

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

Property Reference	3604-2			Issued on Date	16/12/2020
Assessment Reference	3604ds	Prop Type Ref			
Property	105, Addington Road, Reading, RG1 5PZ				
SAP Rating	90 B	DER	9.60	TER	21.52
Environmental	91 B	% DER<TER	55.38		
CO ₂ Emissions (t/year)	1.31	DFEE	44.09	TFEE	51.32
General Requirements Compliance	Pass	% DFEE<TFEE	14.10		
Assessor Details	Mr. Ian Lloyd, Property and Energy Services Limited, Tel: 01367240212, ianl@propertyandenergy.co.uk			Assessor ID	H044-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 165 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 21.52 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.60 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.25 (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	0.13 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (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:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric

Vaillant aroTHERM plus 7kW + hydraulic module VWL75/6A230VS2+VWZMEH97/5MB2

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.60 kWh/day	
Permitted by DBSCG 2.56	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
-------------------------	-----------------------------------	----

Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	14.67 m ² , No overhang
Windows facing East:	3.69 m ² , No overhang
Windows facing South:	8.22 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.027 W/m ² K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	46.3700 (1a)	x 2.3800 (2a)	= 110.3606 (1a) - (3a)
Ground floor	46.3700 (1b)	x 2.6700 (2b)	= 123.8079 (1b) - (3b)
First floor	39.8300 (1c)	x 2.6200 (2c)	= 104.3546 (1c) - (3c)
Second floor	32.5400 (1d)	x 2.3400 (2d)	= 76.1436 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.1100		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 414.6667 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0965 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3465 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (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	0.4086	0.4006	0.3926	0.3525	0.3445	0.3045	0.3045	0.2964	0.3205	0.3445	0.3605	0.3766 (22b)
Effective ac	0.5835	0.5802	0.5771	0.5621	0.5593	0.5463	0.5463	0.5439	0.5514	0.5593	0.5650	0.5709 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door -1			1.8000	1.0000	1.8000		(26)
W-1.4 (Uw = 1.40)			26.5800	1.3258	35.2386		(27)
Velux (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)
Basement floor			46.3700	0.1300	6.0281		(28)
Basement wall	33.2500		33.2500	0.2500	8.3125		(29a)
External wall	150.4600	24.6600	125.8000	0.2100	26.4180		(29a)
Dormer cheek	8.1600	3.7200	4.4400	0.1800	0.7992		(29a)
Ceiling	29.5200		29.5200	0.1100	3.2472		(30)
skelling	15.0200	1.8400	13.1800	0.1600	2.1088		(30)
Total net area of external elements Aum(A, m ²)			282.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.3918		(33)
Party Wall			96.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7190 (36)
Total fabric heat loss						(33) + (36) =	94.1108 (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	79.8435	79.4000	78.9651	76.9229	76.5408	74.7620	74.7620	74.4326	75.4472	76.5408	77.3138	78.1219 (38)
Heat transfer coeff	173.9544	173.5108	173.0760	171.0337	170.6516	168.8728	168.8728	168.5434	169.5580	170.6516	171.4246	172.2327 (39)
Average = Sum(39)m / 12 =												171.0319 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0536	1.0509	1.0482	1.0359	1.0336	1.0228	1.0228	1.0208	1.0269	1.0336	1.0382	1.0431 (40)
HLP (average)												1.0359 (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												2.9560 (42)
Average daily hot water use (litres/day)												104.4043 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8447	110.6686	106.4924	102.3162	98.1400	93.9639	93.9639	98.1400	102.3162	106.4924	110.6686	114.8447 (44)
Energy conte	170.3114	148.9555	153.7087	134.0070	128.5829	110.9572	102.8182	117.9854	119.3945	139.1428	151.8852	164.9375 (45)

Regs Region: England

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1642.6862 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.5467	22.3433	23.0563	20.1010	19.2874	16.6436	15.4227	17.6978	17.9092	20.8714	22.7828	24.7406	(46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8640 (55)
Total storage loss												
26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage												
26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839	(64)
Heat gains from water heating, kWh/month												
96.6657	85.6902	91.1453	83.3029	82.7909	75.6389	74.2242	79.2673	78.4443	86.3021	89.2474	94.8788	(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
147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
30.8033	27.3592	22.2500	16.8447	12.5916	10.6304	11.4865	14.9306	20.0398	25.4451	29.6982	31.6594	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
336.5285	340.0206	331.2206	312.4864	288.8379	266.6116	251.7631	248.2710	257.0710	275.8051	299.4537	321.6800	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	(71)
Water heating gains (Table 5)												
129.9270	127.5152	122.5071	115.6985	111.2781	105.0540	99.7637	106.5420	108.9504	115.9974	123.9548	127.5253	(72)
Total internal gains	564.5984	562.2347	543.3173	512.3692	480.0472	449.6355	430.3528	437.0831	453.4007	484.5872	520.4462	548.2043 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					14.6700	10.6334	0.6300	0.7000	0.7700	47.6731 (74)		
East					3.6900	19.6403	0.6300	0.7000	0.7700	22.1486 (76)		
South					8.2200	46.7521	0.6300	0.7000	0.7700	117.4477 (78)		
North					0.9200	15.6897	0.6300	0.7000	1.0000	5.7291 (82)		
South					0.9200	45.6416	0.6300	0.7000	1.0000	16.6659 (82)		
Solar gains	209.6644	367.5911	535.1311	724.1851	872.1559	894.0756	850.1351	734.5066	599.2917	414.5165	252.9267	178.3239 (83)
Total gains	774.2627	929.8257	1078.4484	1236.5543	1352.2030	1343.7111	1280.4879	1171.5897	1052.6923	899.1038	773.3730	726.5282 (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
65.9137	66.0822	66.2482	67.0393	67.1894	67.8971	67.8971	68.0298	67.6227	67.1894	66.8864	66.5726	
alpha	5.3942	5.4055	5.4165	5.4693	5.4793	5.5265	5.5353	5.5082	5.4793	5.4591	5.4382	
util living area	0.9994	0.9983	0.9941	0.9750	0.9047	0.7420	0.5679	0.6373	0.8873	0.9880	0.9985	0.9996 (86)
Tweekday	18.7159	18.8861	19.1586	19.5250	19.8212	19.9670	19.9897	19.9886	19.9002	19.5162	19.0549	18.6978
Tweekend	20.3692	20.4436	20.5636	20.7246	20.8655	20.9446	20.9637	20.9602	20.9016	20.7182	20.5144	20.3581
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.0264	20.1394	20.3266	20.5700	20.7924	20.9149	20.9440	20.9386	20.8463	20.5650	20.2418	20.0094 (87)
Th 2	20.0389	20.0411	20.0433	20.0535	20.0555	20.0644	20.0644	20.0660	20.0609	20.0555	20.0516	20.0475 (88)
util rest of house	0.9992	0.9976	0.9919	0.9650	0.8672	0.6572	0.4536	0.5201	0.8286	0.9816	0.9979	0.9995 (89)
Tweekday	18.7159	18.8861	19.1586	19.5250	19.8212	19.9670	19.9897	19.9886	19.9002	19.5162	19.0549	18.6978
Tweekend	18.7159	18.8861	19.1586	19.5250	19.8212	19.9670	19.9897	19.9886	19.9002	19.5162	19.0549	18.6978
MIT 2	18.7159	18.8861	19.1586	19.5250	19.8212	19.9670	19.9897	19.9886	19.9002	19.5162	19.0549	18.6978 (90)
Living area fraction												
MIT	18.9255	19.0865	19.3453	19.6921	19.9764	20.1186	20.1423	20.1405	20.0515	19.6839	19.2446	18.9075 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9255	19.0865	19.3453	19.6921	19.9764	20.1186	20.1423	20.1405	20.0515	19.6839	19.2446	18.9075 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9989	0.9968	0.9897	0.9601	0.8635	0.6626	0.4634	0.5299	0.8279	0.9781	0.9972	0.9992	(94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Useful gains	773.3826	926.8211	1067.3066	1187.2222	1167.5755	890.3183	593.4096	620.8454	871.5310	879.4369	771.1870	725.9462 (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												
Month fracti	2544.1663	2461.5104	2223.2207	1845.8085	1412.3882	931.9375	598.1936	630.4415	1009.1211	1550.1789	2081.8910	2533.1126 (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	1317.4631	1031.3112	860.0001	474.1821	182.1406	0.0000	0.0000	0.0000	0.0000	499.0321	943.7069	1344.5318 (98)
Space heating per m2											(98) / (4) =	40.2905 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												388.4742 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1712.4349 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1317.4631	1031.3112	860.0001	474.1821	182.1406	0.0000	0.0000	0.0000	0.0000	499.0321	943.7069	1344.5318 (98)
Space heating efficiency (main heating system 1)	388.4742	388.4742	388.4742	388.4742	388.4742	0.0000	0.0000	0.0000	0.0000	388.4742	388.4742	388.4742 (210)
Space heating fuel (main heating system)	339.1378	265.4774	221.3789	122.0627	46.8862	0.0000	0.0000	0.0000	0.0000	128.4595	242.9265	346.1058 (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	220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839 (64)
Efficiency of water heater	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650 (216)
Fuel for water heating, kWh/month	78.7091	69.3510	72.7788	65.1649	63.8041	56.9318	54.6013	60.0189	59.9455	67.5760	71.5508	76.7896 (219)
Water heating fuel used												797.2219 (219)
Annual totals kWh/year												
Space heating fuel - main system												1712.4349 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												543.9962 (232)
Total delivered energy for all uses												3053.6530 (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	1712.4349	0.5190	888.7537 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	797.2219	0.5190	413.7581 (264)
Space and water heating			1302.5118 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	543.9962	0.5190	282.3340 (268)
Total CO2, kg/year			1584.8459 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.6000 (273)

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

DER		9.6000 ZC1
Total Floor Area	TFA	165.1100
Assumed number of occupants	N	2.9560
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		12.0780 ZC2
CO2 emissions from cooking, equation (L16)		1.1504 ZC3
Total CO2 emissions		22.8284 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		22.8284 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	46.3700 (1a)	x 2.3800 (2a)	= 110.3606 (1a) - (3a)
Ground floor	46.3700 (1b)	x 2.6700 (2b)	= 123.8079 (1b) - (3b)
First floor	39.8300 (1c)	x 2.6200 (2c)	= 104.3546 (1c) - (3c)
Second floor	32.5400 (1d)	x 2.3400 (2d)	= 76.1436 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.1100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 414.6667 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0965 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3465 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (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	0.4086	0.4006	0.3926	0.3525	0.3445	0.3045	0.3045	0.2964	0.3205	0.3445	0.3605	0.3766 (22b)
Effective ac	0.5835	0.5802	0.5771	0.5621	0.5593	0.5463	0.5463	0.5439	0.5514	0.5593	0.5650	0.5709 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8000	1.0000	1.8000		(26)
TER Opening Type (Uw = 1.40)			26.5800	1.3258	35.2386		(27)
TER Room Window (Uw = 1.70)			1.8400	1.5918	2.9288		(27a)
Basement floor			46.3700	0.1300	6.0281		(28)
Basement wall	33.2500		33.2500	0.1800	5.9850		(29a)
External wall	150.4600	24.6600	125.8000	0.1800	22.6440		(29a)
Dormer cheek	8.1600	3.7200	4.4400	0.1800	0.7992		(29a)
Ceiling	29.5200		29.5200	0.1300	3.8376		(30)
Skelling	15.0200	1.8400	13.1800	0.1300	1.7134		(30)
Total net area of external elements Aum(A, m ²)			282.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.9748		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.6988 (36)
Total fabric heat loss (33) + (36) = 95.6736 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 79.8435	Feb 79.4000	Mar 78.9651	Apr 76.9229	May 76.5408	Jun 74.7620	Jul 74.7620	Aug 74.4326	Sep 75.4472	Oct 76.5408	Nov 77.3138	Dec 78.1219 (38)
Heat transfer coeff	175.5171	175.0735	174.6387	172.5965	172.2144	170.4356	170.4356	170.1062	171.1207	172.2144	172.9873	173.7955 (39)
Average = Sum(39)m / 12 =												172.5946 (39)
HLP	Jan 1.0630	Feb 1.0603	Mar 1.0577	Apr 1.0453	May 1.0430	Jun 1.0323	Jul 1.0323	Aug 1.0303	Sep 1.0364	Oct 1.0430	Nov 1.0477	Dec 1.0526 (40)
HLP (average)												1.0453 (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												2.9560 (42)
Average daily hot water use (litres/day)												104.4043 (43)
Daily hot water use	Jan 114.8447	Feb 110.6686	Mar 106.4924	Apr 102.3162	May 98.1400	Jun 93.9639	Jul 93.9639	Aug 98.1400	Sep 102.3162	Oct 106.4924	Nov 110.6686	Dec 114.8447 (44)
Energy conte	170.3114	148.9555	153.7087	134.0070	128.5829	110.9572	102.8182	117.9854	119.3945	139.1428	151.8852	164.9375 (45)
Energy content (annual)										Total = Sum(45)m =		1642.6862 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.5467	22.3433	23.0563	20.1010	19.2874	16.6436	15.4227	17.6978	17.9092	20.8714	22.7828	24.7406 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (56)												
If cylinder contains dedicated solar storage												
31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (57)												
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)												
Total heat required for water heating calculated for each month												
225.2182 198.5487 208.6155 187.1426 183.4897 164.0928 157.7250 172.8922 172.5301 194.0496 205.0208 219.8443 (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												
225.2182 198.5487 208.6155 187.1426 183.4897 164.0928 157.7250 172.8922 172.5301 194.0496 205.0208 219.8443 (64)												
Total per year (kWh/year) = Sum(64)m =												2289.1693 (64)
Heat gains from water heating, kWh/month												
100.5540 89.2023 95.0336 87.0658 86.6792 79.4018 78.1125 83.1556 82.2072 90.1904 93.0103 98.7672 (65)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
30.8033 27.3592 22.2500 16.8447 12.5916 10.6304 11.4865 14.9306 20.0398 25.4451 29.6982 31.6594 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
336.5285 340.0206 331.2206 312.4864 288.8379 266.6116 251.7631 248.2710 257.0710 275.8051 299.4537 321.6800 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.7799 37.7799 37.7799 37.7799 37.7799 37.7799 37.7799 37.7799 37.7799 37.7799 37.7799 37.7799 (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)												
-118.2388 -118.2388 -118.2388 -118.2388 -118.2388 -118.2388 -118.2388 -118.2388 -118.2388 -118.2388 -118.2388 -118.2388 (71)												
Water heating gains (Table 5)												
135.1532 132.7415 127.7333 120.9247 116.5043 110.2802 104.9899 111.7682 114.1766 121.2237 129.1810 132.7516 (72)												
Total internal gains												
572.8246 570.4609 551.5435 520.5954 488.2734 457.8617 438.5790 445.3093 461.6269 492.8135 528.6724 556.4305 (73)												

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				14.6700	10.6334	0.6300	0.7000	0.7700	47.6731 (74)			
East				3.6900	19.6403	0.6300	0.7000	0.7700	22.1486 (76)			
South				8.2200	46.7521	0.6300	0.7000	0.7700	117.4477 (78)			
North				0.9200	15.6897	0.6300	0.7000	1.0000	5.7291 (82)			
South				0.9200	45.6416	0.6300	0.7000	1.0000	16.6659 (82)			
Solar gains	209.6644	367.5911	535.1311	724.1851	872.1559	894.0756	850.1351	734.5066	599.2917	414.5165	252.9267	178.3239 (83)
Total gains	782.4890	938.0519	1086.6746	1244.7805	1360.4293	1351.9373	1288.7141	1179.8159	1060.9186	907.3300	781.5992	734.7544 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
tau 65.3268 65.4923 65.6554 66.4323 66.5797 67.2745 67.2745 67.4048 67.0052 66.5797 66.2821 65.9739												
alpha 5.3551 5.3662 5.3770 5.4288 5.4386 5.4850 5.4850 5.4937 5.4670 5.4386 5.4188 5.3983												
util living area 0.9994 0.9982 0.9939 0.9748 0.9047 0.7429 0.5690 0.6381 0.8868 0.9876 0.9985 0.9996 (86)												
MIT 19.7579 19.9115 20.1599 20.4926 20.7849 20.9498 20.9904 20.9827 20.8607 20.4808 20.0586 19.7345 (87)												
Th 2 20.0311 20.0333 20.0355 20.0457 20.0476 20.0565 20.0565 20.0582 20.0531 20.0476 20.0438 20.0397 (88)												
util rest of house 0.9992 0.9975 0.9917 0.9646 0.8670 0.6576 0.4537 0.5199 0.8277 0.9811 0.9978 0.9994 (89)												
MIT 2 18.3557 18.5820 18.9457 19.4317 19.8283 20.0217 20.0528 20.0506 19.9335 19.4216 18.8050 18.3277 (90)												
Living area fraction fLA = Living area / (4) =												
MIT 18.5799 18.7945 19.1398 19.6013 19.9813 20.1701 20.2027 20.1997 20.0818 19.5909 19.0055 18.5526 (92)												
Temperature adjustment												0.0000
adjusted MIT 18.5799 18.7945 19.1398 19.6013 19.9813 20.1701 20.2027 20.1997 20.0818 19.5909 19.0055 18.5526 (93)												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9986 0.9963 0.9886 0.9584 0.8639 0.6688 0.4722 0.5386 0.8298 0.9766 0.9967 0.9990 (94)												
Useful gains 781.4325 934.5770 1074.3286 1193.0430 1175.2765 904.1117 608.4745 635.4110 880.3928 886.1194 779.0496 734.0478 (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												
2506.3634 2432.5671 2207.3982 1847.0130 1426.1572 949.3446 614.0299 646.3458 1023.6031 1548.3687 2059.4943 2494.4231 (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												
1283.3486 1006.6494 843.0038 470.8584 186.6553 0.0000 0.0000 0.0000 0.0000 492.7135 921.9202 1309.7193 (98)												
Space heating												6514.8684 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating per m2

(98) / (4) = 39.4577 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6967.7737 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1283.3486	1006.6494	843.0038	470.8584	186.6553	0.0000	0.0000	0.0000	0.0000	492.7135	921.9202	1309.7193	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1372.5653	1076.6303	901.6084	503.5919	199.6313	0.0000	0.0000	0.0000	0.0000	526.9663	986.0109	1400.7693	(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	225.2182	198.5487	208.6155	187.1426	183.4897	164.0928	157.7250	172.8922	172.5301	194.0496	205.0208	219.8443	(64)
Efficiency of water heater (217)m	88.7239	88.5441	88.1551	87.1755	84.8595	79.8000	79.8000	79.8000	79.8000	87.1964	88.3449	79.8000	(216)
Fuel for water heating, kWh/month	253.8416	224.2371	236.6458	214.6733	216.2277	205.6301	197.6503	216.6568	216.2031	222.5430	232.0685	247.6035	(219)
Water heating fuel used												2683.9810	(219)
Annual totals kWh/year													
Space heating fuel - main system												6967.7737	(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)												543.9962	(232)
Total delivered energy for all uses												10270.7509	(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	6967.7737	0.2160	1505.0391 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2683.9810	0.2160	579.7399 (264)
Space and water heating			2084.7790 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	543.9962	0.5190	282.3340 (268)
Total CO2, kg/m2/year			2406.0381 (272)
Emissions per m2 for space and water heating			12.6266 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.7100 (272b)
Emissions per m2 for pumps and fans			0.2358 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.6266 * 1.55) + 1.7100 + 0.2358, rounded to 2 d.p.			21.5200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	46.3700 (1a)	x 2.3800 (2a)	= 110.3606 (1a) - (3a)
Ground floor	46.3700 (1b)	x 2.6700 (2b)	= 123.8079 (1b) - (3b)
First floor	39.8300 (1c)	x 2.6200 (2c)	= 104.3546 (1c) - (3c)
Second floor	32.5400 (1d)	x 2.3400 (2d)	= 76.1436 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.1100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 414.6667 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0965 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3465 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (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	0.4086	0.4006	0.3926	0.3525	0.3445	0.3045	0.3045	0.2964	0.3205	0.3445	0.3605	0.3766 (22b)
Effective ac	0.5835	0.5802	0.5771	0.5621	0.5593	0.5463	0.5463	0.5439	0.5514	0.5593	0.5650	0.5709 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door -1			1.8000	1.0000	1.8000		(26)
W-1.4 (Uw = 1.40)			26.5800	1.3258	35.2386		(27)
Velux (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)
Basement floor			46.3700	0.1300	6.0281		(28)
Basement wall	33.2500		33.2500	0.2500	8.3125		(29a)
External wall	150.4600	24.6600	125.8000	0.2100	26.4180		(29a)
Dormer cheek	8.1600	3.7200	4.4400	0.1800	0.7992		(29a)
Ceiling	29.5200		29.5200	0.1100	3.2472		(30)
skelling	15.0200	1.8400	13.1800	0.1600	2.1088		(30)
Total net area of external elements Aum(A, m ²)			282.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.3918		(33)
Party Wall			96.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7190 (36)
Total fabric heat loss						(33) + (36) =	94.1108 (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	79.8435	79.4000	78.9651	76.9229	76.5408	74.7620	74.7620	74.4326	75.4472	76.5408	77.3138	78.1219 (38)
Heat transfer coeff	173.9544	173.5108	173.0760	171.0337	170.6516	168.8728	168.8728	168.5434	169.5580	170.6516	171.4246	172.2327 (39)
Average = Sum(39)m / 12 =												171.0319 (39)
HLP	1.0536	1.0509	1.0482	1.0359	1.0336	1.0228	1.0228	1.0208	1.0269	1.0336	1.0382	1.0431 (40)
HLP (average)												1.0359 (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												2.9560 (42)
Average daily hot water use (litres/day)												104.4043 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.8447	110.6686	106.4924	102.3162	98.1400	93.9639	93.9639	98.1400	102.3162	106.4924	110.6686	114.8447 (44)
	170.3114	148.9555	153.7087	134.0070	128.5829	110.9572	102.8182	117.9854	119.3945	139.1428	151.8852	164.9375 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1642.6862 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.1912	31.6530	32.6631	28.4765	27.3239	23.5784	21.8489	25.0719	25.3713	29.5678	32.2756	35.0492 (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)
(66)m	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.8033	27.3592	22.2500	16.8447	12.5916	10.6304	11.4865	14.9306	20.0398	25.4451	29.6982	31.6594	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.5285	340.0206	331.2206	312.4864	288.8379	266.6116	251.7631	248.2710	257.0710	275.8051	299.4537	321.6800	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	(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)	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	(71)
Water heating gains (Table 5)	48.6441	47.1027	43.9020	39.5507	36.7256	32.7478	29.3668	33.6988	35.2380	39.7417	44.8272	47.1092	(72)
Total internal gains	483.3154	481.8221	464.7122	436.2214	405.4947	377.3293	359.9559	364.2399	379.6883	408.3315	441.3187	467.7881	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North						14.6700	10.6334	0.6300	0.7000	0.7700	47.6731 (74)	
East						3.6900	19.6403	0.6300	0.7000	0.7700	22.1486 (76)	
South						8.2200	46.7521	0.6300	0.7000	0.7700	117.4477 (78)	
North						0.9200	15.6897	0.6300	0.7000	1.0000	5.7291 (82)	
South						0.9200	45.6416	0.6300	0.7000	1.0000	16.6659 (82)	
Solar gains	209.6644	367.5911	535.1311	724.1851	872.1559	894.0756	850.1351	734.5066	599.2917	414.5165	252.9267	178.3239 (83)
Total gains	692.9798	849.4132	999.8433	1160.4064	1277.6505	1271.4049	1210.0910	1098.7465	978.9799	822.8481	694.2454	646.1121 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.9137	66.0822	66.2482	67.0393	67.1894	67.8971	67.8971	68.0298	67.6227	67.1894	66.8864	66.5726	
alpha	5.3942	5.4055	5.4165	5.4693	5.4793	5.5265	5.5265	5.5353	5.5082	5.4793	5.4591	5.4382	
util living area	0.9997	0.9989	0.9959	0.9810	0.9213	0.7706	0.5973	0.6720	0.9109	0.9920	0.9992	0.9998	(86)
MIT	19.7191	19.8733	20.1226	20.4591	20.7617	20.9412	20.9882	20.9785	20.8381	20.4430	20.0192	19.6962	(87)
Th 2	20.0389	20.0411	20.0433	20.0535	20.0555	20.0644	20.0644	20.0660	20.0609	20.0555	20.0516	20.0475	(88)
util rest of house	0.9995	0.9985	0.9943	0.9731	0.8881	0.6872	0.4789	0.5519	0.8595	0.9876	0.9988	0.9997	(89)
MIT 2	18.8548	19.0106	19.2610	19.6013	19.8862	20.0358	20.0612	20.0594	19.9625	19.5900	19.1651	18.8389	(90)
Living area fraction	fLA = Living area / (4) =												0.1599 (91)
MIT	18.9930	19.1486	19.3988	19.7385	20.0262	20.1805	20.2094	20.2063	20.1025	19.7264	19.3017	18.9760	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9930	19.1486	19.3988	19.7385	20.0262	20.1805	20.2094	20.2063	20.1025	19.7264	19.3017	18.9760	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9994	0.9980	0.9928	0.9697	0.8868	0.6985	0.4980	0.5711	0.8623	0.9855	0.9984	0.9996	(94)
Useful gains	692.5373	847.6804	992.6833	1125.2238	1133.0650	888.1045	602.6171	627.5357	844.1732	810.8886	693.1185	645.8331	(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	2555.9137	2472.2778	2232.4667	1853.7485	1420.8792	942.4033	609.5323	641.5333	1017.7665	1557.4329	2091.6629	2544.9028	(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	1386.3520	1091.7294	922.3988	524.5378	214.1338	0.0000	0.0000	0.0000	0.0000	555.4289	1006.9520	1412.9078	(98)
Space heating													7114.4406 (98)
Space heating per m2													(98) / (4) = 43.0891 (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
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1587.4047	1249.6591	1280.9302	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8490	0.9169	0.8815	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1347.6306	1145.7749	1129.1773	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1595.6097	1522.1154	1398.2561	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	178.5449	279.9973	200.1947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												658.7369 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	44.6362	69.9993	50.0487	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												164.6842 (107)
Space cooling per m2												0.9974 (108)
Energy for space heating												43.0891 (99)
Energy for space cooling												0.9974 (108)
Total												44.0865 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	46.3700 (1a)	x 2.3800 (2a)	= 110.3606 (1a) - (3a)
Ground floor	46.3700 (1b)	x 2.6700 (2b)	= 123.8079 (1b) - (3b)
First floor	39.8300 (1c)	x 2.6200 (2c)	= 104.3546 (1c) - (3c)
Second floor	32.5400 (1d)	x 2.3400 (2d)	= 76.1436 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.1100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 414.6667 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0965 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3465 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (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	0.4086	0.4006	0.3926	0.3525	0.3445	0.3045	0.3045	0.2964	0.3205	0.3445	0.3605	0.3766 (22b)
Effective ac	0.5835	0.5802	0.5771	0.5621	0.5593	0.5463	0.5463	0.5439	0.5514	0.5593	0.5650	0.5709 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8000	1.0000	1.8000		(26)
TER Opening Type (Uw = 1.40)			26.5800	1.3258	35.2386		(27)
TER Room Window (Uw = 1.70)			1.8400	1.5918	2.9288		(27a)
Basement floor			46.3700	0.1300	6.0281		(28)
Basement wall	33.2500		33.2500	0.1800	5.9850		(29a)
External wall	150.4600	24.6600	125.8000	0.1800	22.6440		(29a)
Dormer cheek	8.1600	3.7200	4.4400	0.1800	0.7992		(29a)
Ceiling	29.5200		29.5200	0.1300	3.8376		(30)
Skelling	15.0200	1.8400	13.1800	0.1300	1.7134		(30)
Total net area of external elements Aum(A, m ²)			282.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.9748		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.6988 (36)
Total fabric heat loss (33) + (36) = 95.6736 (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	79.8435	79.4000	78.9651	76.9229	76.5408	74.7620	74.7620	74.4326	75.4472	76.5408	77.3138	78.1219 (38)
Heat transfer coeff	175.5171	175.0735	174.6387	172.5965	172.2144	170.4356	170.4356	170.1062	171.1207	172.2144	172.9873	173.7955 (39)
Average = Sum(39)m / 12 =												172.5946 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0630	1.0603	1.0577	1.0453	1.0430	1.0323	1.0323	1.0303	1.0364	1.0430	1.0477	1.0526 (40)
HLP (average)												1.0453 (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												2.9560 (42)
Average daily hot water use (litres/day)												104.4043 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8447	110.6686	106.4924	102.3162	98.1400	93.9639	93.9639	98.1400	102.3162	106.4924	110.6686	114.8447 (44)
Energy conte	170.3114	148.9555	153.7087	134.0070	128.5829	110.9572	102.8182	117.9854	119.3945	139.1428	151.8852	164.9375 (45)
Energy content (annual)										Total = Sum(45)m =		1642.6862 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.1912	31.6530	32.6631	28.4765	27.3239	23.5784	21.8489	25.0719	25.3713	29.5678	32.2756	35.0492 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	147.7985	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.8033	27.3592	22.2500	16.8447	12.5916	10.6304	11.4865	14.9306	20.0398	25.4451	29.6982	31.6594	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.5285	340.0206	331.2206	312.4864	288.8379	266.6116	251.7631	248.2710	257.0710	275.8051	299.4537	321.6800	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	37.7799	(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)	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	(71)
Water heating gains (Table 5)	48.6441	47.1027	43.9020	39.5507	36.7256	32.7478	29.3668	33.6988	35.2380	39.7417	44.8272	47.1092	(72)
Total internal gains	483.3154	481.8221	464.7122	436.2214	405.4947	377.3293	359.9559	364.2399	379.6883	408.3315	441.3187	467.7881	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North					14.6700	10.6334	0.6300	0.7000	0.7700	47.6731 (74)			
East					3.6900	19.6403	0.6300	0.7000	0.7700	22.1486 (76)			
South					8.2200	46.7521	0.6300	0.7000	0.7700	117.4477 (78)			
North					0.9200	15.6897	0.6300	0.7000	1.0000	5.7291 (82)			
South					0.9200	45.6416	0.6300	0.7000	1.0000	16.6659 (82)			
Solar gains	209.6644	367.5911	535.1311	724.1851	872.1559	894.0756	850.1351	734.5066	599.2917	414.5165	252.9267	178.3239	(83)
Total gains	692.9798	849.4132	999.8433	1160.4064	1277.6505	1271.4049	1210.0910	1098.7465	978.9799	822.8481	694.2454	646.1121	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.3268	65.4923	65.6554	66.4323	66.5797	67.2745	67.2745	67.4048	67.0052	66.5797	66.2821	65.9739	
alpha	5.3551	5.3662	5.3770	5.4288	5.4386	5.4850	5.4850	5.4937	5.4670	5.4386	5.4188	5.3983	
util living area	0.9997	0.9989	0.9959	0.9813	0.9228	0.7744	0.6018	0.6765	0.9127	0.9921	0.9992	0.9998	(86)
MIT	19.7063	19.8607	20.1111	20.4493	20.7549	20.9383	20.9874	20.9772	20.8332	20.4346	20.0084	19.6833	(87)
Th 2	20.0311	20.0333	20.0355	20.0457	20.0476	20.0565	20.0565	20.0582	20.0531	20.0476	20.0438	20.0397	(88)
util rest of house	0.9995	0.9985	0.9943	0.9735	0.8899	0.6908	0.4820	0.5553	0.8617	0.9877	0.9988	0.9997	(89)
MIT 2	18.8357	18.9917	19.2431	19.5852	19.8732	20.0265	20.0531	20.0511	19.9514	19.5753	19.1479	18.8196	(90)
Living area fraction									fLA = Living area / (4) =			0.1599	(91)
MIT	18.9749	19.1307	19.3819	19.7234	20.0142	20.1723	20.2025	20.1992	20.0924	19.7127	19.2855	18.9577	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9749	19.1307	19.3819	19.7234	20.0142	20.1723	20.2025	20.1992	20.0924	19.7127	19.2855	18.9577	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9994	0.9980	0.9929	0.9700	0.8885	0.7020	0.5013	0.5746	0.8643	0.9856	0.9984	0.9996	(94)
Ext temp.	692.5317	847.6724	992.7081	1125.6303	1135.2174	892.5845	606.5847	631.3726	846.0979	810.9765	693.1114	645.8288	(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	2575.6914	2491.4146	2249.6797	1868.0807	1431.8268	949.7108	613.9956	646.2650	1025.4187	1569.3307	2107.9291	2564.8248	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1401.0708	1104.5948	935.1869	534.5643	220.6774	0.0000	0.0000	0.0000	0.0000	564.2155	1018.6688	1427.7330	(98)
												7206.7114	(98)
												43.6479	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1602.0946	1261.2234	1292.8071	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8441	0.9133	0.8771	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1352.2908	1151.8258	1133.9755	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1595.6097	1522.1154	1398.2561	0.0000	0.0000	0.0000	0.0000 (103)
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 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	175.1896	275.4955	196.6248	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			647.3098 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	43.7974	68.8739	49.1562	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												161.8275 (107)
Energy for space heating												0.9801 (108)
Energy for space cooling												43.6479 (99)
Total												0.9801 (108)
Target Fabric Energy Efficiency (TFEE)												44.6281 (109)
												51.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	46.3700 (1a)	x 2.3800 (2a)	= 110.3606 (1a) - (3a)
Ground floor	46.3700 (1b)	x 2.6700 (2b)	= 123.8079 (1b) - (3b)
First floor	39.8300 (1c)	x 2.6200 (2c)	= 104.3546 (1c) - (3c)
Second floor	32.5400 (1d)	x 2.3400 (2d)	= 76.1436 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.1100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 414.6667 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0965 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3465 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3205 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3445	0.3285	0.3285	0.3045	0.3125	0.2724	0.2724	0.2644	0.2724	0.3045	0.2964	0.3205 (22b)
Effective ac	0.5593	0.5540	0.5540	0.5463	0.5488	0.5371	0.5371	0.5350	0.5371	0.5463	0.5439	0.5514 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door -1			1.8000	1.0000	1.8000		(26)
W-1.4 (Uw = 1.40)			26.5800	1.3258	35.2386		(27)
Velux (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)
Basement floor			46.3700	0.1300	6.0281		(28)
Basement wall	33.2500		33.2500	0.2500	8.3125		(29a)
External wall	150.4600	24.6600	125.8000	0.2100	26.4180		(29a)
Dormer cheek	8.1600	3.7200	4.4400	0.1800	0.7992		(29a)
Ceiling	29.5200		29.5200	0.1100	3.2472		(30)
skelling	15.0200	1.8400	13.1800	0.1600	2.1088		(30)
Total net area of external elements Aum(A, m ²)			282.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.3918		(33)
Party Wall			96.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7190 (36)
Total fabric heat loss						(33) + (36) =	94.1108 (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	76.5408	75.8029	75.8029	74.7620	75.1002	73.4971	73.4971	73.2029	73.4971	74.7620	74.4326	75.4472 (38)
Heat transfer coeff	170.6516	169.9137	169.9137	168.8728	169.2110	167.6080	167.6080	167.3137	167.6080	168.8728	168.5434	169.5580 (39)
Average = Sum(39)m / 12 =												168.8062 (39)
HLP	1.0336	1.0291	1.0291	1.0228	1.0248	1.0151	1.0151	1.0133	1.0151	1.0228	1.0208	1.0269 (40)
HLP (average)												1.0224 (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												2.9560 (42)
Average daily hot water use (litres/day)												104.4043 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.8447	110.6686	106.4924	102.3162	98.1400	93.9639	93.9639	98.1400	102.3162	106.4924	110.6686	114.8447 (44)
	170.3114	148.9555	153.7087	134.0070	128.5829	110.9572	102.8182	117.9854	119.3945	139.1428	151.8852	164.9375 (45)

Regs Region: England

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1642.6862 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.5467	22.3433	23.0563	20.1010	19.2874	16.6436	15.4227	17.6978	17.9092	20.8714	22.7828	24.7406	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8640	(55)
Total storage loss													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839	(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													
	220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839	(64)
Total per year (kWh/year) = Sum(64)m =												2231.9422	(64)
												2232	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month													
	96.6657	85.6902	91.1453	83.3029	82.7909	75.6389	74.2242	79.2673	78.4443	86.3021	89.2474	94.8788	(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	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.0083	68.3981	55.6251	42.1118	31.4790	26.5759	28.7162	37.3264	50.0995	63.6128	74.2455	79.1486	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	502.2814	507.4935	494.3591	466.3977	431.1013	397.9278	375.7658	370.5537	383.6880	411.6495	446.9458	480.1194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	(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)													
	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	(71)
Water heating gains (Table 5)													
	129.9270	127.5152	122.5071	115.6985	111.2781	105.0540	99.7637	106.5420	108.9504	115.9974	123.9548	127.5253	(72)
Total internal gains	824.0278	818.2180	787.3025	739.0191	688.6697	644.3689	619.0569	629.2333	657.5490	706.0709	759.9573	801.6045	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				14.6700	12.7650		0.6300		0.7000		0.7700		57.2301 (74)
East				3.6900	23.8018		0.6300		0.7000		0.7700		26.8415 (76)
South				8.2200	54.2217		0.6300		0.7000		0.7700		136.2125 (78)
North				0.9200	18.6626		0.6300		0.7000		1.0000		6.8146 (82)
South				0.9200	54.1718		0.6300		0.7000		1.0000		19.7807 (82)
Solar gains	246.8794	379.3159	551.6999	764.0726	900.9413	978.4467	920.6321	812.7192	660.7808	460.0503	293.5852	211.0731	(83)
Total gains	1070.9072	1197.5340	1339.0023	1503.0917	1589.6110	1622.8155	1539.6889	1441.9525	1318.3299	1166.1211	1053.5425	1012.6776	(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	67.1894	67.4811	67.4811	67.8971	67.7614	68.4095	68.4095	68.5298	68.4095	67.8971	68.0298	67.6227	
alpha	5.4793	5.4987	5.4987	5.5265	5.5174	5.5606	5.5606	5.5687	5.5606	5.5265	5.5353	5.5082	
util living area	0.9963	0.9924	0.9785	0.9234	0.7776	0.5291	0.3585	0.3932	0.7145	0.9465	0.9909	0.9972	(86)
Tweekday	19.0338	19.1852	19.4430	19.7568	19.9408	19.9965	19.9991	20.0006	19.9813	19.7549	19.3583	19.0121	
Tweekend	20.5040	20.5701	20.6859	20.8309	20.9302	20.9647	20.9681	20.9679	20.9504	20.8269	20.6443	20.4924	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.2346	20.3350	20.5152	20.7359	20.8923	20.9459	20.9507	20.9505	20.9225	20.7328	20.4446	20.2166	(87)
Th 2	20.0555	20.0592	20.0592	20.0644	20.0627	20.0707	20.0707	20.0722	20.0707	20.0644	20.0660	20.0609	(88)
util rest of house	0.9950	0.9897	0.9708	0.8970	0.7135	0.4385	0.2580	0.2867	0.6235	0.9219	0.9872	0.9962	(89)
Tweekday	19.0338	19.1852	19.4430	19.7568	19.9408	19.9965	19.9991	20.0006	19.9813	19.7549	19.3583	19.0121	
Tweekend	19.0338	19.1852	19.4430	19.7568	19.9408	19.9965	19.9991	20.0006	19.9813	19.7549	19.3583	19.0121	
MIT 2	19.0338	19.1852	19.4430	19.7568	19.9408	19.9965	19.9991	20.0006	19.9813	19.7549	19.3583	19.0121	(90)
Living area fraction	fLA = Living area / (4) =											0.1599	(91)
MIT	19.2258	19.3691	19.6145	19.9134	20.0930	20.1483	20.1512	20.1525	20.1318	19.9113	19.5320	19.2047	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2258	19.3691	19.6145	19.9134	20.0930	20.1483	20.1512	20.1525	20.1318	19.9113	19.5320	19.2047	(93)

8. Space heating requirement

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF HEAT DEMAND 09 Jan 2014

Utilisation	0.9934	0.9871	0.9662	0.8920	0.7158	0.4462	0.2667	0.2959	0.6300	0.9169	0.9843	0.9949 (94)
Useful gains	1063.8902	1182.1343	1293.6922	1340.7008	1137.8445	724.0951	410.6515	426.7173	830.5176	1069.1983	1036.9740	1007.5226 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	2410.5931	2322.5626	2075.4069	1690.9893	1217.1299	728.8022	410.8458	427.0603	860.1339	1420.4358	1943.6464	2391.5643 (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	1001.9470	766.3679	581.5957	252.2077	58.9883	0.0000	0.0000	0.0000	0.0000	261.3208	652.8041	1029.7270 (98)
Space heating												4604.9585 (98)
RHI space heating demand												4605 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	46.3700 (1a)	x 2.3800 (2a)	= 110.3606 (1a) - (3a)
Ground floor	46.3700 (1b)	x 2.6700 (2b)	= 123.8079 (1b) - (3b)
First floor	39.8300 (1c)	x 2.6200 (2c)	= 104.3546 (1c) - (3c)
Second floor	32.5400 (1d)	x 2.3400 (2d)	= 76.1436 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.1100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 414.6667 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0965 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3465 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (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	0.4086	0.4006	0.3926	0.3525	0.3445	0.3045	0.3045	0.2964	0.3205	0.3445	0.3605	0.3766 (22b)
Effective ac	0.5835	0.5802	0.5771	0.5621	0.5593	0.5463	0.5463	0.5439	0.5514	0.5593	0.5650	0.5709 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door -1			1.8000	1.0000	1.8000		(26)
W-1.4 (Uw = 1.40)			26.5800	1.3258	35.2386		(27)
Velux (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)
Basement floor			46.3700	0.1300	6.0281		(28)
Basement wall	33.2500		33.2500	0.2500	8.3125		(29a)
External wall	150.4600	24.6600	125.8000	0.2100	26.4180		(29a)
Dormer cheek	8.1600	3.7200	4.4400	0.1800	0.7992		(29a)
Ceiling	29.5200		29.5200	0.1100	3.2472		(30)
skelling	15.0200	1.8400	13.1800	0.1600	2.1088		(30)
Total net area of external elements Aum(A, m ²)			282.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.3918		(33)
Party Wall			96.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7190 (36)
Total fabric heat loss						(33) + (36) =	94.1108 (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	79.8435	79.4000	78.9651	76.9229	76.5408	74.7620	74.7620	74.4326	75.4472	76.5408	77.3138	78.1219 (38)
Heat transfer coeff	173.9544	173.5108	173.0760	171.0337	170.6516	168.8728	168.8728	168.5434	169.5580	170.6516	171.4246	172.2327 (39)
Average = Sum(39)m / 12 =												171.0319 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0536	1.0509	1.0482	1.0359	1.0336	1.0228	1.0228	1.0208	1.0269	1.0336	1.0382	1.0431 (40)
HLP (average)												1.0359 (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												2.9560 (42)
Average daily hot water use (litres/day)												104.4043 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8447	110.6686	106.4924	102.3162	98.1400	93.9639	93.9639	98.1400	102.3162	106.4924	110.6686	114.8447 (44)
Energy conte	170.3114	148.9555	153.7087	134.0070	128.5829	110.9572	102.8182	117.9854	119.3945	139.1428	151.8852	164.9375 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1642.6862 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.5467	22.3433	23.0563	20.1010	19.2874	16.6436	15.4227	17.6978	17.9092	20.8714	22.7828	24.7406 (46)
Water storage loss:											
Store volume	250.0000 (47)										
a) If manufacturer declared loss factor is known (kWh/day):	1.6000 (48)										
Temperature factor from Table 2b	0.5400 (49)										
Enter (49) or (54) in (55)	0.8640 (55)										
Total storage loss											
26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated storage											
26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month											
220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839 (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 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839 (64)
Heat gains from water heating, kWh/month											
96.6657	85.6902	91.1453	83.3029	82.7909	75.6389	74.2242	79.2673	78.4443	86.3021	89.2474	94.8788 (65)

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

Metabolic gains (Table 5), Watts											
(66)m	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
77.0083	68.3981	55.6251	42.1118	31.4790	26.5759	28.7162	37.3264	50.0995	63.6128	74.2455	79.1486 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
502.2814	507.4935	494.3591	466.3977	431.1013	397.9278	375.7658	370.5537	383.6880	411.6495	446.9458	480.1194 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918 (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 (70)
Losses e.g. evaporation (negative values) (Table 5)											
-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388 (71)
Water heating gains (Table 5)											
129.9270	127.5152	122.5071	115.6985	111.2781	105.0540	99.7637	106.5420	108.9504	115.9974	123.9548	127.5253 (72)
Total internal gains	824.0278	818.2180	787.3025	739.0191	688.6697	644.3689	619.0569	629.2333	657.5490	706.0709	759.9573 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				14.6700	10.6334		0.6300		0.7000		0.7700		47.6731 (74)
East				3.6900	19.6403		0.6300		0.7000		0.7700		22.1486 (76)
South				8.2200	46.7521		0.6300		0.7000		0.7700		117.4477 (78)
North				0.9200	15.6897		0.6300		0.7000		1.0000		5.7291 (82)
South				0.9200	45.6416		0.6300		0.7000		1.0000		16.6659 (82)
Solar gains	209.6644	367.5911	535.1311	724.1851	872.1559	894.0756	850.1351	734.5066	599.2917	414.5165	252.9267		178.3239 (83)
Total gains	1033.6922	1185.8091	1322.4336	1463.2042	1560.8255	1538.4445	1469.1919	1363.7399	1256.8407	1120.5874	1012.8840		979.9284 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.9137	66.0822	66.2482	67.0393	67.1894	67.8971	67.8971	68.0298	67.6227	67.1894	66.8864	66.5726
alpha	5.3942	5.4055	5.4165	5.4693	5.4793	5.5265	5.5265	5.5353	5.5082	5.4793	5.4591	5.4382
util living area	0.9976	0.9944	0.9850	0.9508	0.8526	0.6695	0.4999	0.5575	0.8145	0.9687	0.9946	0.9982 (86)
Tweekday	18.8792	19.0447	19.3025	19.6350	19.8747	19.9778	19.9910	19.9914	19.9384	19.6354	19.2038	18.8580
Tweekend	20.4414	20.5141	20.6284	20.7768	20.8957	20.9539	20.9658	20.9640	20.9268	20.7737	20.5806	20.4290
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.1379	20.2484	20.4265	20.6516	20.8391	20.9292	20.9472	20.9445	20.8858	20.6508	20.3452	20.1187 (87)
Th 2	20.0389	20.0411	20.0433	20.0535	20.0555	20.0644	20.0644	20.0660	20.0609	20.0555	20.0516	20.0475 (88)
util rest of house	0.9967	0.9925	0.9799	0.9334	0.8050	0.5851	0.3967	0.4500	0.7416	0.9543	0.9925	0.9976 (89)
Tweekday	18.8792	19.0447	19.3025	19.6350	19.8747	19.9778	19.9910	19.9914	19.9384	19.6354	19.2038	18.8580
Tweekend	18.8792	19.0447	19.3025	19.6350	19.8747	19.9778	19.9910	19.9914	19.9384	19.6354	19.2038	18.8580
MIT 2	18.8792	19.0447	19.3025	19.6350	19.8747	19.9778	19.9910	19.9914	19.9384	19.6354	19.2038	18.8580 (90)
Living area fraction	fLA = Living area / (4) =											0.1599 (91)
MIT	19.0805	19.2372	19.4823	19.7976	20.0289	20.1300	20.1439	20.1438	20.0899	19.7977	19.3863	19.0596 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0805	19.2372	19.4823	19.7976	20.0289	20.1300	20.1439	20.1438	20.0899	19.7977	19.3863	19.0596 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9956	0.9904	0.9759	0.9277	0.8035	0.5913	0.4057	0.4592	0.7442	0.9491	0.9904	0.9967 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Useful gains	1029.1458	1174.4008	1290.5588	1357.3777	1254.1120	909.6738	595.9779	626.2038	935.2901	1063.5762	1003.1335	976.6540 (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	2571.1238	2487.6579	2246.9173	1863.8512	1421.3391	933.8590	598.4641	630.9942	1015.6377	1569.6107	2106.1691	2559.3041 (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	1147.2317	882.5088	711.5307	364.6609	124.4170	0.0000	0.0000	0.0000	0.0000	376.4897	794.1856	1177.4917 (98)
Space heating												5578.5161 (98)
Space heating per m2												(98) / (4) = 33.7867 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												388.4742 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1436.0068 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1147.2317	882.5088	711.5307	364.6609	124.4170	0.0000	0.0000	0.0000	0.0000	376.4897	794.1856	1177.4917 (98)
Space heating efficiency (main heating system 1)	388.4742	388.4742	388.4742	388.4742	388.4742	0.0000	0.0000	0.0000	0.0000	388.4742	388.4742	388.4742 (210)
Space heating fuel (main heating system)	295.3173	227.1731	183.1603	93.8700	32.0271	0.0000	0.0000	0.0000	0.0000	96.9150	204.4372	303.1068 (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	220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839 (64)
Efficiency of water heater	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650 (216)
(217)m	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650 (217)
Fuel for water heating, kWh/month	78.7091	69.3510	72.7788	65.1649	63.8041	56.9318	54.6013	60.0189	59.9455	67.5760	71.5508	76.7896 (219)
Water heating fuel used												797.2219 (219)
Annual totals kWh/year												
Space heating fuel - main system												1436.0068 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												543.9962 (232)
Total delivered energy for all uses												2777.2249 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	1436.0068	13.1900	189.4093 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	797.2219	13.1900	105.1536 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	543.9962	13.1900	71.7531 (250)
Additional standing charges			0.0000 (251)
Total energy cost			366.3160 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.7322 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	89.7851
SAP rating (Section 12)		90 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	1436.0068	0.5190	745.2875 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	797.2219	0.5190	413.7581 (264)
Space and water heating			1159.0457 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	543.9962	0.5190	282.3340 (268)
Total kg/year			1441.3797 (272)
CO2 emissions per m2			8.7300 (273)
EI value			90.8074
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 3.8847 = 3.641$, stars = 5
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 3.8847 = 0.1433$, stars = 5
Water heating energy efficiency	$13.19 / 2.7997 = 4.711$, stars = 4
Water heating environmental impact	$0.519 / 2.7997 = 0.1854$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	46.3700 (1a)	x 2.3800 (2a)	= 110.3606 (1a) - (3a)
Ground floor	46.3700 (1b)	x 2.6700 (2b)	= 123.8079 (1b) - (3b)
First floor	39.8300 (1c)	x 2.6200 (2c)	= 104.3546 (1c) - (3c)
Second floor	32.5400 (1d)	x 2.3400 (2d)	= 76.1436 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.1100		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 414.6667 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0965 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3465 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3445	0.3285	0.3285	0.3045	0.3125	0.2724	0.2724	0.2644	0.2724	0.3045	0.2964	0.3205 (22b)
Effective ac	0.5593	0.5540	0.5540	0.5463	0.5488	0.5371	0.5371	0.5350	0.5371	0.5463	0.5439	0.5514 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door -1			1.8000	1.0000	1.8000		(26)
W-1.4 (Uw = 1.40)			26.5800	1.3258	35.2386		(27)
Velux (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)
Basement floor			46.3700	0.1300	6.0281		(28)
Basement wall	33.2500		33.2500	0.2500	8.3125		(29a)
External wall	150.4600	24.6600	125.8000	0.2100	26.4180		(29a)
Dormer cheek	8.1600	3.7200	4.4400	0.1800	0.7992		(29a)
Ceiling	29.5200		29.5200	0.1100	3.2472		(30)
skelling	15.0200	1.8400	13.1800	0.1600	2.1088		(30)
Total net area of external elements Aum(A, m ²)			282.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.3918		(33)
Party Wall			96.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7190 (36)
Total fabric heat loss						(33) + (36) =	94.1108 (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	76.5408	75.8029	75.8029	74.7620	75.1002	73.4971	73.4971	73.2029	73.4971	74.7620	74.4326	75.4472 (38)
Heat transfer coeff	170.6516	169.9137	169.9137	168.8728	169.2110	167.6080	167.6080	167.3137	167.6080	168.8728	168.5434	169.5580 (39)
Average = Sum(39)m / 12 =												168.8062 (39)
HLP	1.0336	1.0291	1.0291	1.0228	1.0248	1.0151	1.0151	1.0133	1.0151	1.0228	1.0208	1.0269 (40)
HLP (average)												1.0224 (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												2.9560 (42)
Average daily hot water use (litres/day)												104.4043 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.8447	110.6686	106.4924	102.3162	98.1400	93.9639	93.9639	98.1400	102.3162	106.4924	110.6686	114.8447 (44)
	170.3114	148.9555	153.7087	134.0070	128.5829	110.9572	102.8182	117.9854	119.3945	139.1428	151.8852	164.9375 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

Energy content (annual)												Total = Sum(45)m =	1642.6862 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.5467	22.3433	23.0563	20.1010	19.2874	16.6436	15.4227	17.6978	17.9092	20.8714	22.7828	24.7406	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8640	(55)
Total storage loss													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839	(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													
	220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839	(64)
												Total per year (kWh/year) = Sum(64)m =	2231.9422 (64)
Heat gains from water heating, kWh/month													
	96.6657	85.6902	91.1453	83.3029	82.7909	75.6389	74.2242	79.2673	78.4443	86.3021	89.2474	94.8788	(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	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.0083	68.3981	55.6251	42.1118	31.4790	26.5759	28.7162	37.3264	50.0995	63.6128	74.2455	79.1486	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	502.2814	507.4935	494.3591	466.3977	431.1013	397.9278	375.7658	370.5537	383.6880	411.6495	446.9458	480.1194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	(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)													
	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	(71)
Water heating gains (Table 5)													
	129.9270	127.5152	122.5071	115.6985	111.2781	105.0540	99.7637	106.5420	108.9504	115.9974	123.9548	127.5253	(72)
Total internal gains	824.0278	818.2180	787.3025	739.0191	688.6697	644.3689	619.0569	629.2333	657.5490	706.0709	759.9573	801.6045	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				14.6700	12.7650	0.6300	0.7000	0.7700	57.2301 (74)			
East				3.6900	23.8018	0.6300	0.7000	0.7700	26.8415 (76)			
South				8.2200	54.2217	0.6300	0.7000	0.7700	136.2125 (78)			
North				0.9200	18.6626	0.6300	0.7000	1.0000	6.8146 (82)			
South				0.9200	54.1718	0.6300	0.7000	1.0000	19.7807 (82)			
Solar gains	246.8794	379.3159	551.6999	764.0726	900.9413	978.4467	920.6321	812.7192	660.7808	460.0503	293.5852	211.0731 (83)
Total gains	1070.9072	1197.5340	1339.0023	1503.0917	1589.6110	1622.8155	1539.6889	1441.9525	1318.3299	1166.1211	1053.5425	1012.6776 (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	67.1894	67.4811	67.4811	67.8971	67.7614	68.4095	68.4095	68.5298	68.4095	67.8971	68.0298	67.6227	
alpha	5.4793	5.4987	5.4987	5.5265	5.5174	5.5606	5.5606	5.5687	5.5606	5.5265	5.5353	5.5082	
util living area	0.9963	0.9924	0.9785	0.9234	0.7776	0.5291	0.3585	0.3932	0.7145	0.9465	0.9909	0.9972	(86)
Tweekday	19.0338	19.1852	19.4430	19.7568	19.9408	19.9965	19.9991	20.0006	19.9813	19.7549	19.3583	19.0121	
Tweekend	20.5040	20.5701	20.6859	20.8309	20.9302	20.9647	20.9681	20.9679	20.9504	20.8269	20.6443	20.4924	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.2346	20.3350	20.5152	20.7359	20.8923	20.9459	20.9507	20.9505	20.9225	20.7328	20.4446	20.2166	(87)
Th 2	20.0555	20.0592	20.0592	20.0644	20.0627	20.0707	20.0707	20.0722	20.0707	20.0644	20.0660	20.0609	(88)
util rest of house	0.9950	0.9897	0.9708	0.8970	0.7135	0.4385	0.2580	0.2867	0.6235	0.9219	0.9872	0.9962	(89)
Tweekday	19.0338	19.1852	19.4430	19.7568	19.9408	19.9965	19.9991	20.0006	19.9813	19.7549	19.3583	19.0121	
Tweekend	19.0338	19.1852	19.4430	19.7568	19.9408	19.9965	19.9991	20.0006	19.9813	19.7549	19.3583	19.0121	
MIT 2	19.0338	19.1852	19.4430	19.7568	19.9408	19.9965	19.9991	20.0006	19.9813	19.7549	19.3583	19.0121	(90)
Living area fraction												fLA = Living area / (4) =	0.1599 (91)
MIT	19.2258	19.3691	19.6145	19.9134	20.0930	20.1483	20.1512	20.1525	20.1318	19.9113	19.5320	19.2047	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2258	19.3691	19.6145	19.9134	20.0930	20.1483	20.1512	20.1525	20.1318	19.9113	19.5320	19.2047	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9934	0.9871	0.9662	0.8920	0.7158	0.4462	0.2667	0.2959	0.6300	0.9169	0.9843	0.9949	(94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

Useful gains	1063.8902	1182.1343	1293.6922	1340.7008	1137.8445	724.0951	410.6515	426.7173	830.5176	1069.1983	1036.9740	1007.5226 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	2410.5931	2322.5626	2075.4069	1690.9893	1217.1299	728.8022	410.8458	427.0603	860.1339	1420.4358	1943.6464	2391.5643 (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	1001.9470	766.3679	581.5957	252.2077	58.9883	0.0000	0.0000	0.0000	0.0000	261.3208	652.8041	1029.7270 (98)
Space heating												4604.9585 (98)
Space heating per m2										(98) / (4) =		27.8902 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												389.7763 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1181.4362 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1001.9470	766.3679	581.5957	252.2077	58.9883	0.0000	0.0000	0.0000	0.0000	261.3208	652.8041	1029.7270 (98)
Space heating efficiency (main heating system 1)	389.7763	389.7763	389.7763	389.7763	389.7763	0.0000	0.0000	0.0000	0.0000	389.7763	389.7763	389.7763 (210)
Space heating fuel (main heating system)	257.0569	196.6173	149.2127	64.7058	15.1339	0.0000	0.0000	0.0000	0.0000	67.0438	167.4817	264.1841 (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	220.3578	194.1587	203.7551	182.4390	178.6293	159.3892	152.8646	168.0318	167.8265	189.1892	200.3172	214.9839 (64)
Efficiency of water heater	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650 (216)
(217)m	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650 (217)
Fuel for water heating, kWh/month	78.7091	69.3510	72.7788	65.1649	63.8041	56.9318	54.6013	60.0189	59.9455	67.5760	71.5508	76.7896 (219)
Water heating fuel used												797.2219 (219)
Annual totals kWh/year												
Space heating fuel - main system												1181.4362 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												543.9962 (232)
Total delivered energy for all uses												2522.6543 (238)

10a. Fuel costs - using BEDF prices (467)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	1181.4362	18.7000	220.9286 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	797.2219	18.7000	149.0805 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	543.9962	18.7000	101.7273 (250)
Additional standing charges			0.0000 (251)
Total energy cost			471.7363 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	1181.4362	0.5190	613.1654 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	797.2219	0.5190	413.7581 (264)
Space and water heating			1026.9235 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	543.9962	0.5190	282.3340 (268)
Total kg/year			1309.2576 (272)

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

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	1181.4362	3.0700	3627.0091 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	797.2219	3.0700	2447.4711 (264)
Space and water heating			6074.4801 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	543.9962	3.0700	1670.0685 (268)
Primary energy kWh/year			7744.5486 (272)
Primary energy kWh/m2/year			46.9054 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 90
Current environmental impact rating: B 91

(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	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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
N Solar water heating	+ 1.1	-£ 56	-155 kg (11.8%)
U Solar photovoltaic panels	+ 6.4	-£ 350	-971 kg (84.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£56	0.94 kg/m²	B 91 A 92
Solar photovoltaic panels	£350	5.88 kg/m²	A 97 A 97
Total Savings	£406	6.82 kg/m²	

Potential energy efficiency rating: A 97
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 467 TEST (29 Oct 2020)
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	£472	£416	£56
Space heating	£221	£221	-£0
Water heating	£149	£93	£56
Lighting	£102	£102	£0
Generated (PV)	-£0	-£350	£350
Total cost of fuels	£472	£66	£406
Total cost of uses	£472	£66	£406
Delivered energy	15 kWh/m²	2 kWh/m²	13 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	8 kg/m²	1 kg/m²	7 kg/m²
Primary energy	47 kWh/m²	7 kWh/m²	40 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	46.3700 (1a)	x 2.3800 (2a)	= 110.3606 (1a) - (3a)
Ground floor	46.3700 (1b)	x 2.6700 (2b)	= 123.8079 (1b) - (3b)
First floor	39.8300 (1c)	x 2.6200 (2c)	= 104.3546 (1c) - (3c)
Second floor	32.5400 (1d)	x 2.3400 (2d)	= 76.1436 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.1100		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 414.6667 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0965 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3465 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (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	0.4086	0.4006	0.3926	0.3525	0.3445	0.3045	0.3045	0.2964	0.3205	0.3445	0.3605	0.3766 (22b)
Effective ac	0.5835	0.5802	0.5771	0.5621	0.5593	0.5463	0.5463	0.5439	0.5514	0.5593	0.5650	0.5709 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door -1			1.8000	1.0000	1.8000		(26)
W-1.4 (Uw = 1.40)			26.5800	1.3258	35.2386		(27)
Velux (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)
Basement floor			46.3700	0.1300	6.0281		(28)
Basement wall	33.2500		33.2500	0.2500	8.3125		(29a)
External wall	150.4600	24.6600	125.8000	0.2100	26.4180		(29a)
Dormer cheek	8.1600	3.7200	4.4400	0.1800	0.7992		(29a)
Ceiling	29.5200		29.5200	0.1100	3.2472		(30)
skelling	15.0200	1.8400	13.1800	0.1600	2.1088		(30)
Total net area of external elements Aum(A, m ²)			282.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.3918		(33)
Party Wall			96.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7190 (36)
Total fabric heat loss						(33) + (36) =	94.1108 (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	79.8435	79.4000	78.9651	76.9229	76.5408	74.7620	74.7620	74.4326	75.4472	76.5408	77.3138	78.1219 (38)
Heat transfer coeff	173.9544	173.5108	173.0760	171.0337	170.6516	168.8728	168.8728	168.5434	169.5580	170.6516	171.4246	172.2327 (39)
Average = Sum(39)m / 12 =												171.0319 (39)
HLP	1.0536	1.0509	1.0482	1.0359	1.0336	1.0228	1.0228	1.0208	1.0269	1.0336	1.0382	1.0431 (40)
HLP (average)												1.0359 (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												2.9560 (42)
Average daily hot water use (litres/day)												104.4043 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.8447	110.6686	106.4924	102.3162	98.1400	93.9639	93.9639	98.1400	102.3162	106.4924	110.6686	114.8447 (44)
	170.3114	148.9555	153.7087	134.0070	128.5829	110.9572	102.8182	117.9854	119.3945	139.1428	151.8852	164.9375 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1642.6862 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.5467	22.3433	23.0563	20.1010	19.2874	16.6436	15.4227	17.6978	17.9092	20.8714	22.7828	24.7406 (46)
Water storage loss:											
Store volume	250.0000 (47)										
a) If manufacturer declared loss factor is known (kWh/day):	1.6000 (48)										
Temperature factor from Table 2b	0.5400 (49)										
Enter (49) or (54) in (55)	0.8640 (55)										
Total storage loss											
26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage											
26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120 (59)
Total heat required for water heating calculated for each month											
220.3578	194.1587	202.3593	175.6854	165.8349	146.7825	139.8376	155.9353	162.4236	187.7934	200.3172	214.9839 (62)
Aperture area of solar collector	3.0000 (H1)										
Zero-loss collector efficiency	0.7000 (H2)										
Collector heat loss coefficient	1.8000 (H3)										
Collector 2nd order heat loss coefficient	0.0050 (H3a)										
Collector effective heat loss coefficient	1.8063 (H3b)										
Collector performance ratio	2.5804 (H4)										
Annual solar radiation per m2	1079.5246 (H5)										
Overshading factor	0.8000 (H6)										
Solar energy available	1813.6014 (H7)										
Adjustment factor for showers	1.0000 (H7a)										
Solar-to-load ratio	1.1040 (H8)										
Utilisation factor	0.5958 (H9)										
Collector performance factor	0.8793 (H10)										
Dedicated solar storage volume	75.0000 (H11)										
Effective solar volume	75.0000 (H13)										
Daily hot water demand	104.4043 (H14)										
Volume ratio Veff/V	0.7184 (H15)										
Solar storage volume factor	0.9338 (H16)										
Solar input	-887.2067 (H17)										
Solar input	-25.7272	-42.9313	-73.1170	-97.9912	-121.0599	-119.0211	-117.4482	-102.6151	-80.3682	-54.8820	-30.5162
Solar input (sum of months) = Sum(63)m =	-887.2067 (63)										
Output from w/h											
194.6306	151.2273	129.2423	77.6942	44.7751	27.7614	22.3894	53.3202	82.0554	132.9114	169.8010	193.4546 (64)
Total per year (kWh/year) = Sum(64)m =	1279.2630 (64)										
Heat gains from water heating, kWh/month											
96.6657	85.6902	90.0287	77.9000	72.5555	65.5535	63.8026	69.5901	74.1220	85.1855	89.2474	94.8788 (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	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.0083	68.3981	55.6251	42.1118	31.4790	26.5759	28.7162	37.3264	50.0995	63.6128	74.2455	79.1486	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	502.2814	507.4935	494.3591	466.3977	431.1013	397.9278	375.7658	370.5537	383.6880	411.6495	446.9458	480.1194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	(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)	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	(71)
Water heating gains (Table 5)	129.9270	127.5152	121.0063	108.1945	97.5208	91.0465	85.7562	93.5351	102.9472	114.4966	123.9548	127.5253	(72)
Total internal gains	824.0278	818.2180	785.8017	731.5151	674.9123	630.3614	605.0494	616.2264	651.5458	704.5701	759.9573	801.6045	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
North					14.6700	10.6334	0.6300	0.7000	0.7700				47.6731 (74)
East					3.6900	19.6403	0.6300	0.7000	0.7700				22.1486 (76)
South					8.2200	46.7521	0.6300	0.7000	0.7700				117.4477 (78)
North					0.9200	15.6897	0.6300	0.7000	1.0000				5.7291 (82)
South					0.9200	45.6416	0.6300	0.7000	1.0000				16.6659 (82)

Solar gains	209.6644	367.5911	535.1311	724.1851	872.1559	894.0756	850.1351	734.5066	599.2917	414.5165	252.9267	178.3239	(83)
Total gains	1033.6922	1185.8091	1320.9328	1455.7002	1547.0682	1524.4370	1455.1845	1350.7330	1250.8375	1119.0866	1012.8840	979.9284	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.9137	66.0822	66.2482	67.0393	67.1894	67.8971	67.8971	68.0298	67.6227	67.1894	66.8864	66.5726
alpha	5.3942	5.4055	5.4165	5.4693	5.4793	5.5265	5.5265	5.5353	5.5082	5.4793	5.4591	5.4382
util living area	0.9976	0.9944	0.9851	0.9517	0.8562	0.6745	0.5045	0.5624	0.8167	0.9689	0.9946	0.9982 (86)
Tweekday	18.8792	19.0447	19.3017	19.6317	19.8718	19.9773	19.9909	19.9913	19.9376	19.6346	19.2038	18.8580
Tweekend	20.4414	20.5141	20.6280	20.7752	20.8940	20.9534	20.9657	20.9638	20.9262	20.7734	20.5806	20.4290
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.1379	20.2484	20.4259	20.6490	20.8364	20.9284	20.9470	20.9442	20.8848	20.6503	20.3452	20.1187 (87)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Th 2	20.0389	20.0411	20.0433	20.0535	20.0555	20.0644	20.0644	20.0660	20.0609	20.0555	20.0516	20.0475 (88)
util rest of house	0.9967	0.9925	0.9800	0.9346	0.8092	0.5898	0.4005	0.4542	0.7441	0.9545	0.9925	0.9976 (89)
Tuesday	18.8792	19.0447	19.3017	19.6317	19.8718	19.9773	19.9909	19.9913	19.9376	19.6346	19.2038	18.8580
Tuesday	18.8792	19.0447	19.3017	19.6317	19.8718	19.9773	19.9909	19.9913	19.9376	19.6346	19.2038	18.8580
MIT 2	18.8792	19.0447	19.3017	19.6317	19.8718	19.9773	19.9909	19.9913	19.9376	19.6346	19.2038	18.8580 (90)
Living area fraction									fLA = Living area / (4) =			0.1599 (91)
MIT	19.0805	19.2372	19.4814	19.7944	20.0260	20.1293	20.1438	20.1437	20.0891	19.7970	19.3863	19.0596 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0805	19.2372	19.4814	19.7944	20.0260	20.1293	20.1438	20.1437	20.0891	19.7970	19.3863	19.0596 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9956	0.9904	0.9760	0.9289	0.8075	0.5960	0.4095	0.4634	0.7466	0.9494	0.9904	0.9967 (94)
Useful gains	1029.1458	1174.4008	1289.2376	1352.2044	1249.2926	908.6302	595.8460	625.9583	933.8555	1062.4248	1003.1335	976.6540 (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	2571.1238	2487.6579	2246.7766	1863.3031	1420.8447	933.7557	598.4501	630.9687	1015.4925	1569.4890	2106.1691	2559.3041 (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	1147.2317	882.5088	712.4090	367.9911	127.6348	0.0000	0.0000	0.0000	0.0000	377.2557	794.1856	1177.4917 (98)
Space heating												5586.7084 (98)
Space heating per m2										(98) / (4) =		33.8363 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													388.4742 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1438.1156 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1147.2317	882.5088	712.4090	367.9911	127.6348	0.0000	0.0000	0.0000	0.0000	377.2557	794.1856	1177.4917	(98)
Space heating efficiency (main heating system 1)	388.4742	388.4742	388.4742	388.4742	388.4742	0.0000	0.0000	0.0000	0.0000	388.4742	388.4742	388.4742	(210)
Space heating fuel (main heating system)	295.3173	227.1731	183.3864	94.7273	32.8554	0.0000	0.0000	0.0000	0.0000	97.1122	204.4372	303.1068	(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	194.6306	151.2273	129.2423	77.6942	44.7751	27.7614	22.3894	53.3202	82.0554	132.9114	169.8010	193.4546	(64)
Efficiency of water heater	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	(216)
(217)m	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	(217)
Fuel for water heating, kWh/month	69.5196	54.0165	46.1637	27.7514	15.9931	9.9160	7.9972	19.0453	29.3092	47.4743	60.6508	69.0996	(219)
Water heating fuel used												456.9368	(219)
Annual totals kWh/year													
Space heating fuel - main system												1438.1156	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												50.0000	(231)
Electricity for lighting (calculated in Appendix L)												543.9962	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)
Total delivered energy for all uses												761.8093	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1438.1156	13.1900	189.6875 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	456.9368	13.1900	60.2700 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	543.9962	13.1900	71.7531 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			100.4826 (255)

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):
 Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] = 0.4200$ (256)
 SAP value 0.2009 (257)
 SAP rating (Section 12) 97.1980
 SAP band 97 (258)
 A

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	1438.1156	0.5190	746.3820 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	456.9368	0.5190	237.1502 (264)
Space and water heating			983.5322 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	543.9962	0.5190	282.3340 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			395.3790 (272)
CO2 emissions per m2			2.3900 (273)
EI value			97.4784
EI rating			97 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	46.3700 (1a)	x 2.3800 (2a)	= 110.3606 (1a) - (3a)
Ground floor	46.3700 (1b)	x 2.6700 (2b)	= 123.8079 (1b) - (3b)
First floor	39.8300 (1c)	x 2.6200 (2c)	= 104.3546 (1c) - (3c)
Second floor	32.5400 (1d)	x 2.3400 (2d)	= 76.1436 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.1100		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 414.6667 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0965 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3465 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3205 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3445	0.3285	0.3285	0.3045	0.3125	0.2724	0.2724	0.2644	0.2724	0.3045	0.2964	0.3205 (22b)
Effective ac	0.5593	0.5540	0.5540	0.5463	0.5488	0.5371	0.5371	0.5350	0.5371	0.5463	0.5439	0.5514 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door -1			1.8000	1.0000	1.8000		(26)
W-1.4 (Uw = 1.40)			26.5800	1.3258	35.2386		(27)
Velux (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)
Basement floor			46.3700	0.1300	6.0281		(28)
Basement wall	33.2500		33.2500	0.2500	8.3125		(29a)
External wall	150.4600	24.6600	125.8000	0.2100	26.4180		(29a)
Dormer cheek	8.1600	3.7200	4.4400	0.1800	0.7992		(29a)
Ceiling	29.5200		29.5200	0.1100	3.2472		(30)
skelling	15.0200	1.8400	13.1800	0.1600	2.1088		(30)
Total net area of external elements Aum(A, m ²)			282.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.3918		(33)
Party Wall			96.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7190 (36)
Total fabric heat loss						(33) + (36) =	94.1108 (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	76.5408	75.8029	75.8029	74.7620	75.1002	73.4971	73.4971	73.2029	73.4971	74.7620	74.4326	75.4472 (38)
Heat transfer coeff	170.6516	169.9137	169.9137	168.8728	169.2110	167.6080	167.6080	167.3137	167.6080	168.8728	168.5434	169.5580 (39)
Average = Sum(39)m / 12 =												168.8062 (39)
HLP	1.0336	1.0291	1.0291	1.0228	1.0248	1.0151	1.0151	1.0133	1.0151	1.0228	1.0208	1.0269 (40)
HLP (average)												1.0224 (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												2.9560 (42)
Average daily hot water use (litres/day)												104.4043 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.8447	110.6686	106.4924	102.3162	98.1400	93.9639	93.9639	98.1400	102.3162	106.4924	110.6686	114.8447 (44)
	170.3114	148.9555	153.7087	134.0070	128.5829	110.9572	102.8182	117.9854	119.3945	139.1428	151.8852	164.9375 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

Energy content (annual)											Total = Sum (45)m =	1642.6862 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.5467	22.3433	23.0563	20.1010	19.2874	16.6436	15.4227	17.6978	17.9092	20.8714	22.7828	24.7406 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8640 (55)
Total storage loss												
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage												
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	220.3578	194.1587	202.3593	175.6854	165.8349	146.7825	139.8376	155.9353	162.4236	187.7934	200.3172	214.9839 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1169.5850 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1964.9028 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1962 (H8)
Utilisation factor												0.5666 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												104.4043 (H14)
Volume ratio Veff/V												0.7184 (H15)
Solar storage volume factor												0.9338 (H16)
Solar input												-914.1109 (H17)
Solar input	-29.2109	-42.6350	-72.1742	-98.3276	-118.4670	-123.2579	-120.4059	-107.7738	-84.6120	-58.5257	-34.1420	-24.5790 (63)
												-914.1109 (63)
Solar input (sum of months) = Sum (63)m =												
Output from w/h												
	191.1469	151.5236	130.1851	77.3577	47.3680	23.5246	19.4317	48.1615	77.8117	129.2678	166.1752	190.4050 (64)
Total per year (kWh/year) = Sum (64)m =												1252.3588 (64)
Heat gains from water heating, kWh/month												
	96.6657	85.6902	90.0287	77.9000	72.5555	65.5535	63.8026	69.5901	74.1220	85.1855	89.2474	94.8788 (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	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582	177.3582 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	77.0083	68.3981	55.6251	42.1118	31.4790	26.5759	28.7162	37.3264	50.0995	63.6128	74.2455	79.1486 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	502.2814	507.4935	494.3591	466.3977	431.1013	397.9278	375.7658	370.5537	383.6880	411.6495	446.9458	480.1194 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918	55.6918 (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)												
	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388	-118.2388 (71)
Water heating gains (Table 5)												
	129.9270	127.5152	121.0063	108.1945	97.5208	91.0465	85.7562	93.5351	102.9472	114.4966	123.9548	127.5253 (72)
Total internal gains	824.0278	818.2180	785.8017	731.5151	674.9123	630.3614	605.0494	616.2264	651.5458	704.5701	759.9573	801.6045 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				14.6700	12.7650		0.6300		0.7000		0.7700		57.2301 (74)
East				3.6900	23.8018		0.6300		0.7000		0.7700		26.8415 (76)
South				8.2200	54.2217		0.6300		0.7000		0.7700		136.2125 (78)
North				0.9200	18.6626		0.6300		0.7000		1.0000		6.8146 (82)
South				0.9200	54.1718		0.6300		0.7000		1.0000		19.7807 (82)
Solar gains	246.8794	379.3159	551.6999	764.0726	900.9413	978.4467	920.6321	812.7192	660.7808	460.0503	293.5852	211.0731	(83)
Total gains	1070.9072	1197.5340	1337.5015	1495.5877	1575.8537	1608.8081	1525.6814	1428.9456	1312.3267	1164.6203	1053.5425	1012.6776	(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	67.1894	67.4811	67.4811	67.8971	67.7614	68.4095	68.4095	68.5298	68.4095	67.8971	68.0298	67.6227
alpha	5.4793	5.4987	5.4987	5.5265	5.5174	5.5606	5.5606	5.5687	5.5606	5.5265	5.5353	5.5082
util living area	0.9963	0.9924	0.9786	0.9247	0.7819	0.5334	0.3617	0.3967	0.7169	0.9467	0.9909	0.9972 (86)
Tweekday	19.0338	19.1852	19.4422	19.7541	19.9392	19.9963	19.9991	20.0006	19.9810	19.7543	19.3583	19.0121
Tweekend	20.5040	20.5701	20.6855	20.8295	20.9291	20.9646	20.9681	20.9679	20.9501	20.8266	20.6443	20.4924
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.2346	20.3350	20.5146	20.7337	20.8906	20.9456	20.9507	20.9504	20.9221	20.7323	20.4446	20.2166 (87)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

Th 2	20.0555	20.0592	20.0592	20.0644	20.0627	20.0707	20.0707	20.0722	20.0707	20.0644	20.0660	20.0609 (88)
util rest of house	0.9950	0.9897	0.9709	0.8987	0.7182	0.4422	0.2603	0.2893	0.6260	0.9223	0.9872	0.9962 (89)
Tuesday	19.0338	19.1852	19.4422	19.7541	19.9392	19.9963	19.9991	20.0006	19.9810	19.7543	19.3583	19.0121
Tuesday	19.0338	19.1852	19.4422	19.7541	19.9392	19.9963	19.9991	20.0006	19.9810	19.7543	19.3583	19.0121
MIT 2	19.0338	19.1852	19.4422	19.7541	19.9392	19.9963	19.9991	20.0006	19.9810	19.7543	19.3583	19.0121 (90)
Living area fraction									fLA = Living area / (4) =			0.1599 (91)
MIT	19.2258	19.3691	19.6137	19.9107	20.0914	20.1481	20.1512	20.1524	20.1315	19.9107	19.5320	19.2047 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2258	19.3691	19.6137	19.9107	20.0914	20.1481	20.1512	20.1524	20.1315	19.9107	19.5320	19.2047 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9871	0.9663	0.8936	0.7203	0.4499	0.2692	0.2986	0.6324	0.9172	0.9843	0.9949	(94)
Useful gains	1063.8902	1182.1343	1292.4372	1336.4219	1135.1192	723.8748	410.6407	426.6987	829.9082	1068.2252	1036.9740	1007.5226	(95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000	(96)
Heat loss rate W	2410.5931	2322.5626	2075.2749	1690.5436	1216.8575	728.7800	410.8445	427.0581	860.0734	1420.3341	1943.6464	2391.5643	(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	1001.9470	766.3679	582.4313	254.9676	60.8133	0.0000	0.0000	0.0000	0.0000	261.9690	652.8041	1029.7270	(98)
Space heating												4611.0271	(98)
Space heating per m2										(98) / (4) =		27.9270	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													389.7763 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1182.9931 (211)
Space heating requirement	1001.9470	766.3679	582.4313	254.9676	60.8133	0.0000	0.0000	0.0000	0.0000	261.9690	652.8041	1029.7270	(98)
Space heating efficiency (main heating system 1)	389.7763	389.7763	389.7763	389.7763	389.7763	0.0000	0.0000	0.0000	0.0000	389.7763	389.7763	389.7763	(210)
Space heating fuel (main heating system)	257.0569	196.6173	149.4271	65.4138	15.6021	0.0000	0.0000	0.0000	0.0000	67.2101	167.4817	264.1841	(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	191.1469	151.5236	130.1851	77.3577	47.3680	23.5246	19.4317	48.1615	77.8117	129.2678	166.1752	190.4050	(64)
Efficiency of water heater	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	(216)
Fuel for water heating, kWh/month	68.2753	54.1223	46.5005	27.6312	16.9192	8.4027	6.9408	17.2027	27.7934	46.1728	59.3557	68.0103	(219)
Water heating fuel used												447.3269	(219)
Annual totals kWh/year												1182.9931	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													
Electricity for pumps and fans:													
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												50.0000	(231)
Electricity for lighting (calculated in Appendix L)												543.9962	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 2.50 * 1170 * 0.80) =										-1871.3360		-1871.3360	(233)
Total delivered energy for all uses												352.9803	(238)

10a. Fuel costs - using BEDF prices (467)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1182.9931	18.7000	221.2197 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	447.3269	18.7000	83.6501 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	18.7000	9.3500 (249)
Energy for lighting	543.9962	18.7000	101.7273 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1871.3360	18.7000	-349.9398 (252)
Total energy cost			66.0073 (255)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property and Energy
Services Ltd.

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1182.9931	0.5190	613.9734 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	447.3269	0.5190	232.1627 (264)
Space and water heating			846.1361 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	543.9962	0.5190	282.3340 (268)
Energy saving/generation technologies			
PV Unit	-1871.3360	0.5190	-971.2234 (269)
Total kg/year			183.1968 (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	1182.9931	3.0700	3631.7889 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	447.3269	3.0700	1373.2937 (264)
Space and water heating			5005.0826 (265)
Pumps and fans	50.0000	3.0700	153.5000 (267)
Energy for lighting	543.9962	3.0700	1670.0685 (268)
Energy saving/generation technologies			
PV Unit	-1871.3360	3.0700	-5745.0015 (269)
Primary energy kWh/year			1083.6496 (272)
Primary energy kWh/m2/year			6.5632 (273)