

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	161 Old Hall Lane				Issued on Date	04/05/2021
Assessment Reference	01 Be Lean			Prop Type Ref		
Property	161, Old Hall Lane, Manchester, M14 6HJ					
SAP Rating	87 B	DER	14.09	TER	14.13	
Environmental	85 B	% DER<TER	0.29			
CO ₂ Emissions (t/year)	3.97	DFEE	47.21	TFEE	59.21	
General Requirements Compliance	Pass	% DFEE<TFEE	20.27			
Assessor Details	Mr. Thomas McMahon, SApeasy Ltd, Tel: 0114 321 2037, info@sapeasy.co.uk				Assessor ID	r863-0001
Client						

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	14.13	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.09	kgCO ₂ /m ²	Pass
	-0.04 (-0.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.21	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.21	kWh/m ² /yr	
	-12.0 (-20.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.26 (max. 0.70)	Pass
Floor	0.13 (max. 0.25)	0.22 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.17 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

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	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from manufacturer - - Efficiency: 90% Minimum: 88%	Pass
---------------------	--	------

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 2.86 kWh/day
Permitted by DBSCG 2.86

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (West Pennines (England))

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

12.54 m², No overhang

Windows facing South

25.30 m², No overhang

Windows facing West

3.36 m², No overhang

Air change rate

2.50 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.11

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.12

W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	161 Old Hall Lane			Issued on Date	04/05/2021
Assessment Reference	01 Be Lean	Prop Type Ref			
Property	161, Old Hall Lane, Manchester, M14 6HJ				
SAP Rating	87 B	DER	14.09	TER	14.13
Environmental	85 B	% DER<TER	0.29		
CO ₂ Emissions (t/year)	3.97	DFEE	47.21	TFEE	59.21
General Requirements Compliance	Pass	% DFEE<TFEE	20.27		
Assessor Details	Mr. Thomas McMahon, SApeasy Ltd, Tel: 0114 321 2037, info@sapeasy.co.uk			Assessor ID	r863-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 330 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 14.13 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.09 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)47.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.26 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.40 (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: Boiler system with radiators or underfloor - Mains gas

Data from manufacturer

- -

Efficiency: 90%

Minimum: 88% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.86 kWh/day

Permitted by DBSCG 2.86 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

Boiler interlock Yes 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 (West Pennines (England)):Not significant OK

Based on:

Overshading:	Average
Windows facing North:	12.54 m ² , No overhang
Windows facing South:	25.30 m ² , No overhang
Windows facing West:	3.36 m ² , No overhang
Air change rate:	2.50 ach
Blinds/curtains:	None

10 Key features

Roof U-value	0.11 W/m ² K
Roof U-value	0.11 W/m ² K
Floor U-value	0.12 W/m ² K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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)
Ground floor	121.7600 (1b)	x 2.6500 (2b)	= 322.6640 (1b) - (3b)
First floor	110.3700 (1c)	x 2.7400 (2c)	= 302.4138 (1c) - (3c)
Second floor	97.8100 (1d)	x 2.3600 (2d)	= 230.8316 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	329.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 855.9094 (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					8 * 10 = 80.0000 (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) =				80.0000 / (5) = 0.0935 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3435 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2919 (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	0.3722	0.3649	0.3576	0.3211	0.3138	0.2774	0.2774	0.2701	0.2919	0.3138	0.3284	0.3430 (22b)
Effective ac	0.5693	0.5666	0.5640	0.5516	0.5492	0.5385	0.5385	0.5365	0.5426	0.5492	0.5539	0.5588 (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
W (Uw = 1.40)			41.2000	1.3258	54.6212		(27)
D			1.8900	1.4000	2.6460		(26)
RL (Velux) (Uw = 1.30)			0.6500	1.2357	0.8032		(27a)
Lantern (Uw = 1.40)			3.6000	1.3258	4.7727		(27a)
Ground floor			121.7600	0.1200	14.6112		(28a)
Garage's ceiling			15.3700	0.1914	2.9414		(28b)
Overhanging floor			4.7300	0.2200	1.0406		(28b)
External wall	261.2700	27.9600	233.3100	0.1800	41.9958		(29a)
External wall (stone)	34.2400	3.3600	30.8800	0.1800	5.5584		(29a)
Dormer wall	46.8300	11.7700	35.0600	0.1700	5.9602		(29a)
Dwarf wall	19.2400		19.2400	0.1651	3.1772		(29a)
Wall to garage	23.0100		23.0100	0.2560	5.8912		(29a)
Raftered roof	44.4300	0.6500	43.7800	0.1600	7.0048		(30)
Apex ceiling (insu JR)	17.7300		17.7300	0.1100	1.9503		(30)
Eaves void	10.3500		10.3500	0.1043	1.0791		(30)
Rear flat roof (0F)	31.4900	3.6000	27.8900	0.1700	4.7413		(30)
Bay flat roof (1F)	2.2100		2.2100	0.1700	0.3757		(30)
Dormer flat roof (2F)	47.4700		47.4700	0.1700	8.0699		(30)
Total net area of external elements Aum(A, m ²)			680.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	167.2404		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							37.4334 (36)
Total fabric heat loss						(33) + (36) =	204.6738 (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	160.7929	160.0330	159.2882	155.7899	155.1354	152.0885	152.0885	151.5243	153.2621	155.1354	156.4595	157.8438 (38)
Heat transfer coeff	365.4666	364.7068	363.9620	360.4637	359.8092	356.7623	356.7623	356.1981	357.9359	359.8092	361.1333	362.5175 (39)
Average = Sum(39)m / 12 =												360.4606 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1077	1.1054	1.1031	1.0925	1.0905	1.0813	1.0813	1.0796	1.0849	1.0905	1.0945	1.0987 (40)
HLP (average)												1.0925 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Assumed occupancy 3.1709 (42)
Average daily hot water use (litres/day) 109.5077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.4585	116.0782	111.6979	107.3176	102.9373	98.5570	98.5570	102.9373	107.3176	111.6979	116.0782	120.4585	(44)
Energy content (annual)	178.6365	156.2366	161.2222	140.5574	134.8682	116.3810	107.8441	123.7527	125.2307	145.9443	159.3096	172.9999	(45)
Distribution loss (46)m = 0.15 x (45)m	26.7955	23.4355	24.1833	21.0836	20.2302	17.4571	16.1766	18.5629	18.7846	21.8916	23.8964	25.9500	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.8600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.5444	(55)
Total storage loss	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764	(56)
If cylinder contains dedicated solar storage	47.8764	43.2432	47.8764	46.3320	47.8764	46.3320	47.8764	47.8764	46.3320	47.8764	46.3320	47.8764	(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	249.7753	220.4910	232.3610	209.4014	206.0070	185.2250	178.9829	194.8915	194.0747	217.0831	228.1536	244.1387	(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	249.7753	220.4910	232.3610	209.4014	206.0070	185.2250	178.9829	194.8915	194.0747	217.0831	228.1536	244.1387	(64)
Total per year (kWh/year) = Sum(64)m =												2560.5851	(64)
Heat gains from water heating, kWh/month	116.3077	103.3522	110.5174	101.8105	101.7547	93.7719	92.7692	98.0588	96.7144	105.4375	108.0456	114.4335	(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	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0794	40.9273	33.2843	25.1984	18.8361	15.9022	17.1829	22.3350	29.9780	38.0639	44.4262	47.3601	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	482.0811	487.0836	474.4774	447.6405	413.7637	381.9242	360.6536	355.6511	368.2572	395.0941	428.9709	460.8104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	(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)	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	(71)
Water heating gains (Table 5)	156.3275	153.7979	148.5449	141.4035	136.7671	130.2387	124.6898	131.7995	134.3256	141.7171	150.0634	153.8085	(72)
Total internal gains	758.0508	755.3716	729.8695	687.8052	642.9296	601.6280	576.0890	583.3483	606.1235	648.4379	697.0234	735.5417	(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				12.5400	10.6334		0.7600		0.7000		0.7700		49.1603 (74)
South				25.3000	46.7521		0.7600		0.7000		0.7700		436.0800 (78)
West				3.3600	19.6403		0.7600		0.7000		0.7700		24.3294 (80)
North				0.6500	16.7973		0.7600		0.7000		1.0000		5.2277 (82)
Horizontal				3.6000	26.0000		0.7600		0.7000		1.0000		44.8157 (82)
Solar gains	559.6130	958.8229	1331.6524	1691.0693	1937.4208	1943.9921	1865.5369	1677.5802	1454.9305	1064.5563	671.1878	478.3936	(83)
Total gains	1317.6638	1714.1945	2061.5219	2378.8745	2580.3504	2545.6201	2441.6260	2260.9285	2061.0540	1712.9942	1368.2112	1213.9354	(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	62.6938	62.8244	62.9530	63.5640	63.6796	64.2234	64.2234	64.3252	64.0129	63.6796	63.4461	63.2038		
alpha	5.1796	5.1883	5.1969	5.2376	5.2453	5.2816	5.2816	5.2883	5.2675	5.2453	5.2297	5.2136		
util living area	0.9997	0.9988	0.9954	0.9806	0.9271	0.7918	0.6192	0.6828	0.9059	0.9909	0.9992	0.9998	(86)	
MIT	19.9179	20.0524	20.2532	20.5104	20.7423	20.8907	20.9360	20.9282	20.8182	20.5070	20.1603	19.8970	(87)	
Th 2	19.9946	19.9964	19.9983	20.0070	20.0086	20.0161	20.0161	20.0175	20.0132	20.0086	20.0053	20.0019	(88)	
util rest of house	0.9996	0.9984	0.9936	0.9724	0.8948	0.7072	0.4927	0.5570	0.8514	0.9859	0.9988	0.9998	(89)	
MIT 2	18.5254	18.7237	19.0184	19.3968	19.7176	19.8991	19.9358	19.9331	19.8232	19.3965	18.8888	18.5006	(90)	
Living area fraction									fLA = Living area / (4) =			0.0549	(91)	
MIT	18.6019	18.7967	19.0862	19.4580	19.7739	19.9536	19.9908	19.9878	19.8779	19.4575	18.9587	18.5773	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6019	18.7967	19.0862	19.4580	19.7739	19.9536	19.9908	19.9878	19.8779	19.4575	18.9587	18.5773	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9994	0.9976	0.9913	0.9662	0.8852	0.7011	0.4893	0.5529	0.8419	0.9818	0.9983	0.9996	(94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Useful gains	1316.8802	1710.0955	2043.5108	2298.4700	2284.2090	1784.7662	1194.5735	1249.9861	1735.1653	1681.8286	1365.8247	1213.4678 (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	5226.8854	5068.2114	4580.9100	3805.7856	2905.0696	1909.9465	1209.7098	1277.9535	2068.1224	3187.0225	4282.5601	5212.0330 (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	2909.0439	2256.6539	1887.8250	1085.2672	461.9203	0.0000	0.0000	0.0000	0.0000	1119.8643	2100.0495	2974.9325 (98)
Space heating												14795.5565 (98)
Space heating per m2										(98) / (4) =		44.8432 (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 %)												89.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												16531.3481 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2909.0439	2256.6539	1887.8250	1085.2672	461.9203	0.0000	0.0000	0.0000	0.0000	1119.8643	2100.0495	2974.9325 (98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000 (210)
Space heating fuel (main heating system)	3250.3283	2521.4010	2109.3017	1212.5891	516.1121	0.0000	0.0000	0.0000	0.0000	1251.2450	2346.4240	3323.9469 (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	249.7753	220.4910	232.3610	209.4014	206.0070	185.2250	178.9829	194.8915	194.0747	217.0831	228.1536	244.1387 (64)
Efficiency of water heater	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (217)
Fuel for water heating, kWh/month	279.0785	246.3587	259.6212	233.9681	230.1754	206.9553	199.9809	217.7558	216.8432	242.5509	254.9202	272.7807 (219)
Water heating fuel used												2860.9889 (219)
Annual totals kWh/year												
Space heating fuel - main system												16531.3481 (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)												813.7771 (232)
Total delivered energy for all uses												20281.1141 (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	16531.3481	0.2160	3570.7712 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2860.9889	0.2160	617.9736 (264)
Space and water heating			4188.7448 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	813.7771	0.5190	422.3503 (268)
Total CO2, kg/year			4650.0201 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0900 (273)

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

DER		14.0900 ZC1
Total Floor Area	TFA	329.9400
Assumed number of occupants	N	3.1709
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		8.6583 ZC2
CO2 emissions from cooking, equation (L16)		0.5913 ZC3
Total CO2 emissions		23.3396 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		23.3396 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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)
Ground floor	121.7600 (1b)	x 2.6500 (2b)	= 322.6640 (1b) - (3b)
First floor	110.3700 (1c)	x 2.7400 (2c)	= 302.4138 (1c) - (3c)
Second floor	97.8100 (1d)	x 2.3600 (2d)	= 230.8316 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	329.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 855.9094 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.0467 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.2967 (18)					
Number of sides sheltered							2 (19)					
Shelter factor	(20) = 1 - [0.075 x (19)] =						0.8500 (20)					
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =						0.2522 (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	0.3216	0.3153	0.3090	0.2774	0.2711	0.2396	0.2396	0.2333	0.2522	0.2711	0.2838	0.2964 (22b)
Effective ac	0.5517	0.5497	0.5477	0.5385	0.5368	0.5287	0.5287	0.5272	0.5318	0.5368	0.5403	0.5439 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.8900	1.0000	1.8900		(26)					
TER Opening Type (Uw = 1.40)			41.2000	1.3258	54.6212		(27)					
TER Room Window (Uw = 1.70)			4.2500	1.5918	6.7650		(27a)					
Ground floor			121.7600	0.1300	15.8288		(28a)					
Garage's ceiling			15.3700	0.1300	1.9981		(28b)					
Overhanging floor			4.7300	0.1300	0.6149		(28b)					
External wall	261.2700	27.9600	233.3100	0.1800	41.9958		(29a)					
External wall (stone)	34.2400	3.3600	30.8800	0.1800	5.5584		(29a)					
Dormer wall	46.8300	11.7700	35.0600	0.1800	6.3108		(29a)					
Dwarf wall	19.2400		19.2400	0.1800	3.4632		(29a)					
Wall to garage	23.0100		23.0100	0.1800	4.1418		(29a)					
Raftered roof	44.4300	0.6500	43.7800	0.1300	5.6914		(30)					
Apex ceiling (insu JR)	17.7300		17.7300	0.1300	2.3049		(30)					
Eaves void	10.3500		10.3500	0.1300	1.3455		(30)					
Rear flat roof (OF)	31.4900	3.6000	27.8900	0.1300	3.6257		(30)					
Bay flat roof (1F)	2.2100		2.2100	0.1300	0.2873		(30)					
Dormer flat roof (2F)	47.4700		47.4700	0.1300	6.1711		(30)					
Total net area of external elements Aum(A, m2)			680.1300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	162.6139		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							53.3931 (36)					
Total fabric heat loss						(33) + (36) =	216.0070 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 155.8301	Feb 155.2630	Mar 154.7071	Apr 152.0960	May 151.6075	Jun 149.3334	Jul 149.3334	Aug 148.9122	Sep 150.2093	Oct 151.6075	Nov 152.5958	Dec 153.6290 (38)
Heat transfer coeff	371.8371	371.2700	370.7141	368.1030	367.6145	365.3404	365.3404	364.9192	366.2163	367.6145	368.6028	369.6360 (39)
Average = Sum(39)m / 12 =												368.1007 (39)
HLP	Jan 1.1270	Feb 1.1253	Mar 1.1236	Apr 1.1157	May 1.1142	Jun 1.1073	Jul 1.1073	Aug 1.1060	Sep 1.1099	Oct 1.1142	Nov 1.1172	Dec 1.1203 (40)
HLP (average)												1.1157 (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 3.1709 (42)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Average daily hot water use (litres/day)												109.5077 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	120.4585	116.0782	111.6979	107.3176	102.9373	98.5570	98.5570	102.9373	107.3176	111.6979	116.0782	120.4585 (44)
Energy content (annual)	178.6365	156.2366	161.2222	140.5574	134.8682	116.3810	107.8441	123.7527	125.2307	145.9443	159.3096	172.9999 (45)
Distribution loss (46)m = 0.15 x (45)m												1722.9831 (45)
Water storage loss:	26.7955	23.4355	24.1833	21.0836	20.2302	17.4571	16.1766	18.5629	18.7846	21.8916	23.8964	25.9500 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (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	237.2653	209.1917	219.8510	197.2950	193.4970	173.1185	166.4729	182.3815	181.9682	204.5731	216.0472	231.6287 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	237.2653	209.1917	219.8510	197.2950	193.4970	173.1185	166.4729	182.3815	181.9682	204.5731	216.0472	231.6287 (64)
Heat gains from water heating, kWh/month	106.2997	94.3127	100.5094	92.1254	91.7467	84.0867	82.7612	88.0508	87.0292	95.4295	98.3605	104.4255 (65)
Total per year (kWh/year) = Sum(64)m =												2413.2901 (64)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426	158.5426 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0794	40.9273	33.2843	25.1984	18.8361	15.9022	17.1829	22.3350	29.9780	38.0639	44.4262	47.3601 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	482.0811	487.0836	474.4774	447.6405	413.7637	381.9242	360.6536	355.6511	368.2572	395.0941	428.9709	460.8104 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543	38.8543 (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)	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341	-126.8341 (71)
Water heating gains (Table 5)	142.8759	140.3463	135.0933	127.9519	123.3155	116.7871	111.2382	118.3479	120.8740	128.2655	136.6118	140.3569 (72)
Total internal gains	744.5992	741.9200	716.4179	674.3536	629.4780	588.1764	562.6374	569.8967	592.6719	634.9863	683.5718	722.0901 (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			12.5400		10.6334		0.6300		0.7000		0.7700		40.7513 (74)
South			25.3000		46.7521		0.6300		0.7000		0.7700		361.4874 (78)
West			3.3600		19.6403		0.6300		0.7000		0.7700		20.1678 (80)
North			0.6500		16.7973		0.6300		0.7000		1.0000		4.3335 (82)
Horizontal			3.6000		26.0000		0.6300		0.7000		1.0000		37.1498 (82)
Solar gains	463.8897	794.8137	1103.8697	1401.8075	1606.0199	1611.4672	1546.4319	1390.6257	1206.0608	882.4611	556.3794	396.5631	(83)
Total gains	1208.4889	1536.7337	1820.2876	2076.1611	2235.4979	2199.6435	2109.0694	1960.5224	1798.7327	1517.4475	1239.9511	1118.6533	(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	61.6197	61.7138	61.8064	62.2448	62.3275	62.7155	62.7155	62.7879	62.5655	62.3275	62.1604	61.9867
alpha	5.1080	5.1143	5.1204	5.1497	5.1552	5.1810	5.1810	5.1859	5.1710	5.1552	5.1440	5.1324
util living area	0.9998	0.9993	0.9974	0.9894	0.9582	0.8627	0.7076	0.7670	0.9434	0.9948	0.9995	0.9999 (86)
MIT	19.5704	19.7299	19.9818	20.3126	20.6342	20.8736	20.9670	20.9498	20.7620	20.3371	19.8877	19.5429 (87)
Th 2	19.9789	19.9803	19.9816	19.9881	19.9893	19.9949	19.9949	19.9959	19.9927	19.9893	19.9868	19.9843 (88)
util rest of house	0.9997	0.9990	0.9964	0.9846	0.9366	0.7890	0.5720	0.6392	0.9038	0.9918	0.9993	0.9998 (89)
MIT 2	18.0439	18.2784	18.6477	19.1334	19.5892	19.8959	19.9806	19.9711	19.7692	19.1724	18.5142	18.0075 (90)
Living area fraction									fLA = Living area / (4) =			0.0549 (91)
MIT	18.1278	18.3582	18.7210	19.1982	19.6466	19.9496	20.0348	20.0249	19.8237	19.2364	18.5897	18.0918 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1278	18.3582	18.7210	19.1982	19.6466	19.9496	20.0348	20.0249	19.8237	19.2364	18.5897	18.0918 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9995	0.9983	0.9944	0.9791	0.9268	0.7849	0.5779	0.6434	0.8947	0.9883	0.9987	0.9997 (94)
Useful gains	1207.9217	1534.1727	1810.0332	2032.8023	2071.8542	1726.6013	1218.9315	1261.4947	1609.4061	1499.6379	1238.3697	1118.3024 (95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	5141.6787	4996.6273	4530.5097	3790.7835	2921.2860	1954.4404	1254.8823	1322.7945	2096.1204	3174.8690	4235.1376	5134.9260 (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	2926.7152	2326.7695	2024.0346	1265.7465	631.9772	0.0000	0.0000	0.0000	0.0000	1246.3719	2157.6729	2988.3680 (98)
Space heating												15567.6556 (98)
Space heating per m2											(98) / (4) =	47.1833 (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												16649.8991 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2926.7152	2326.7695	2024.0346	1265.7465	631.9772	0.0000	0.0000	0.0000	0.0000	1246.3719	2157.6729	2988.3680 (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)	3130.1767	2488.5235	2164.7428	1353.7395	675.9114	0.0000	0.0000	0.0000	0.0000	1333.0181	2307.6715	3196.1155 (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	237.2653	209.1917	219.8510	197.2950	193.4970	173.1185	166.4729	182.3815	181.9682	204.5731	216.0472	231.6287 (64)
Efficiency of water heater	89.5991	89.5100	89.3265	88.8927	87.7422	79.8000	79.8000	79.8000	79.8000	88.8208	89.4089	79.8000 (216)
Fuel for water heating, kWh/month	264.8077	233.7077	246.1207	221.9474	220.5290	216.9405	208.6127	228.5482	228.0304	230.3211	241.6395	258.4120 (219)
Water heating fuel used												2799.6169 (219)
Annual totals kWh/year												
Space heating fuel - main system												16649.8991 (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)												813.7771 (232)
Total delivered energy for all uses												20338.2931 (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	16649.8991	0.2160	3596.3782 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2799.6169	0.2160	604.7173 (264)
Space and water heating			4201.0955 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	813.7771	0.5190	422.3503 (268)
Total CO2, kg/m2/year			4662.3708 (272)
Emissions per m2 for space and water heating			12.7329 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.2801 (272b)
Emissions per m2 for pumps and fans			0.1180 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.7329 * 1.00) + 1.2801 + 0.1180, rounded to 2 d.p.			14.1300 (273)