	155.4359	150.4894	132.5426	126.9859	141.5595	143.1229	162.9740	173.9715	188.2960 (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	192.8242	168.4369	175.2477	155.4359	150.4894	132.5426	126.9859	141.5595	143.1229	162.9740	173.9715	188.2960 (64)
	60.0456	52.4642	54.4973	48.1748	46.5611	40.8491	38.8941	43.5919	44.0807	50.4163	54.0515	58.5400 (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	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3312	16.2816	13.2411	10.0244	7.4933	6.3262	6.8357	8.8853	11.9258	15.1425	17.6735	18.8407	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.0411	201.1066	195.9018	184.8214	170.8343	157.6885	148.9063	146.8409	152.0457	163.1261	177.1131	190.2589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	(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)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)	80.7065	78.0717	73.2491	66.9094	62.5821	56.7349	52.2771	58.5913	61.2232	67.7639	75.0716	78.6828	(72)
Total internal gains	358.0418	355.4228	342.3549	321.7180	300.8727	280.7125	267.9819	274.2803	285.1576	305.9954	329.8211	347.7453	(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					2.8800	19.6403	0.6300	0.7000	0.7700	17.2867 (76)		
South					9.0400	46.7521	0.6300	0.7000	0.7700	129.1639 (78)		
Solar gains	146.4506	245.3536	325.1516	385.7709	416.8994	407.3121	395.4193	373.1269	346.2543	268.2887	174.6577	125.8252 (83)
Total gains	504.4923	600.7764	667.5065	707.4890	717.7721	688.0246	663.4012	647.4072	631.4119	574.2840	504.4788	473.5705 (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	57.2460	57.3753	57.5026	58.1081	58.2228	58.7628	58.7628	58.8639	58.5536	58.2228	57.9912	57.7511	
alpha	4.8164	4.8250	4.8335	4.8739	4.8815	4.9175	4.9175	4.9243	4.9036	4.8815	4.8661	4.8501	
util living area	0.9957	0.9897	0.9761	0.9423	0.8648	0.7129	0.5405	0.5738	0.7927	0.9525	0.9907	0.9968	(86)
MIT	19.7783	19.9705	20.2284	20.5307	20.7839	20.9411	20.9877	20.9835	20.8965	20.5645	20.1079	19.7414	(87)
Th 2	19.9095	19.9117	19.9139	19.9239	19.9258	19.9346	19.9346	19.9362	19.9312	19.9258	19.9220	19.9180	(88)
util rest of house	0.9943	0.9863	0.9680	0.9216	0.8158	0.6190	0.4168	0.4507	0.7107	0.9312	0.9870	0.9958	(89)
MIT 2	18.2987	18.5791	18.9519	19.3839	19.7163	19.8956	19.9302	19.9297	19.8529	19.4392	18.7879	18.2510	(90)
Living area fraction	18.8480	19.0957	19.4259	19.8097	20.1127	20.2838	20.3229	20.3210	20.2404	19.8571	19.2780	18.8044	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8480	19.0957	19.4259	19.8097	20.1127	20.2838	20.3229	20.3210	20.2404	19.8571	19.2780	18.8044	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	500.6489	590.4716	643.0512	650.1836	592.4321	448.4001	307.2247	321.5460	465.1923	533.7791	496.4283	470.8365	(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	1248.5999	1215.6155	1104.4284	922.4436	709.9156	475.2268	311.2699	327.2721	515.2383	781.1660	1031.7578	1242.4725	(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	556.4755	420.0967	343.2646	196.0272	87.4077	0.0000	0.0000	0.0000	0.0000	184.0559	385.4373	574.0972	(98)
Space heating												2746.8621	(98)
Space heating per m2												38.8249	(99)

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													2940.9659 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.4755	420.0967	343.2646	196.0272	87.4077	0.0000	0.0000	0.0000	0.0000	184.0559	385.4373	574.0972	(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)	595.7982	449.7823	367.5210	209.8792	93.5843	0.0000	0.0000	0.0000	0.0000	197.0619	412.6738	614.6651	(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	192.8242	168.4369	175.2477	155.4359	150.4894	132.5426	126.9859	141.5595	143.1229	162.9740	173.9715	188.2960	(64)
Efficiency of water heater (217)m	87.5657	87.2589	86.7137	85.6364	83.7374	80.3000	80.3000	80.3000	80.3000	85.3580	86.9970	87.6764	(217)
Fuel for water heating, kWh/month	220.2052	193.0312	202.0991	181.5068	179.7158	165.0593	158.1394	176.2884	178.2353	190.9299	199.9741	214.7625	(219)
Water heating fuel used												2259.9469	(219)
Annual totals kWh/year													
Space heating fuel - main system												2940.9659	(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)												323.7346	(232)
Total delivered energy for all uses												5599.6474	(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	2940.9659	0.2160	635.2486 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2259.9469	0.2160	488.1485 (264)
Space and water heating			1123.3972 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	323.7346	0.5190	168.0183 (268)
Total CO2, kg/m2/year			1330.3404 (272)
Emissions per m2 for space and water heating			15.8784 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3748 (272b)
Emissions per m2 for pumps and fans			0.5502 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8784 * 1.00) + 2.3748 + 0.5502, rounded to 2 d.p.			18.8000 (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	70.7500 (1b)	x 2.4000 (2b)	= 169.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.8000 (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) = 0.1767 (8)
Measured/design AP50					Yes
Infiltration rate					4.8100
Number of sides sheltered					0.4172 (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) =				0.3233 (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												
	0.4122	0.4041	0.3961	0.3556	0.3476	0.3071	0.3071	0.2991	0.3233	0.3476	0.3637	0.3799 (22b)
Effective ac	0.5850	0.5817	0.5784	0.5632	0.5604	0.5472	0.5472	0.5447	0.5523	0.5604	0.5661	0.5722 (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)			11.9200	1.2357	14.7300		(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260		(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099		(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196		(29a)
Flat Roof	70.7500		70.7500	0.1500	10.6125		(30)
Total net area of external elements Aum(A, m ²)			144.9800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.6180		(33)
Party Wall 1			13.2000	0.0000	0.0000		(32)
Party Floor 1			70.7500				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.9649 (36)
Total fabric heat loss						(33) + (36) =	58.5829 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	32.7779	32.5930	32.4118	31.5607	31.4014	30.6601	30.6601	30.5228	30.9457	31.4014	31.7236	32.0604 (38)
Heat transfer coeff	91.3608	91.1760	90.9948	90.1436	89.9844	89.2431	89.2431	89.1058	89.5286	89.9844	90.3065	90.6433 (39)
Average = Sum(39)m / 12 =												90.1429 (39)
HLP	1.2913	1.2887	1.2861	1.2741	1.2719	1.2614	1.2614	1.2594	1.2654	1.2719	1.2764	1.2812 (40)
HLP (average)												1.2741 (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												2.2642 (42)
Average daily hot water use (litres/day)												87.9746 (43)
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721 (44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820 (45)
Energy content (annual)										Total = Sum(45)m =		1384.1834 (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)
	30.4959	26.6719	27.5230	23.9953	23.0240	19.8680	18.4106	21.1264	21.3787	24.9149	27.1965	29.5337 (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	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3312	16.2816	13.2411	10.0244	7.4933	6.3262	6.8357	8.8853	11.9258	15.1425	17.6735	18.8407	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.0411	201.1066	195.9018	184.8214	170.8343	157.6885	148.9063	146.8409	152.0457	163.1261	177.1131	190.2589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	(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)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)	40.9891	39.6904	36.9933	33.3267	30.9463	27.5944	24.7454	28.3957	29.6927	33.4877	37.7730	39.6958	(72)
Total internal gains	315.3244	314.0415	303.0991	285.1354	266.2368	248.5720	237.4503	241.0848	250.6270	268.7192	289.5225	305.7583	(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					2.8800	19.6403		0.4500		0.0000		0.7700		19.5994	
South					9.0400	46.7521		0.4500		0.0000		0.7700		146.4443 (76)	
Solar gains	166.0437	278.1786	368.6526	437.3820	472.6750	461.8052	448.3212	423.0463	392.5786	304.1822	198.0246	142.6590 (83)			
Total gains	481.3681	592.2201	671.7517	722.5174	738.9119	710.3772	685.7715	664.1311	643.2057	572.9014	487.5471	448.4173 (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	53.7779	53.8869	53.9943	54.5041	54.6005	55.0541	55.0541	55.1389	54.8785	54.6005	54.4058	54.2036	
alpha	4.5852	4.5925	4.5996	4.6336	4.6400	4.6703	4.6703	4.6759	4.6586	4.6400	4.6271	4.6136	
util living area	0.9965	0.9907	0.9775	0.9445	0.8698	0.7239	0.5537	0.5907	0.8063	0.9575	0.9923	0.9975	(86)
MIT	19.6463	19.8591	20.1415	20.4699	20.7478	20.9259	20.9831	20.9771	20.8711	20.4971	19.9990	19.6056	(87)
Th 2	19.8476	19.8497	19.8517	19.8612	19.8629	19.8712	19.8712	19.8727	19.8680	19.8629	19.8594	19.8556	(88)
util rest of house	0.9954	0.9876	0.9696	0.9239	0.8202	0.6261	0.4211	0.4588	0.7229	0.9376	0.9891	0.9966	(89)
MIT 2	18.6295	18.8422	19.1217	19.4451	19.6961	19.8378	19.8671	19.8666	19.8011	19.4781	18.9900	18.5952	(90)
Living area fraction									fLA = Living area / (4) =			0.3713	(91)
MIT	19.0070	19.2197	19.5003	19.8256	20.0866	20.2418	20.2815	20.2790	20.1984	19.8564	19.3646	18.9704	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0070	19.2197	19.5003	19.8256	20.0866	20.2418	20.2815	20.2790	20.1984	19.8564	19.3646	18.9704	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	478.5683	583.5403	649.3084	667.0122	614.2295	469.2519	322.9571	337.6204	482.3420	537.0560	481.3600	446.4949	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1343.6467	1305.6165	1182.9616	984.8764	754.6669	503.4948	328.5493	345.6375	545.9816	832.9344	1107.5755	1338.8383	(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	643.6184	485.2352	397.0380	228.8622	104.4855	0.0000	0.0000	0.0000	0.0000	220.1335	450.8751	663.9035	(98)
Space heating												3194.1515	(98)
Space heating per m2										(98) / (4) =		45.1470	(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	838.8848	660.3986	677.2039	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8573	0.9199	0.9065	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	719.1622	607.5217	613.8562	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	914.6713	884.2278	860.3773	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	140.7666	205.8693	183.4117	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

Space cooling												530.0476 (104)
Cooled Fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	35.1916	51.4673	45.8529	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												132.5119 (107)
Space cooling per m2												1.8730 (108)
Energy for space heating												45.1470 (99)
Energy for space cooling												1.8730 (108)
Total												47.0200 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.0 (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	70.7500 (1b)	x 2.4000 (2b)	= 169.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.8000 (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) = 0.1767 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4267 (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) =	0.3307 (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	0.4216	0.4133	0.4051	0.3637	0.3555	0.3141	0.3141	0.3059	0.3307	0.3555	0.3720	0.3885 (22b)
	0.5889	0.5854	0.5820	0.5662	0.5632	0.5493	0.5493	0.5468	0.5547	0.5632	0.5692	0.5755 (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)			11.9200	1.3258	15.8030			(27)				
WT-E-01	43.5500	11.9200	31.6300	0.1800	5.6934			(29a)				
WT-I-01	22.5700	2.1200	20.4500	0.1800	3.6810			(29a)				
WT-I-11	8.1100		8.1100	0.1800	1.4598			(29a)				
Flat Roof	70.7500		70.7500	0.1300	9.1975			(30)				
Total net area of external elements Aum(A, m2)			144.9800					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	37.9547			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								14.8740 (36)				
Total fabric heat loss						(33) + (36) =		52.8287 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.9972	Feb 32.8038	Mar 32.6143	Apr 31.7239	May 31.5573	Jun 30.7819	Jul 30.7819	Aug 30.6383	Sep 31.0806	Oct 31.5573	Nov 31.8943	Dec 32.2466 (38)
Heat transfer coeff	85.8259	85.6325	85.4430	84.5526	84.3861	83.6106	83.6106	83.4670	83.9093	84.3861	84.7230	85.0754 (39)
Average = Sum(39)m / 12 =												84.5518 (39)
HLP	Jan 1.2131	Feb 1.2104	Mar 1.2077	Apr 1.1951	May 1.1927	Jun 1.1818	Jul 1.1818	Aug 1.1797	Sep 1.1860	Oct 1.1927	Nov 1.1975	Dec 1.2025 (40)
HLP (average)												1.1951 (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												2.2642 (42)
Average daily hot water use (litres/day)												87.9746 (43)
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721 (44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820 (45)
Energy content (annual)										Total = Sum(45)m =		1384.1834 (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)
	30.4959	26.6719	27.5230	23.9953	23.0240	19.8680	18.4106	21.1264	21.3787	24.9149	27.1965	29.5337	(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	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3312	16.2816	13.2411	10.0244	7.4933	6.3262	6.8357	8.8853	11.9258	15.1425	17.6735	18.8407	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.0411	201.1066	195.9018	184.8214	170.8343	157.6885	148.9063	146.8409	152.0457	163.1261	177.1131	190.2589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	(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)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)	40.9891	39.6904	36.9933	33.3267	30.9463	27.5944	24.7454	28.3957	29.6927	33.4877	37.7730	39.6958	(72)
Total internal gains	315.3244	314.0415	303.0991	285.1354	266.2368	248.5720	237.4503	241.0848	250.6270	268.7192	289.5225	305.7583	(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					2.8800	19.6403		0.6300	0.7000	0.7700	17.2867 (76)	
South					9.0400	46.7521		0.6300	0.7000	0.7700	129.1639 (78)	
Solar gains	146.4506	245.3536	325.1516	385.7709	416.8994	407.3121	395.4193	373.1269	346.2543	268.2887	174.6577	125.8252 (83)
Total gains	461.7749	559.3950	628.2507	670.9063	683.1362	655.8842	632.8696	614.2116	596.8814	537.0079	464.1802	431.5835 (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	57.2460	57.3753	57.5026	58.1081	58.2228	58.7628	58.7628	58.8639	58.5536	58.2228	57.9912	57.7511	
alpha	4.8164	4.8250	4.8335	4.8739	4.8815	4.9175	4.9175	4.9243	4.9036	4.8815	4.8661	4.8501	
util living area	0.9971	0.9923	0.9811	0.9519	0.8820	0.7370	0.5637	0.6004	0.8177	0.9626	0.9934	0.9979	(86)
MIT	19.7233	19.9186	20.1822	20.4939	20.7599	20.9317	20.9853	20.9800	20.8801	20.5249	20.0570	19.6870	(87)
Th 2	19.9095	19.9117	19.9139	19.9239	19.9258	19.9346	19.9346	19.9362	19.9312	19.9258	19.9220	19.9180	(88)
util rest of house	0.9961	0.9897	0.9745	0.9340	0.8365	0.6437	0.4361	0.4737	0.7390	0.9450	0.9908	0.9972	(89)
MIT 2	18.7550	18.9508	19.2125	19.5217	19.7642	19.9031	19.9309	19.9307	19.8677	19.5577	19.0976	18.7256	(90)
Living area fraction	19.1145	19.3102	19.5726	19.8827	20.1339	20.2850	20.3224	20.3203	20.2436	19.9168	19.4539	19.0826	(91)
MIT	19.1145	19.3102	19.5726	19.8827	20.1339	20.2850	20.3224	20.3203	20.2436	19.9168	19.4539	19.0826	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1145	19.3102	19.5726	19.8827	20.1339	20.2850	20.3224	20.3203	20.2436	19.9168	19.4539	19.0826	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	459.5309	552.6034	610.6053	626.0795	578.2867	443.7720	306.3361	320.1642	456.3530	507.3872	459.1964	430.0424	(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	1271.4723	1233.9793	1116.9616	928.6158	711.7074	475.3297	311.2337	327.2147	515.5056	786.2105	1046.6561	1266.1419	(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	604.0844	457.8846	376.7291	217.8262	99.2650	0.0000	0.0000	0.0000	0.0000	207.4445	422.9710	622.0580	(98)
Space heating												3008.2628	(98)
Space heating per m2												42.5196	(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	785.9396	618.7184	634.3491	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8623	0.9250	0.9123	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	677.6800	572.2889	578.6949	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	850.9782	822.3944	802.0299	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	124.7747	186.0785	166.1613	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												477.0145	(104)
Cooled fraction												1.0000	(105)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	31.1937	46.5196	41.5403	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											119.2536 (107)
Space cooling per m2											1.6856 (108)
Energy for space heating											42.5196 (99)
Energy for space cooling											1.6856 (108)
Total											44.2052 (109)
Target Fabric Energy Efficiency (TFEE)											50.8 (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	70.7500 (1b)	x 2.4000 (2b)	= 169.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.8000 (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					4.8100
Infiltration rate					0.2405 (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) =				0.1864 (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	0.1957	0.1864	0.1864	0.1724	0.1724	0.1538	0.1584	0.1491	0.1538	0.1631	0.1631	0.1771 (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)			11.9200	1.2357	14.7300		(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260		(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099		(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196		(29a)
Flat Roof	70.7500		70.7500	0.1500	10.6125		(30)
Total net area of external elements Aum(A, m ²)			144.9800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.6180		(33)
Party Wall 1			13.2000	0.0000	0.0000		(32)
Party Floor 1			70.7500				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.9649 (36)
Total fabric heat loss							(33) + (36) = 58.5829 (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	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170 (38)
Heat transfer coeff	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999 (39)
Average = Sum(39)m / 12 =												86.5999 (39)
HLP	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240 (40)
HLP (average)												1.2240 (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												2.2642 (42)
Average daily hot water use (litres/day)												87.9746 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721 (44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820 (45)
Energy content (annual)											Total = Sum(45)m =	1384.1834 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473 (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	14.0899	12.7062	14.0355	13.5464	13.9716	13.4905	13.9212	13.9539	13.5210	14.0091	13.5992	14.0793 (61)
Total heat required for water heating calculated for each month	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613 (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	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613 (64)
RHI water heating demand	51.2396	44.9103	46.5743	40.9321	39.5187	34.4602	32.2875	36.5451	36.8317	42.4867	45.9544	49.7313 (65)
Heat gains from water heating, kWh/month												1549 (64)
												1549 (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	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8280	40.7040	33.1027	25.0609	18.7333	15.8155	17.0892	22.2131	29.8144	37.8562	44.1838	47.1017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.0763	300.1591	292.3907	275.8528	254.9766	235.3560	222.2482	219.1655	226.9338	243.4717	264.3479	283.9685	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	(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)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)	68.8704	66.8308	62.5999	56.8502	53.1165	47.8613	43.3971	49.1198	51.1551	57.1058	63.8255	66.8432	(72)
Total internal gains	510.9080	506.8271	487.2266	456.8971	425.9597	398.1660	381.8677	389.6316	407.0366	437.5670	471.4905	497.0467	(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					2.8800	22.3313	0.4500	0.0000			0.7700	22.2849
South					9.0400	50.9848	0.4500	0.0000			0.7700	159.7028 (78)
Solar gains	181.9877	273.9406	358.5521	440.0766	466.0135	488.8042	468.7322	449.9359	414.2876	319.6994	222.2385	154.9329 (83)
Total gains	692.8957	780.7677	845.7787	896.9737	891.9732	886.9702	850.6000	839.5675	821.3242	757.2664	693.7290	651.9796 (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	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	
util living area	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	
	0.9810	0.9664	0.9321	0.8544	0.7093	0.4800	0.3147	0.3290	0.5875	0.8555	0.9597	0.9851	(86)
MIT	20.0868	20.2416	20.4900	20.7447	20.9212	20.9904	20.9990	20.9988	20.9742	20.7824	20.3974	20.0377	(87)
Th 2	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	(88)
util rest of house	0.9750	0.9563	0.9116	0.8122	0.6339	0.3785	0.2036	0.2166	0.4868	0.8048	0.9452	0.9802	(89)
MIT 2	19.1069	19.2566	19.4928	19.7207	19.8586	19.8981	19.9007	19.9007	19.8913	19.7576	19.4098	19.0591	(90)
Living area fraction	19.4708	19.6223	19.8630	20.1009	20.2532	20.3037	20.3085	20.3084	20.2934	20.1381	19.7765	19.4224	(91)
MIT	19.4708	19.6223	19.8630	20.1009	20.2532	20.3037	20.3085	20.3084	20.2934	20.1381	19.7765	19.4224	(92)
Temperature adjustment	19.3208	19.4723	19.7130	19.9509	20.1032	20.1537	20.1585	20.1584	20.1434	19.9881	19.6265	19.2724	(93)
adjusted MIT													

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9710	0.9514	0.9075	0.8144	0.6487	0.4023	0.2298	0.2431	0.5099	0.8094	0.9408	0.9766	(94)
Ext temp.	672.8081	742.8156	767.5246	730.4920	578.5799	356.8395	195.4562	204.0606	418.7938	612.9429	652.6295	636.7489	(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	1231.5172	1201.3446	1066.3091	870.4111	615.1334	359.7101	195.5895	204.2398	428.0955	726.4078	1006.8555	1227.3332	(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	415.6796	308.1315	222.2957	100.7418	27.1958	0.0000	0.0000	0.0000	0.0000	84.4178	255.0428	439.3948	(98)
RHI space heating demand												1852.8997	(98)
												1853	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.7500 (1b)	x 2.4000 (2b)	= 169.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.8000 (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					4.8100
Infiltration rate					0.2405 (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) =				0.1864 (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	0.2376	0.2330	0.2283	0.2050	0.2004	0.1771	0.1771	0.1724	0.1864	0.2004	0.2097	0.2190 (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)			11.9200	1.2357	14.7300		(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260		(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099		(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196		(29a)
Flat Roof	70.7500		70.7500	0.1500	10.6125		(30)
Total net area of external elements Aum(A, m ²)			144.9800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.6180		(33)
Party Wall 1			13.2000	0.0000	0.0000		(32)
Party Floor 1			70.7500				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.9649 (36)
Total fabric heat loss							(33) + (36) = 58.5829 (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	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170 (38)
Heat transfer coeff	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999 (39)
Average = Sum(39)m / 12 =												86.5999 (39)
HLP	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240 (40)
HLP (average)												1.2240 (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												2.2642 (42)
Average daily hot water use (litres/day)												87.9746 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721 (44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820 (45)
Energy content (annual)											Total = Sum (45)m =	1384.1834 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473 (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	14.0899	12.7062	14.0355	13.5464	13.9716	13.4905	13.9212	13.9539	13.5210	14.0091	13.5992	14.0793 (61)
Total heat required for water heating calculated for each month	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613 (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	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613 (64)
								Total per year (kWh/year) = Sum(64)m =				1549.1071 (64)
Heat gains from water heating, kWh/month	51.2396	44.9103	46.5743	40.9321	39.5187	34.4602	32.2875	36.5451	36.8317	42.4867	45.9544	49.7313 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8280	40.7040	33.1027	25.0609	18.7333	15.8155	17.0892	22.2131	29.8144	37.8562	44.1838	47.1017 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.0763	300.1591	292.3907	275.8528	254.9766	235.3560	222.2482	219.1655	226.9338	243.4717	264.3479	283.9685 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494 (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)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678 (71)
Water heating gains (Table 5)	68.8704	66.8308	62.5999	56.8502	53.1165	47.8613	43.3971	49.1198	51.1551	57.1058	63.8255	66.8432 (72)
Total internal gains	510.9080	506.8271	487.2266	456.8971	425.9597	398.1660	381.8677	389.6316	407.0366	437.5670	471.4905	497.0467 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
East				2.8800	19.6403	0.4500		0.0000	0.7700		19.5994 (76)	
South				9.0400	46.7521	0.4500		0.0000	0.7700		146.4443 (78)	
Solar gains	166.0437	278.1786	368.6526	437.3820	472.6750	461.8052	448.3212	423.0463	392.5786	304.1822	198.0246	142.6590 (83)
Total gains	676.9517	785.0057	855.8792	894.2791	898.6348	859.9712	830.1889	812.6780	799.6152	741.7492	669.5151	639.7056 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344
alpha	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823
util living area	0.9857	0.9709	0.9429	0.8855	0.7789	0.6141	0.4529	0.4818	0.6897	0.8966	0.9722	0.9889 (86)
MIT	19.9798	20.1721	20.4123	20.6648	20.8619	20.9657	20.9934	20.9911	20.9397	20.6914	20.2759	19.9230 (87)
Th 2	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008 (88)
util rest of house	0.9813	0.9624	0.9261	0.8521	0.7180	0.5211	0.3429	0.3710	0.6011	0.8593	0.9624	0.9854 (89)
MIT 2	19.0014	19.1888	19.4190	19.6511	19.8157	19.8865	19.8993	19.8986	19.8724	19.6807	19.2929	18.9456 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.3713 (91)
MIT	19.3647	19.5539	19.7878	20.0275	20.2041	20.2872	20.3056	20.3042	20.2687	20.0560	19.6579	19.3085 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2147	19.4039	19.6378	19.8775	20.0541	20.1372	20.1556	20.1542	20.1187	19.9060	19.5079	19.1585 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9778	0.9576	0.9213	0.8513	0.7272	0.5420	0.3689	0.3970	0.6198	0.8595	0.9580	0.9824 (94)
Useful gains	661.9285	751.7114	788.5504	761.3253	653.4955	466.0791	306.2192	322.6642	495.6238	637.5196	641.4228	628.4267 (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	1291.6097	1256.0402	1137.7323	950.6521	723.4688	479.5242	307.9119	325.1164	521.2191	805.8976	1074.5218	1295.4066 (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	468.4828	338.9090	259.7913	136.3153	52.0602	0.0000	0.0000	0.0000	0.0000	125.2733	311.8313	496.2331 (98)
Space heating												2188.8961 (99)
Space heating per m2												30.9385 (99)
										(98) / (4) =		

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF 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													2418.6697 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	468.4828	338.9090	259.7913	136.3153	52.0602	0.0000	0.0000	0.0000	0.0000	125.2733	311.8313	496.2331	(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)	517.6605	374.4851	287.0622	150.6246	57.5250	0.0000	0.0000	0.0000	0.0000	138.4235	344.5649	548.3238	(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	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(64)
Efficiency of water heater (217)m	89.6726	89.5491	89.3345	88.9312	88.2314	87.3000	87.3000	87.3000	87.3000	88.8339	89.4759	87.3000	(216)
Fuel for water heating, kWh/month	175.7505	154.3523	160.6945	142.2057	138.6354	122.5508	115.1882	129.8653	130.7295	147.7538	158.2359	170.5900	(219)
Water heating fuel used												1746.5518	(219)
Annual totals kWh/year													
Space heating fuel - main system												2418.6697	(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)													38.1167 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													113.1167 (231)
Electricity for lighting (calculated in Appendix L)													323.7346 (232)
Total delivered energy for all uses													4602.0729 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2418.6697	3.4800	84.1697 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1746.5518	3.4800	60.7800 (247)
Mechanical ventilation fans	38.1167	13.1900	5.0276 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	323.7346	13.1900	42.7006 (250)
Additional standing charges			120.0000 (251)
Total energy cost			322.5704 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1704 (257)
SAP value		83.6722
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	2418.6697	0.2160	522.4327 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1746.5518	0.2160	377.2552 (264)
Space and water heating			899.6879 (265)
Pumps and fans	113.1167	0.5190	58.7076 (267)
Energy for lighting	323.7346	0.5190	168.0183 (268)
Total kg/year			1126.4137 (272)
CO2 emissions per m2			15.9200 (273)
EI value			86.9599
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	$3.48 / 0.8858 = 3.929$, stars = 4
Water heating environmental impact	$0.216 / 0.8858 = 0.2438$, 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	70.7500 (1b)	x 2.4000 (2b)	= 169.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.8000 (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					4.8100
Infiltration rate					0.2405 (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) =				0.1864 (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	0.1957	0.1864	0.1864	0.1724	0.1724	0.1538	0.1584	0.1491	0.1538	0.1631	0.1631	0.1771 (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)			11.9200	1.2357	14.7300		(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260		(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099		(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196		(29a)
Flat Roof	70.7500		70.7500	0.1500	10.6125		(30)
Total net area of external elements Aum(A, m ²)			144.9800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	42.6180	(33)
Party Wall 1			13.2000	0.0000	0.0000		(32)
Party Floor 1			70.7500				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.9649 (36)
Total fabric heat loss							(33) + (36) = 58.5829 (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	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170 (38)
Heat transfer coeff	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999	86.5999 (39)
Average = Sum(39)m / 12 =												86.5999 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240	1.2240 (40)
HLP (average)												1.2240 (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												2.2642 (42)
Average daily hot water use (litres/day)												87.9746 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721 (44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820 (45)
Energy content (annual)												Total = Sum(45)m = 1384.1834 (45)
Distribution loss (46)m = 0.15 x (45)m												

Southern Energy
Consultants
Energy & Sustainability Solutions

	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473 (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	14.0899	12.7062	14.0355	13.5464	13.9716	13.4905	13.9212	13.9539	13.5210	14.0091	13.5992	14.0793 (61)
Total heat required for water heating calculated for each month	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613 (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	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	Solar input (sum of months) = Sum(63)m =				0.0000 (63)
	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613 (64)
								Total per year (kWh/year) = Sum(64)m =				1549.1071 (64)
Heat gains from water heating, kWh/month	51.2396	44.9103	46.5743	40.9321	39.5187	34.4602	32.2875	36.5451	36.8317	42.4867	45.9544	49.7313 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8280	40.7040	33.1027	25.0609	18.7333	15.8155	17.0892	22.2131	29.8144	37.8562	44.1838	47.1017 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.0763	300.1591	292.3907	275.8528	254.9766	235.3560	222.2482	219.1655	226.9338	243.4717	264.3479	283.9685 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494 (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)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678 (71)
Water heating gains (Table 5)	68.8704	66.8308	62.5999	56.8502	53.1165	47.8613	43.3971	49.1198	51.1551	57.1058	63.8255	66.8432 (72)
Total internal gains	510.9080	506.8271	487.2266	456.8971	425.9597	398.1660	381.8677	389.6316	407.0366	437.5670	471.4905	497.0467 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
East				2.8800	22.3313	0.4500		0.0000	0.7700		22.2849 (76)	
South				9.0400	50.9848	0.4500		0.0000	0.7700		159.7028 (78)	
Solar gains	181.9877	273.9406	358.5521	440.0766	466.0135	488.8042	468.7322	449.9359	414.2876	319.6994	222.2385	154.9329 (83)
Total gains	692.8957	780.7677	845.7787	896.9737	891.9732	886.9702	850.6000	839.5675	821.3242	757.2664	693.7290	651.9796 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344	56.7344
alpha	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823	4.7823
util living area	0.9810	0.9664	0.9321	0.8544	0.7093	0.4800	0.3147	0.3290	0.5875	0.8555	0.9597	0.9851 (86)
MIT	20.0868	20.2416	20.4900	20.7447	20.9212	20.9904	20.9990	20.9988	20.9742	20.7824	20.3974	20.0377 (87)
Th 2	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008	19.9008 (88)
util rest of house	0.9750	0.9563	0.9116	0.8122	0.6339	0.3785	0.2036	0.2166	0.4868	0.8048	0.9452	0.9802 (89)
MIT 2	19.1069	19.2566	19.4928	19.7207	19.8586	19.8981	19.9007	19.9007	19.8913	19.7576	19.4098	19.0591 (90)
Living area fraction												0.3713 (91)
MIT	19.4708	19.6223	19.8630	20.1009	20.2532	20.3037	20.3085	20.3084	20.2934	20.1381	19.7765	19.4224 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3208	19.4723	19.7130	19.9509	20.1032	20.1537	20.1585	20.1584	20.1434	19.9881	19.6265	19.2724 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9710	0.9514	0.9075	0.8144	0.6487	0.4023	0.2298	0.2431	0.5099	0.8094	0.9408	0.9766 (94)
Useful gains	672.8081	742.8156	767.5246	730.4920	578.5799	356.8395	195.4562	204.0606	418.7938	612.9429	652.6295	636.7489 (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	1231.5172	1201.3446	1066.3091	870.4111	615.1334	359.7101	195.5895	204.2398	428.0955	726.4078	1006.8555	1227.3332 (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	415.6796	308.1315	222.2957	100.7418	27.1958	0.0000	0.0000	0.0000	0.0000	84.4178	255.0428	439.3948 (98)
Space heating												1852.8997 (98)
Space heating per m2										(98) / (4) =		26.1894 (99)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF 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												2047.4029 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	415.6796	308.1315	222.2957	100.7418	27.1958	0.0000	0.0000	0.0000	0.0000	84.4178	255.0428	439.3948 (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)	459.3144	340.4768	245.6306	111.3169	30.0506	0.0000	0.0000	0.0000	0.0000	93.2794	281.8152	485.5191 (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	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613 (64)
Efficiency of water heater (217)m	89.5971	89.4843	89.2168	88.6905	87.8651	87.3000	87.3000	87.3000	87.3000	88.5252	89.3311	87.3000 (216)
Fuel for water heating, kWh/month	175.8985	154.4642	160.9066	142.5917	139.2133	122.5508	115.1882	129.8653	130.7295	148.2691	158.4922	170.7302 (219)
Water heating fuel used												1748.8995 (219)
Annual totals kWh/year												
Space heating fuel - main system												2047.4029 (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)												38.1167 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												113.1167 (231)
Electricity for lighting (calculated in Appendix L)												323.7346 (232)
Total delivered energy for all uses												4233.1538 (238)

10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2047.4029	3.6300	74.3207 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1748.8995	3.6300	63.4851 (247)
Mechanical ventilation fans	38.1167	19.4400	7.4099 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	323.7346	19.4400	62.9340 (250)
Additional standing charges			95.0000 (251)
Total energy cost			317.7297 (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	2047.4029	0.2160	442.2390 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1748.8995	0.2160	377.7623 (264)
Space and water heating			820.0013 (265)
Pumps and fans	113.1167	0.5190	58.7076 (267)
Energy for lighting	323.7346	0.5190	168.0183 (268)
Total kg/year			1046.7272 (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	2047.4029	1.2200	2497.8316 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1748.8995	1.2200	2133.6574 (264)
Space and water heating			4631.4890 (265)
Pumps and fans	113.1167	3.0700	347.2683 (267)
Energy for lighting	323.7346	3.0700	993.8653 (268)
Primary energy kWh/year			5972.6225 (272)
Primary energy kWh/m2/year			84.4187 (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 490 TEST (31 Jan 2022)
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	£233	£233	£0
Space heating	£191	£191	£0
Water heating	£63	£63	£0
Lighting	£63	£63	£0
Total cost of fuels	£318	£318	£0
Total cost of uses	£317	£317	£0
Delivered energy	60 kWh/m²	60 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	15 kg/m²	15 kg/m²	0 kg/m²
Primary energy	84 kWh/m²	84 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 EndTerrace 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 250.0
 Night ventilation Yes
 Ventilation rate during hot weather (ach) 3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient 168.10 (P1)
 Transmission heat loss coefficient 58.58 (37)
 Summer heat loss coefficient 226.68 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	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)
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	Shading	Gains W
East	2.8800	117.5071	0.4500	0.0000	0.9000	137.0602
South	9.0400	112.2060	0.4500	0.0000	0.9000	410.8086
total:						547.8688

	Jun	Jul	Aug	
Solar gains	571	548	526	(P4)
Internal gains	395	379	387	
Total summer gains	966	927	913	(P5)
Summer gain/loss ratio	4.26	4.09	4.03	(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	20.51	22.24	22.08	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			