

Appendix B – Clean TER/DER worksheets

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000006_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.01_3B			
Property						
SAP Rating	83 B	DER	10.94	TER	19.32	
Environmental	92 A	% DER<TER	43.36			
CO ₂ Emissions (t/year)	0.57	DFEE	44.93	TFEE	49.65	
General Requirements Compliance	Pass	% DFEE<TFEE	9.50			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 58 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.32 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.94 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	(no roof)		
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: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system
Specific fan power: 0.42
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 4.50 m², Overhang twice as wide as window, ratio 2.38
Windows facing West: 4.50 m², Overhang twice as wide as window, ratio 1.57
Air change rate: 4.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Air permeability 3.0 m³/m²h
Community CHP, Mains gas

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	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							3.0000					
Infiltration rate							0.1500	(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) =	0.1275 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			9.0000	1.3258	11.9318		(27)					
Heat Loss Floor 1			58.4000	0.1600	9.3440		(28a)					
External Wall 1	65.4820	9.0000	56.4820	0.1600	9.0371		(29a)					
Total net area of external elements Aum(A, m2)			123.8820				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.3129		(33)					
Party Ceilings 1			58.4000				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4973 (36)					
Total fabric heat loss	(33) + (36) =						38.8102 (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	13.2886	13.1351	12.9815	12.2136	12.0601	11.2922	11.2922	11.1386	11.5993	12.0601	12.3672	12.6744 (38)
Heat transfer coeff	52.0989	51.9453	51.7917	51.0238	50.8703	50.1024	50.1024	49.9488	50.4095	50.8703	51.1774	51.4846 (39)
Average = Sum(39)m / 12 =												50.9854 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8921	0.8895	0.8868	0.8737	0.8711	0.8579	0.8579	0.8553	0.8632	0.8711	0.8763	0.8816 (40)
HLP (average)												0.8730 (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												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
Daily hot water use	Jan 88.1994	Feb 84.9921	Mar 81.7849	Apr 78.5776	May 75.3704	Jun 72.1631	Jul 72.1631	Aug 75.3704	Sep 78.5776	Oct 81.7849	Nov 84.9921	Dec 88.1994 (44)
Energy conte	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Energy content (annual)												Total = Sum(45)m = 1261.5634 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (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	186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (64)	
								Total per year (kWh/year) = Sum (64)m =					1912.4032 (64)
Heat gains from water heating, kWh/month													
	87.7115	77.9786	83.4719	77.0144	77.0559	71.1285	70.4767	74.3497	73.2830	79.7524	81.5798	86.3392 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.4336	13.7080	11.1481	8.4398	6.3089	5.3262	5.7552	7.4808	10.0407	12.7490	14.8799	15.8626 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803 (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)	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421 (71)
Water heating gains (Table 5)	117.8918	116.0396	112.1934	106.9645	103.5697	98.7896	94.7267	99.9324	101.7820	107.1941	113.3052	116.0474 (72)
Total internal gains	354.2606	352.4354	341.6128	324.2735	306.8792	289.9617	278.8757	284.0544	292.8803	310.4028	330.5135	345.3931 (73)

[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					4.5000	10.6334	0.5000	0.8000	0.7700	13.2641 (74)		
West					4.5000	19.6403	0.5000	0.8000	0.7700	24.4993 (80)		
Solar gains	37.7634	73.2741	122.0000	184.2966	234.2722	244.1859	230.6378	192.0025	143.5830	87.0419	46.9107	31.2046 (83)
Total gains	392.0240	425.7095	463.6128	508.5700	541.1514	534.1476	509.5135	476.0569	436.4634	397.4447	377.4242	376.5977 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.1374	31.2294	31.3220	31.7934	31.8894	32.3781	32.3781	32.4777	32.1809	31.8894	31.6980	31.5089
alpha	3.0758	3.0820	3.0881	3.1196	3.1260	3.1585	3.1585	3.1652	3.1454	3.1260	3.1132	3.1006
util living area	0.9508	0.9346	0.8998	0.8250	0.7045	0.5459	0.4147	0.4565	0.6670	0.8531	0.9295	0.9557 (86)
MIT	19.3293	19.5256	19.8763	20.3308	20.6890	20.9011	20.9689	20.9576	20.8073	20.3567	19.7815	19.2966 (87)
Th 2	20.1742	20.1765	20.1787	20.1899	20.1922	20.2034	20.2034	20.2057	20.1989	20.1922	20.1877	20.1832 (88)
util rest of house	0.9444	0.9262	0.8867	0.8022	0.6667	0.4905	0.3456	0.3859	0.6141	0.8290	0.9192	0.9499 (89)
MIT 2	17.9266	18.2100	18.7126	19.3570	19.8390	20.1099	20.1812	20.1738	20.0029	19.4061	18.5894	17.8853 (90)
Living area fraction										fLA = Living area / (4) =		0.5856 (91)
MIT	18.7481	18.9804	19.3941	19.9273	20.3368	20.5733	20.6425	20.6328	20.4740	19.9627	19.2875	18.7118 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7481	18.9804	19.3941	19.9273	20.3368	20.5733	20.6425	20.6328	20.4740	19.9627	19.2875	18.7118 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9307	0.9114	0.8722	0.7941	0.6739	0.5169	0.3842	0.4245	0.6331	0.8213	0.9054	0.9369 (94)
Useful gains	364.8663	388.0093	404.3540	403.8348	364.6552	276.0745	195.7690	202.1032	276.3253	326.4106	341.7025	352.8396 (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	752.7272	731.4118	667.8058	562.6542	439.3569	299.2746	202.5368	211.4234	321.3088	476.2855	623.7264	747.1314 (97)
Month fracti	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	288.5685	230.7664	196.0081	114.3499	55.5781	0.0000	0.0000	0.0000	0.0000	111.5070	203.0572	293.3531 (98)
Space heating												1493.1884 (98)
Space heating per m2												25.5683 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	1493.1884 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	388.2290 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1552.9160 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1912.4032 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	497.2248 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1988.8993 (310b)
Electricity used for heat distribution	44.2727 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	93.5130 (330a)
Total electricity for the above, kWh/year	93.5130 (331)
Electricity for lighting (calculated in Appendix L)	272.5626 (332)
Total delivered energy for all uses	4793.3447 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	932.0567	0.2160	201.3242 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	4137.7990	0.2160	893.7646 (363)
less credit emissions for electricity	-1532.2270	0.5190	-795.2258 (364)
Water heating from Combined Heat and Power	5299.4920	0.2160	1144.6903 (365)
less credit emissions for electricity	-1962.4019	0.5190	-1018.4866 (366)
Electrical energy for heat distribution	44.2727	0.5190	22.9775 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			449.0442 (373)
Space and water heating			449.0442 (376)
Pumps and fans	93.5130	0.5190	48.5332 (378)
Energy for lighting	272.5626	0.5190	141.4600 (379)
Total CO2, kg/year			639.0375 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			10.9400 (384)

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

DER		10.9400 ZC1
Total Floor Area	TFA	58.4000
Assumed number of occupants	N	1.9361
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.1375 ZC2
CO2 emissions from cooking, equation (L16)		2.8333 ZC3
Total CO2 emissions		30.9109 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		30.9109 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	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1370 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3870 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3289 (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												
	0.4194	0.4112	0.4029	0.3618	0.3536	0.3125	0.3125	0.3043	0.3289	0.3536	0.3701	0.3865 (22b)
Effective ac	0.5879	0.5845	0.5812	0.5655	0.5625	0.5488	0.5488	0.5463	0.5541	0.5625	0.5685	0.5747 (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 Opening Type (Uw = 1.40)			9.0000	1.3258	11.9318		(27)
Heat Loss Floor 1			58.4000	0.1300	7.5920		(28a)
External Wall 1	65.4820	9.0000	56.4820	0.1800	10.1668		(29a)
Total net area of external elements Aum(A, m ²)			123.8820				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.6906		(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)	4.3032 (36)
Total fabric heat loss	(33) + (36) = 33.9938 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.3273	28.1627	28.0015	27.2439	27.1022	26.4424	26.4424	26.3202	26.6965	27.1022	27.3889	27.6887 (38)
Heat transfer coeff	62.3211	62.1565	61.9952	61.2377	61.0960	60.4362	60.4362	60.3140	60.6903	61.0960	61.3827	61.6824 (39)
Average = Sum(39)m / 12 =												61.2370 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0671	1.0643	1.0616	1.0486	1.0462	1.0349	1.0349	1.0328	1.0392	1.0462	1.0511	1.0562 (40)
HLP (average)												1.0486 (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												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.1994	84.9921	81.7849	78.5776	75.3704	72.1631	72.1631	75.3704	78.5776	81.7849	84.9921	88.1994 (44)
Energy content (annual)	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1261.5634 (45)
	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (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	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (64)
Heat gains from water heating, kWh/month	80.7660	71.7052	76.5264	70.2930	70.1103	64.4071	63.5312	67.4042	66.5616	72.8069	74.8583	79.3937 (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	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.8278	14.0581	11.4328	8.6554	6.4700	5.4622	5.9022	7.6718	10.2971	13.0746	15.2600	16.2677 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803 (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)	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421 (71)
Water heating gains (Table 5)	108.5564	106.7042	102.8580	97.6291	94.2343	89.4543	85.3914	90.5970	92.4466	97.8587	103.9698	106.7120 (72)
Total internal gains	348.3194	346.4502	335.5622	318.1536	300.7049	283.7623	272.6873	277.9100	286.8014	304.3931	324.5582	339.4628 (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				4.5000	10.6334	0.6300		0.7000		0.7700	14.6237 (74)	
West				4.5000	19.6403	0.6300		0.7000		0.7700	27.0104 (80)	

Solar gains	41.6341	80.7847	134.5050	203.1870	258.2851	269.2150	254.2782	211.6828	158.3003	95.9637	51.7190	34.4031 (83)
Total gains	389.9535	427.2349	470.0671	521.3406	558.9900	552.9773	526.9655	489.5928	445.1017	400.3567	376.2772	373.8659 (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	65.0752	65.2475	65.4172	66.2264	66.3801	67.1048	67.1048	67.2407	66.8238	66.3801	66.0700	65.7489
alpha	5.3383	5.3498	5.3611	5.4151	5.4253	5.4737	5.4737	5.4827	5.4549	5.4253	5.4047	5.3833
util living area	0.9967	0.9939	0.9850	0.9507	0.8512	0.6665	0.4986	0.5555	0.8182	0.9682	0.9933	0.9974 (86)
MIT	19.9353	20.0589	20.2875	20.5980	20.8486	20.9700	20.9948	20.9910	20.9104	20.5938	20.2148	19.9146 (87)
Th 2	20.0278	20.0301	20.0323	20.0430	20.0450	20.0544	20.0544	20.0561	20.0508	20.0450	20.0410	20.0368 (88)
util rest of house	0.9956	0.9919	0.9798	0.9332	0.8030	0.5814	0.3947	0.4473	0.7453	0.9534	0.9906	0.9965 (89)
MIT 2	18.6122	18.7939	19.1265	19.5730	19.8987	20.0348	20.0525	20.0524	19.9801	19.5761	19.0298	18.5887 (90)
Living area fraction	19.3870	19.5347	19.8064	20.1733	20.4550	20.5825	20.6043	20.6021	20.5249	20.1721	19.7237	19.3652 (92)
MIT	19.3870	19.5347	19.8064	20.1733	20.4550	20.5825	20.6043	20.6021	20.5249	20.1721	19.7237	19.3652 (93)
Temperature adjustment												0.0000
adjusted MIT	19.3870	19.5347	19.8064	20.1733	20.4550	20.5825	20.6043	20.6021	20.5249	20.1721	19.7237	19.3652 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9946	0.9906	0.9783	0.9359	0.8252	0.6302	0.4557	0.5108	0.7842	0.9558	0.9895	0.9957 (94)
Ext temp.	387.8663	423.2265	459.8671	487.9240	461.2646	348.4954	240.1447	250.0893	349.0471	382.6439	372.3371	372.2507 (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	940.2369	909.6420	824.9349	690.3486	534.8924	361.5598	242.0060	253.4432	389.9287	584.8164	774.8784	935.4250 (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	410.9637	326.8713	271.6104	145.7457	54.7791	0.0000	0.0000	0.0000	0.0000	150.4163	289.8297	419.0017 (98)
Space heating per m2												2069.2179 (98)
										(98) / (4) =		35.4318 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2213.0673 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	410.9637	326.8713	271.6104	145.7457	54.7791	0.0000	0.0000	0.0000	0.0000	150.4163	289.8297	419.0017 (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)	439.5334	349.5949	290.4924	155.8778	58.5872	0.0000	0.0000	0.0000	0.0000	160.8731	309.9783	448.1302 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (64)
Efficiency of water heater (217)m	86.9835	86.7349	86.1409	84.7728	82.4690	79.8000	79.8000	79.8000	79.8000	84.7606	86.3529	79.8000 (216)
Fuel for water heating, kWh/month	203.9376	180.4138	191.1302	174.5932	176.2421	163.2903	157.3409	171.9377	171.4103	181.0451	187.2988	198.9629 (219)
Water heating fuel used												2157.6027 (219)
Annual totals kWh/year												
Space heating fuel - main system												2213.0673 (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)												279.5239 (232)
Total delivered energy for all uses												4725.1939 (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	2213.0673	0.2160	478.0225 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2157.6027	0.2160	466.0422 (264)
Space and water heating			944.0647 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	279.5239	0.5190	145.0729 (268)
Total CO2, kg/m2/year			1128.0626 (272)
Emissions per m2 for space and water heating			16.1655 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4841 (272b)
Emissions per m2 for pumps and fans			0.6665 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1655 * 1.00) + 2.4841 + 0.6665, rounded to 2 d.p.			19.3200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000050_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.01_3B		
Property					
SAP Rating	81 B	DER	13.06	TER	23.02
Environmental	91 B	% DER<TER	43.27		
CO ₂ Emissions (t/year)	0.67	DFEE	58.01	TFEE	66.13
General Requirements Compliance	Pass	% DFEE<TFEE	12.28		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 58 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 (c)

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 23.02 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.06 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)66.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)58.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (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:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based on:		
Overshading:	Average	
Windows facing South:	4.50 m ² , No overhang	
Air change rate:	4.00 ach	
Blinds/curtains:	Light-coloured curtain or roller blind, closed 100% of daylight hours	

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			4.5000	1.3258	5.9659		(27)					
Heat Loss Floor 1			58.4000	0.1600	9.3440		(28a)					
External Wall 1	65.4820	4.5000	60.9820	0.1600	9.7571		(29a)					
External Roof 1	58.4000		58.4000	0.1600	9.3440		(30)					
Total net area of external elements Aum(A, m2)			182.2820				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4110		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.9026 (36)					
Total fabric heat loss							(33) + (36) = 52.3136 (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	12.5976	12.4575	12.3175	11.6174	11.4774	10.7773	10.7773	10.6372	11.0573	11.4774	11.7574	12.0375 (38)
Heat transfer coeff	64.9111	64.7711	64.6311	63.9310	63.7910	63.0908	63.0908	62.9508	63.3709	63.7910	64.0710	64.3511 (39)
Average = Sum(39)m / 12 =												63.8960 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1115	1.1091	1.1067	1.0947	1.0923	1.0803	1.0803	1.0779	1.0851	1.0923	1.0971	1.1019 (40)
HLP (average)												1.0941 (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												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
Daily hot water use	88.1994	84.9921	81.7849	78.5776	75.3704	72.1631	72.1631	75.3704	78.5776	81.7849	84.9921	88.1994 (44)
Energy conte	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Energy content (annual)												Total = Sum(45)m = 1261.5634 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)
Water storage loss:												
Store volume												110.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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												
Solar input	186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (62)
	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												
	186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (64)
Total per year (kWh/year) = Sum(64)m =												1912.4032 (64)
Heat gains from water heating, kWh/month												
	87.7115	77.9786	83.4719	77.0144	77.0559	71.1285	70.4767	74.3497	73.2830	79.7524	81.5798	86.3392 (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	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	17.8436	15.8486	12.8889	9.7577	7.2940	6.1579	6.6539	8.6489	11.6086	14.7398	17.2035	18.3396 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803 (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)												
	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421 (71)
Water heating gains (Table 5)												
	117.8918	116.0396	112.1934	106.9645	103.5697	98.7896	94.7267	99.9324	101.7820	107.1941	113.3052	116.0474 (72)
Total internal gains	356.6706	354.5760	343.3536	325.5914	307.8643	290.7934	279.7743	285.2225	294.4482	312.3936	332.8371	347.8701 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W

South					4.5000	46.7521	0.3000	0.8000			0.7700			34.9911 (78)

Solar gains	34.9911	57.3064	72.9982	82.5038	85.9741	82.7384	80.8404	78.5073	76.2553	61.8104	41.4764	30.2355 (83)		
Total gains	391.6618	411.8824	416.3519	408.0952	393.8384	373.5318	360.6148	363.7298	370.7035	374.2040	374.3135	378.1056 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.9914	25.0455	25.0997	25.3746	25.4303	25.7125	25.7125	25.7697	25.5989	25.4303	25.3191	25.2089
alpha	2.6661	2.6697	2.6733	2.6916	2.6954	2.7142	2.7142	2.7180	2.7066	2.6954	2.6879	2.6806
util living area	0.9566	0.9476	0.9331	0.9067	0.8571	0.7585	0.6296	0.6433	0.7873	0.8941	0.9412	0.9603 (86)
MIT	18.8007	18.9751	19.2960	19.7414	20.2019	20.6224	20.8416	20.8256	20.5450	19.9735	19.3225	18.7662 (87)
Th 2	19.9915	19.9934	19.9954	20.0052	20.0071	20.0169	20.0169	20.0189	20.0130	20.0071	20.0032	19.9993 (88)
util rest of house	0.9504	0.9399	0.9225	0.8900	0.8267	0.6975	0.5280	0.5467	0.7341	0.8723	0.9313	0.9545 (89)
MIT 2	17.0563	17.3096	17.7749	18.4210	19.0730	19.6440	19.9013	19.8859	19.5429	18.7559	17.8208	17.0111 (90)
Living area fraction									fLA = Living area / (4) =			0.6096 (91)
MIT	18.1196	18.3249	18.7021	19.2259	19.7611	20.2405	20.4745	20.4587	20.1537	19.4981	18.7362	18.0810 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1196	18.3249	18.7021	19.2259	19.7611	20.2405	20.4745	20.4587	20.1537	19.4981	18.7362	18.0810 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9350	0.9235	0.9054	0.8740	0.8180	0.7128	0.5784	0.5930	0.7426	0.8589	0.9152	0.9399 (94)
Useful gains	366.2224	380.3625	376.9487	356.6921	322.1585	266.2600	208.5697	215.6786	275.2845	321.4021	342.5661	355.3817 (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	897.0489	869.5451	788.6362	660.1451	514.2282	355.8610	244.4439	255.5005	383.6309	567.6188	745.5461	893.2560 (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	394.9350	328.7307	306.2955	218.4862	142.8998	0.0000	0.0000	0.0000	0.0000	183.1852	290.1456	400.1785 (98)
Space heating												2264.8564 (98)
Space heating per m ²										(98) / (4) =		38.7818 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	2264.8564	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	588.8627	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	2355.4507	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1912.4032	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	497.2248	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1988.8993	(310b)
Electricity used for heat distribution	54.3044	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	93.5130	(330a)
Total electricity for the above, kWh/year	93.5130	(331)
Electricity for lighting (calculated in Appendix L)	315.1243	(332)
Total delivered energy for all uses	5839.0748	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1143.2500	0.2160	246.9420 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	6276.1809	0.2160	1355.6551 (363)
less credit emissions for electricity	-2324.0698	0.5190	-1206.1922 (364)
Water heating from Combined Heat and Power	5299.4920	0.2160	1144.6903 (365)
less credit emissions for electricity	-1962.4019	0.5190	-1018.4866 (366)
Electrical energy for heat distribution	54.3044	0.5190	28.1840 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			550.7925 (373)
Space and water heating			550.7925 (376)
Pumps and fans	93.5130	0.5190	48.5332 (378)
Energy for lighting	315.1243	0.5190	163.5495 (379)
Total CO2, kg/year			762.8753 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0600 (384)

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

DER		13.0600	ZC1
Total Floor Area	TFA	58.4000	
Assumed number of occupants	N	1.9361	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1375	ZC2
CO2 emissions from cooking, equation (L16)		2.8333	ZC3
Total CO2 emissions		33.0309	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		33.0309	ZC8

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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	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.1370 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3870 (18)
Number of sides sheltered					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2999 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3824	0.3749	0.3674	0.3299	0.3224	0.2849	0.2849	0.2774	0.2999	0.3224	0.3374	0.3524 (22b)
	0.5731	0.5703	0.5675	0.5544	0.5520	0.5406	0.5406	0.5385	0.5450	0.5520	0.5569	0.5621 (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 Opening Type (Uw = 1.40)			4.5000	1.3258	5.9659		(27)
Heat Loss Floor 1			58.4000	0.1300	7.5920		(28a)
External Wall 1	65.4820	4.5000	60.9820	0.1800	10.9768		(29a)
External Roof 1	58.4000		58.4000	0.1300	7.5920		(30)
Total net area of external elements Aum(A, m ²)			182.2820				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.1267		(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)							16.7586 (36)
Total fabric heat loss						(33) + (36) =	48.8852 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	27.6125	27.4757	27.3416	26.7119	26.5941	26.0456	26.0456
Heat transfer coeff	76.4978	76.3610	76.2269	75.5971	75.4793	74.9308	74.9308
Average = Sum(39)m / 12 =							
HLP	1.3099	1.3076	1.3053	1.2945	1.2925	1.2831	1.2831
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
Daily hot water use	88.1994	84.9921	81.7849	78.5776	75.3704	72.1631	72.1631	75.3704	78.5776	81.7849	84.9921	88.1994 (44)
Energy conte	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Energy content (annual)												Total = Sum(45)m = 1261.5634 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												

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If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (64)
	80.7660	71.7052	76.5264	70.2930	70.1103	64.4071	63.5312	67.4042	66.5616	72.8069	74.8583	79.3937 (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	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3011	16.2549	13.2194	10.0079	7.4810	6.3158	6.8245	8.8707	11.9062	15.1177	17.6446	18.8098	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	(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)	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	(71)
Water heating gains (Table 5)	108.5564	106.7042	102.8580	97.6291	94.2343	89.4543	85.3914	90.5970	92.4466	97.8587	103.9698	106.7120	(72)
Total internal gains	350.7928	348.6470	337.3487	319.5062	301.7160	284.6159	273.6096	279.1089	288.4105	306.4362	326.9428	342.0049	(73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF		Access		Gains			
				m2	Table 6a	Specific data		Specific data		factor		W			
					W/m2	or Table 6b		or Table 6c		Table 6d					
South				4.5000	46.7521	0.6300		0.7000		0.7700		64.2962 (78)			
Solar gains				64.2962	105.3006	134.1342	151.6008	157.9774	152.0318	148.5443	144.2571	140.1191	113.5765	76.2129	55.5578 (83)
Total gains				415.0889	453.9475	471.4830	471.1070	459.6934	436.6477	422.1539	423.3660	428.5295	420.0127	403.1557	397.5627 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.0154	53.1103	53.2037	53.6469	53.7307	54.1240	54.1240	54.1975	53.9718	53.7307	53.5615	53.3858	
alpha	4.5344	4.5407	4.5469	4.5765	4.5820	4.6083	4.6083	4.6132	4.5981	4.5820	4.5708	4.5591	
util living area	0.9959	0.9931	0.9880	0.9761	0.9452	0.8579	0.7080	0.7279	0.8899	0.9727	0.9923	0.9966	(86)
MIT	19.6497	19.7829	19.9999	20.2873	20.5808	20.8352	20.9516	20.9434	20.7848	20.4099	19.9781	19.6226	(87)
Th 2	19.8331	19.8349	19.8367	19.8452	19.8467	19.8541	19.8541	19.8555	19.8513	19.8467	19.8435	19.8402	(88)
util rest of house	0.9945	0.9908	0.9835	0.9658	0.9171	0.7767	0.5572	0.5847	0.8248	0.9587	0.9891	0.9955	(89)
MIT 2	18.0583	18.2535	18.5702	18.9905	19.4029	19.7287	19.8343	19.8301	19.6704	19.1689	18.5448	18.0238	(90)
Living area fraction	19.0284	19.1858	19.4417	19.7810	20.1209	20.4032	20.5154	20.5087	20.3497	19.9254	19.4185	18.9984	(91)
MIT	19.0284	19.1858	19.4417	19.7810	20.1209	20.4032	20.5154	20.5087	20.3497	19.9254	19.4185	18.9984	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0284	19.1858	19.4417	19.7810	20.1209	20.4032	20.5154	20.5087	20.3497	19.9254	19.4185	18.9984	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9931	0.9890	0.9815	0.9651	0.9250	0.8200	0.6494	0.6717	0.8568	0.9599	0.9876	0.9943	(94)
Useful gains	412.2450	448.9615	462.7615	454.6659	425.2173	358.0435	274.1559	284.3813	367.1636	403.1680	398.1591	395.3079	(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	1126.6872	1090.8747	986.5078	822.5712	635.6063	434.8394	293.3854	307.4538	469.6177	703.8756	932.7271	1124.1885	(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	531.5450	431.3657	389.6673	264.8918	156.5294	0.0000	0.0000	0.0000	0.0000	223.7265	384.8890	542.2872	(98)
Space heating												2924.9017	(98)
Space heating per m2												50.0839	(99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3128.2372 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	531.5450	431.3657	389.6673	264.8918	156.5294	0.0000	0.0000	0.0000	0.0000	223.7265	384.8890	542.2872	(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)	568.4974	461.3536	416.7564	283.3068	167.4111	0.0000	0.0000	0.0000	0.0000	239.2796	411.6459	579.9863	(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	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649	(64)
Efficiency of water heater (217)m	87.5622	87.3811	87.0338	86.3497	85.0118	79.8000	79.8000	79.8000	79.8000	85.8184	87.0465	79.8000	(216)
Fuel for water heating, kWh/month	202.5898	179.0796	189.1695	171.4049	170.9705	163.2903	157.3409	171.9377	171.4103	178.8135	185.8062	197.6690	(219)
Water heating fuel used												2139.4820	(219)
Annual totals kWh/year													
Space heating fuel - main system												3128.2372	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												323.2038	(232)
Total delivered energy for all uses												5665.9230	(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	3128.2372	0.2160	675.6992 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2139.4820	0.2160	462.1281 (264)
Space and water heating			1137.8273 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	323.2038	0.5190	167.7428 (268)
Total CO2, kg/m2/year			1344.4951 (272)
Emissions per m2 for space and water heating			19.4833 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.8723 (272b)
Emissions per m2 for pumps and fans			0.6665 (272c)
Target Carbon Dioxide Emission Rate (TER) = (19.4833 * 1.00) + 2.8723 + 0.6665, rounded to 2 d.p.			23.0200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000078_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.02_2B		
Property					
SAP Rating	82 B	DER	11.81	TER	21.52
Environmental	92 A	% DER<TER	45.12		
CO ₂ Emissions (t/year)	0.61	DFEE	51.47	TFEE	60.93
General Requirements Compliance	Pass	% DFEE<TFEE	15.52		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 58 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 21.52 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.81 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 51.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor (no floor)			
Roof	0.16 (max. 0.20)	0.16 (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:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK

Based on:

Overshading: Average

Windows facing North: 4.50 m², No overhang

Windows facing West: 4.50 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Air permeability	3.0 m ³ /m ² h

Community CHP, Mains gas

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	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour	
					heating		heating					
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =		0.0000 (8)
Pressure test										Yes		
Measured/design AP50										3.0000		
Infiltration rate										0.1500		(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) =		0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			9.0000	1.3258	11.9318		(27)					
External Wall 1	65.4820	9.0000	56.4820	0.1600	9.0371		(29a)					
External Roof 1	58.4000		58.4000	0.1600	9.3440		(30)					
Total net area of external elements Aum(A, m2)			123.8820				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.3129		(33)					
Party Floor 1			58.4000				(32d)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.9370 (36)					
Total fabric heat loss	(33) + (36) =						46.2499 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 13.2886	Feb 13.1351	Mar 12.9815	Apr 12.2136	May 12.0601	Jun 11.2922	Jul 11.2922	Aug 11.1386	Sep 11.5993	Oct 12.0601	Nov 12.3672	Dec 12.6744 (38)
Heat transfer coeff	59.5386	59.3850	59.2314	58.4635	58.3100	57.5421	57.5421	57.3885	57.8493	58.3100	58.6171	58.9243 (39)
Average = Sum(39)m / 12 =	58.4252 (39)											
HLP	Jan 1.0195	Feb 1.0169	Mar 1.0142	Apr 1.0011	May 0.9985	Jun 0.9853	Jul 0.9853	Aug 0.9827	Sep 0.9906	Oct 0.9985	Nov 1.0037	Dec 1.0090 (40)
HLP (average)	1.0004 (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												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
Daily hot water use	Jan 88.1994	Feb 84.9921	Mar 81.7849	Apr 78.5776	May 75.3704	Jun 72.1631	Jul 72.1631	Aug 75.3704	Sep 78.5776	Oct 81.7849	Nov 84.9921	Dec 88.1994 (44)
Energy conte	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Energy content (annual)												Total = Sum(45)m = 1261.5634 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)
Water storage loss:												
Store volume												110.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
Solar input	186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (62)	
	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	186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (64)	
								Total per year (kWh/year) = Sum(64)m =					1912.4032 (64)
Heat gains from water heating, kWh/month													
	87.7115	77.9786	83.4719	77.0144	77.0559	71.1285	70.4767	74.3497	73.2830	79.7524	81.5798	86.3392 (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	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.4336	13.7080	11.1481	8.4398	6.3089	5.3262	5.7552	7.4808	10.0407	12.7490	14.8799	15.8626 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803 (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)	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421 (71)
Water heating gains (Table 5)	117.8918	116.0396	112.1934	106.9645	103.5697	98.7896	94.7267	99.9324	101.7820	107.1941	113.3052	116.0474 (72)
Total internal gains	354.2606	352.4354	341.6128	324.2735	306.8792	289.9617	278.8757	284.0544	292.8803	310.4028	330.5135	345.3931 (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					4.5000	10.6334	0.5000	0.8000	0.7700		13.2641 (74)	
West					4.5000	19.6403	0.5000	0.8000	0.7700		24.4993 (80)	

Solar gains	37.7634	73.2741	122.0000	184.2966	234.2722	244.1859	230.6378	192.0025	143.5830	87.0419	46.9107	31.2046 (83)
Total gains	392.0240	425.7095	463.6128	508.5700	541.1514	534.1476	509.5135	476.0569	436.4634	397.4447	377.4242	376.5977 (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	27.2466	27.3170	27.3879	27.7476	27.8207	28.1919	28.1919	28.2674	28.0422	27.8207	27.6749	27.5306
alpha	2.8164	2.8211	2.8259	2.8498	2.8547	2.8795	2.8795	2.8845	2.8695	2.8547	2.8450	2.8354
util living area	0.9547	0.9407	0.9110	0.8474	0.7414	0.5934	0.4612	0.5044	0.7076	0.8717	0.9366	0.9590 (86)
MIT	19.0133	19.2180	19.5987	20.1083	20.5444	20.8335	20.9409	20.9224	20.7075	20.1606	19.5135	18.9776 (87)
Th 2	20.0671	20.0693	20.0715	20.0824	20.0846	20.0956	20.0956	20.0978	20.0912	20.0846	20.0802	20.0759 (88)
util rest of house												
	0.9484	0.9325	0.8982	0.8248	0.7019	0.5306	0.3779	0.4207	0.6511	0.8479	0.9265	0.9533 (89)
MIT 2	17.4064	17.7025	18.2499	18.9756	19.5688	19.9397	20.0547	20.0409	19.7953	19.0629	18.1394	17.3602 (90)
Living area fraction												
MIT	18.3475	18.5900	19.0398	19.6389	20.1401	20.4631	20.5737	20.5572	20.3295	19.7057	18.9441	18.3074 (92)
Temperature adjustment												
adjusted MIT	18.3475	18.5900	19.0398	19.6389	20.1401	20.4631	20.5737	20.5572	20.3295	19.7057	18.9441	18.3074 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9334	0.9161	0.8812	0.8124	0.7045	0.5571	0.4230	0.4646	0.6670	0.8364	0.9109	0.9391 (94)
Useful gains	365.9279	390.0070	408.5433	413.1810	381.2274	297.5817	215.5202	221.1601	291.1096	332.4398	343.7797	353.6780 (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												
	836.3650	812.9820	742.7499	627.8356	492.1449	337.3753	228.6534	238.5730	360.3723	530.9532	694.2679	831.2692 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	350.0052	284.2392	248.6497	154.5514	82.5226	0.0000	0.0000	0.0000	0.0000	147.6940	252.3515	355.3279 (98)
Space heating												1875.3415 (98)
Space heating per m2												32.1120 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1875.3415	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	487.5888	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1950.3552	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1912.4032	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	497.2248	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1988.8993	(310b)
Electricity used for heat distribution	49.2407	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	93.5130	(330a)
Total electricity for the above, kWh/year	93.5130	(331)
Electricity for lighting (calculated in Appendix L)	272.5626	(332)
Total delivered energy for all uses	5290.1437	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1036.6459	0.2160	223.9155 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	5196.7898	0.2160	1122.5066 (363)
less credit emissions for electricity	-1924.3713	0.5190	-998.7487 (364)
Water heating from Combined Heat and Power	5299.4920	0.2160	1144.6903 (365)
less credit emissions for electricity	-1962.4019	0.5190	-1018.4866 (366)
Electrical energy for heat distribution	49.2407	0.5190	25.5559 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			499.4330 (373)
Space and water heating			499.4330 (376)
Pumps and fans	93.5130	0.5190	48.5332 (378)
Energy for lighting	272.5626	0.5190	141.4600 (379)
Total CO2, kg/year			689.4263 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			11.8100 (384)

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

DER		11.8100	ZC1
Total Floor Area	TFA	58.4000	
Assumed number of occupants	N	1.9361	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1375	ZC2
CO2 emissions from cooking, equation (L16)		2.8333	ZC3
Total CO2 emissions		31.7809	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		31.7809	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	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1370 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3870 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3289 (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												
	0.4194	0.4112	0.4029	0.3618	0.3536	0.3125	0.3125	0.3043	0.3289	0.3536	0.3701	0.3865 (22b)
Effective ac	0.5879	0.5845	0.5812	0.5655	0.5625	0.5488	0.5488	0.5463	0.5541	0.5625	0.5685	0.5747 (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 Opening Type (Uw = 1.40)			9.0000	1.3258	11.9318		(27)
External Wall 1	65.4820	9.0000	56.4820	0.1800	10.1668		(29a)
External Roof 1	58.4000		58.4000	0.1300	7.5920		(30)
Total net area of external elements Aum(A, m ²)			123.8820				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.6906		(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)							13.8264 (36)
Total fabric heat loss						(33) + (36) =	43.5169 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.3273	28.1627	28.0015	27.2439	27.1022	26.4424	26.4424	26.3202	26.6965	27.1022	27.3889	27.6887 (38)
Heat transfer coeff	71.8442	71.6797	71.5184	70.7609	70.6191	69.9594	69.9594	69.8372	70.2135	70.6191	70.9059	71.2056 (39)
Average = Sum(39)m / 12 =												70.7602 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2302	1.2274	1.2246	1.2117	1.2092	1.1979	1.1979	1.1958	1.2023	1.2092	1.2141	1.2193 (40)
HLP (average)												1.2116 (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												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
Daily hot water use	88.1994	84.9921	81.7849	78.5776	75.3704	72.1631	72.1631	75.3704	78.5776	81.7849	84.9921	88.1994 (44)
Energy conte	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Energy content (annual)										Total = Sum(45)m =		1261.5634 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (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	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (64)
Heat gains from water heating, kWh/month	80.7660	71.7052	76.5264	70.2930	70.1103	64.4071	63.5312	67.4042	66.5616	72.8069	74.8583	79.3937 (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	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.8278	14.0581	11.4328	8.6554	6.4700	5.4622	5.9022	7.6718	10.2971	13.0746	15.2600	16.2677 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803 (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)	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421 (71)
Water heating gains (Table 5)	108.5564	106.7042	102.8580	97.6291	94.2343	89.4543	85.3914	90.5970	92.4466	97.8587	103.9698	106.7120 (72)
Total internal gains	348.3194	346.4502	335.5622	318.1536	300.7049	283.7623	272.6873	277.9100	286.8014	304.3931	324.5582	339.4628 (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				4.5000	10.6334	0.6300		0.7000	0.7700		14.6237 (74)	
West				4.5000	19.6403	0.6300		0.7000	0.7700		27.0104 (80)	

Solar gains	41.6341	80.7847	134.5050	203.1870	258.2851	269.2150	254.2782	211.6828	158.3003	95.9637	51.7190	34.4031 (83)
Total gains	389.9535	427.2349	470.0671	521.3406	558.9900	552.9773	526.9655	489.5928	445.1017	400.3567	376.2772	373.8659 (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	56.4493	56.5789	56.7065	57.3135	57.4286	57.9702	57.9702	58.0716	57.7603	57.4286	57.1963	56.9556
alpha	4.7633	4.7719	4.7804	4.8209	4.8286	4.8647	4.8647	4.8714	4.8507	4.8286	4.8131	4.7970
util living area	0.9968	0.9945	0.9874	0.9621	0.8878	0.7320	0.5656	0.6245	0.8622	0.9750	0.9940	0.9974 (86)
MIT	19.7144	19.8437	20.0911	20.4361	20.7447	20.9315	20.9844	20.9753	20.8396	20.4525	20.0278	19.6924 (87)
Th 2	19.8959	19.8981	19.9003	19.9107	19.9126	19.9217	19.9217	19.9233	19.9182	19.9126	19.9087	19.9046 (88)
util rest of house	0.9957	0.9926	0.9828	0.9472	0.8433	0.6377	0.4363	0.4937	0.7917	0.9623	0.9915	0.9965 (89)
MIT 2	18.1962	18.3861	18.7469	19.2461	19.6597	19.8757	19.9160	19.9131	19.7872	19.2779	18.6628	18.1701 (90)
Living area fraction	19.0853	19.2397	19.5341	19.9430	20.2950	20.4940	20.5417	20.5352	20.4035	19.9658	19.4622	19.0616 (92)
MIT	19.0853	19.2397	19.5341	19.9430	20.2950	20.4940	20.5417	20.5352	20.4035	19.9658	19.4622	19.0616 (93)
Temperature adjustment												0.0000
adjusted MIT	19.0853	19.2397	19.5341	19.9430	20.2950	20.4940	20.5417	20.5352	20.4035	19.9658	19.4622	19.0616 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	387.8610	423.4269	461.0642	494.0954	481.1054	381.7040	269.9962	279.3090	367.9771	385.5688	372.5837	372.2183 (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	1062.2367	1027.8655	932.1758	781.4107	606.9750	412.3392	275.7559	288.7876	442.5904	661.4037	876.5529	1058.2292 (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	501.7355	406.1827	350.5070	206.8670	93.6470	0.0000	0.0000	0.0000	0.0000	205.2212	362.8578	510.3921 (98)
Space heating												2637.4104 (98)
Space heating per m2												45.1611 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2820.7597 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	501.7355	406.1827	350.5070	206.8670	93.6470	0.0000	0.0000	0.0000	0.0000	205.2212	362.8578	510.3921	(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)	536.6155	434.4200	374.8738	221.2481	100.1572	0.0000	0.0000	0.0000	0.0000	219.4879	388.0832	545.8739	(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	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649	(64)
Efficiency of water heater (217)m	87.4376	87.2466	86.7811	85.7070	83.6766	79.8000	79.8000	79.8000	79.8000	85.5900	86.9073	79.8000	(216)
Fuel for water heating, kWh/month	202.8784	179.3558	189.7202	172.6902	173.6985	163.2903	157.3409	171.9377	171.4103	179.2907	186.1040	197.9590	(219)
Water heating fuel used												2145.6760	(219)
Annual totals kWh/year													
Space heating fuel - main system												2820.7597	(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)												279.5239	(232)
Total delivered energy for all uses												5320.9597	(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	2820.7597	0.2160	609.2841 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2145.6760	0.2160	463.4660 (264)
Space and water heating			1072.7501 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	279.5239	0.5190	145.0729 (268)
Total CO2, kg/m2/year			1256.7480 (272)
Emissions per m2 for space and water heating			18.3690 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4841 (272b)
Emissions per m2 for pumps and fans			0.6665 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.3690 * 1.00) + 2.4841 + 0.6665, rounded to 2 d.p.			21.5200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000122_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.02_2B		
Property					
SAP Rating	84 B	DER	9.91	TER	16.29
Environmental	93 A	% DER<TER	39.17		
CO ₂ Emissions (t/year)	0.52	DFEE	34.38	TFEE	31.57
General Requirements Compliance	Fail	% DFEE<TFEE	-8.91		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 58 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.29 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.91 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)31.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)34.4 kWh/m²/yrFail
Excess energy =2.8 kWh/m²/yr (8.9%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system
Specific fan power: 0.42
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing West: 4.50 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Air permeability 3.0 m³/m²h
Community CHP, Mains gas

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	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.40)			4.5000	1.3258	5.9659		(27)
Heat Loss Floor 1			20.2000	0.1600	3.2320		(28a)
External Wall 1	23.2290	4.5000	18.7290	0.1600	2.9966		(29a)
External Roof 1	20.2000		20.2000	0.1600	3.2320		(30)
Total net area of external elements Aum(A, m ²)			63.6290				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.4265		(33)
Party Floor 1			38.1000				(32d)
Party Ceilings 1			38.1000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							9.5444 (36)
Total fabric heat loss							(33) + (36) = 24.9709 (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	12.5976	12.4575	12.3175	11.6174	11.4774	10.7773	10.7773	10.6372	11.0573	11.4774	11.7574	12.0375 (38)
Heat transfer coeff	37.5685	37.4284	37.2884	36.5883	36.4483	35.7482	35.7482	35.6081	36.0282	36.4483	36.7283	37.0084 (39)
Average = Sum(39)m / 12 =												36.5533 (39)
HLP	0.6433	0.6409	0.6385	0.6265	0.6241	0.6121	0.6121	0.6097	0.6169	0.6241	0.6289	0.6337 (40)
HLP (average)												0.6259 (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												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.1994	84.9921	81.7849	78.5776	75.3704	72.1631	72.1631	75.3704	78.5776	81.7849	84.9921	88.1994 (44)
Energy content (annual)	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:											
Store volume											110.0000 (47)
b) If manufacturer declared loss factor is not known :											
Hot water storage loss factor from Table 2 (kWh/litre/day)											0.0152 (51)
Volume factor from Table 2a											1.0294 (52)
Temperature factor from Table 2b											0.6000 (53)
Enter (49) or (54) in (55)											1.0327 (55)
Total storage loss											
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage											
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
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											
186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (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											
186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (64)
Total per year (kWh/year) = Sum(64)m =											1912.4032 (64)
Heat gains from water heating, kWh/month											
87.7115	77.9786	83.4719	77.0144	77.0559	71.1285	70.4767	74.3497	73.2830	79.7524	81.5798	86.3392 (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	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
17.8436	15.8486	12.8889	9.7577	7.2940	6.1579	6.6539	8.6489	11.6086	14.7398	17.2035	18.3396 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803 (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)											
-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421 (71)
Water heating gains (Table 5)											
117.8918	116.0396	112.1934	106.9645	103.5697	98.7896	94.7267	99.9324	101.7820	107.1941	113.3052	116.0474 (72)
Total internal gains											
356.6706	354.5760	343.3536	325.5914	307.8643	290.7934	279.7743	285.2225	294.4482	312.3936	332.8371	347.8701 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
West	4.5000	19.6403	0.3000	0.8000	0.7700	14.6996 (80)
Solar gains						
14.6996	28.7555	47.3561	69.0661	84.6431	86.6473	82.4917
Total gains						
371.3702	383.3314	390.7098	394.6575	392.5074	377.4407	362.2661
						356.0817
						349.5254
						346.5144
						351.1657
						12.0882 (83)
						359.9583 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)											
Utilisation factor for gains for living area, nil,m (see Table 9a)											21.0000 (85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.1804	43.3420	43.5047	44.3372	44.5075	45.3792	45.3792	45.5576	45.0264	44.5075	44.1682
alpha	3.8787	3.8895	3.9003	3.9558	3.9672	4.0253	4.0253	4.0372	4.0018	3.9672	3.9445
util living area	0.9421	0.9297	0.9019	0.8413	0.7363	0.5715	0.4255	0.4490	0.6470	0.8328	0.9153
MIT	19.9702	20.0854	20.2999	20.5863	20.8131	20.9509	20.9882	20.9852	20.9158	20.6616	20.2941
Th 2	20.3912	20.3933	20.3955	20.4062	20.4083	20.4191	20.4191	20.4213	20.4148	20.4083	20.4041
util rest of house	0.9358	0.9219	0.8908	0.8231	0.7064	0.5275	0.3722	0.3960	0.6048	0.8109	0.9050
MIT 2	18.9944	19.1612	19.4693	19.8800	20.1885	20.3699	20.4098	20.4092	20.3262	19.9892	19.4700
Living area fraction	19.5893	19.7246	19.9756	20.3106	20.5693	20.7241	20.7624	20.7603	20.6856	20.3991	19.9724
MIT	19.5893	19.7246	19.9756	20.3106	20.5693	20.7241	20.7624	20.7603	20.6856	20.3991	19.9724
Temperature adjustment											0.0000
adjusted MIT	19.5893	19.7246	19.9756	20.3106	20.5693	20.7241	20.7624	20.7603	20.6856	20.3991	19.9724
											19.5724 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9261	0.9123	0.8823	0.8200	0.7149	0.5509	0.4039	0.4273	0.6248	0.8106	0.8966
Useful gains	343.9173	349.6950	344.7350	323.6283	280.5854	207.9490	146.3290	152.1468	218.3757	280.8767	314.8721
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000
Heat loss rate W	574.3941	554.8606	502.4837	417.4941	323.2698	218.9236	148.7973	155.2635	237.2672	357.1599	472.7805
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000
Space heating kWh	171.4747	137.8713	117.3651	67.5834	31.7572	0.0000	0.0000	0.0000	0.0000	56.7547	113.6940
Space heating											173.7102 (98)
Space heating per m2											870.2106 (98)
											(98) / (4) = 14.9009 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	870.2106	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	226.2548	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	905.0190	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1912.4032	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	497.2248	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1988.8993	(310b)
Electricity used for heat distribution	36.1740	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	93.5130	(330a)
Total electricity for the above, kWh/year	93.5130	(331)
Electricity for lighting (calculated in Appendix L)	315.1243	(332)
Total delivered energy for all uses	4026.0352	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	761.5575	0.2160	164.4964 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	2411.4548	0.2160	520.8742 (363)
less credit emissions for electricity	-892.9617	0.5190	-463.4471 (364)
Water heating from Combined Heat and Power	5299.4920	0.2160	1144.6903 (365)
less credit emissions for electricity	-1962.4019	0.5190	-1018.4866 (366)
Electrical energy for heat distribution	36.1740	0.5190	18.7743 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			366.9015 (373)
Space and water heating			366.9015 (376)
Pumps and fans	93.5130	0.5190	48.5332 (378)
Energy for lighting	315.1243	0.5190	163.5495 (379)
Total CO2, kg/year			578.9843 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.9100 (384)

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

DER		9.9100	ZC1
Total Floor Area	TFA	58.4000	
Assumed number of occupants	N	1.9361	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1375	ZC2
CO2 emissions from cooking, equation (L16)		2.8333	ZC3
Total CO2 emissions		29.8809	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		29.8809	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	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.1370 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3870 (18)
Number of sides sheltered					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2999 (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	0.3824	0.3749	0.3674	0.3299	0.3224	0.2849	0.2849	0.2774	0.2999	0.3224	0.3374	0.3524 (22b)
Effective ac	0.5731	0.5703	0.5675	0.5544	0.5520	0.5406	0.5406	0.5385	0.5450	0.5520	0.5569	0.5621 (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 Opening Type (Uw = 1.40)			4.5000	1.3258	5.9659			(27)					
Heat Loss Floor 1			20.2000	0.1300	2.6260			(28a)					
External Wall 1	23.2290	4.5000	18.7290	0.1800	3.3712			(29a)					
External Roof 1	20.2000		20.2000	0.1300	2.6260			(30)					
Total net area of external elements Aum(A, m2)			63.6290					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.5891			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal Bridges (User defined value 0.050 * total exposed area)								3.1815 (36)					
Total fabric heat loss						(33) + (36) =		17.7706 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 27.6125	Feb 27.4757	Mar 27.3416	Apr 26.7119	May 26.5941	Jun 26.0456	Jul 26.0456	Aug 25.9440	Sep 26.2569	Oct 26.5941	Nov 26.8324	Dec 27.0816	(38)
Heat transfer coeff	45.3831	45.2463	45.1122	44.4825	44.3647	43.8162	43.8162	43.7146	44.0274	44.3647	44.6030	44.8522	(39)
Average = Sum(39)m / 12 =												44.4819	(39)
HLP	Jan 0.7771	Feb 0.7748	Mar 0.7725	Apr 0.7617	May 0.7597	Jun 0.7503	Jul 0.7503	Aug 0.7485	Sep 0.7539	Oct 0.7597	Nov 0.7638	Dec 0.7680	(40)
HLP (average)												0.7617	(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												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
Daily hot water use	88.1994	84.9921	81.7849	78.5776	75.3704	72.1631	72.1631	75.3704	78.5776	81.7849	84.9921	88.1994 (44)
Energy conte	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Energy content (annual)												Total = Sum(45)m = 1261.5634 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (64)
	80.7660	71.7052	76.5264	70.2930	70.1103	64.4071	63.5312	67.4042	66.5616	72.8069	74.8583	79.3937 (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	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3011	16.2549	13.2194	10.0079	7.4810	6.3158	6.8245	8.8707	11.9062	15.1177	17.6446	18.8098	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	(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)	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	(71)
Water heating gains (Table 5)	108.5564	106.7042	102.8580	97.6291	94.2343	89.4543	85.3914	90.5970	92.4466	97.8587	103.9698	106.7120	(72)
Total internal gains	350.7928	348.6470	337.3487	319.5062	301.7160	284.6159	273.6096	279.1089	288.4105	306.4362	326.9428	342.0049	(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	
-----			-----		-----		-----		-----		-----		-----	
West			4.5000		19.6403		0.6300		0.7000		0.7700		27.0104 (80)	
-----			-----		-----		-----		-----		-----		-----	
Solar gains			27.0104	52.8381	87.0169	126.9090	155.5317	159.2144	151.5786	130.2038	101.2043	62.6969	33.6788	22.2121 (83)
Total gains			377.8032	401.4851	424.3656	446.4151	457.2477	443.8303	425.1881	409.3126	389.6148	369.1331	360.6216	364.2170 (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	89.3627	89.6329	89.8993	91.1720	91.4141	92.5584	92.5584	92.7735	92.1143	91.4141	90.9256	90.4204	
alpha	6.9575	6.9575	6.9933	7.0781	7.0943	7.1706	7.1706	7.1849	7.1410	7.0943	7.0617	7.0280	
util living area	0.9960	0.9929	0.9824	0.9418	0.8271	0.6230	0.4526	0.4898	0.7462	0.9508	0.9908	0.9969	(86)
MIT	20.3416	20.4307	20.5903	20.7961	20.9404	20.9932	20.9994	20.9989	20.9774	20.8089	20.5456	20.3252	(87)
Th 2	20.2732	20.2753	20.2773	20.2867	20.2884	20.2966	20.2966	20.2982	20.2935	20.2884	20.2849	20.2811	(88)
util rest of house	0.9948	0.9907	0.9769	0.9241	0.7839	0.5584	0.3807	0.4159	0.6825	0.9323	0.9875	0.9959	(89)
MIT 2	19.3911	19.5221	19.7538	20.0485	20.2312	20.2921	20.2964	20.2977	20.2763	20.0712	19.6972	19.3735	(90)
Living area fraction	19.9705	20.0760	20.2637	20.5042	20.6635	20.7195	20.7249	20.7252	20.7037	20.5209	20.2143	19.9536	(91)
MIT	19.9705	20.0760	20.2637	20.5042	20.6635	20.7195	20.7249	20.7252	20.7037	20.5209	20.2143	19.9536	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9705	20.0760	20.2637	20.5042	20.6635	20.7195	20.7249	20.7252	20.7037	20.5209	20.2143	19.9536	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9942	0.9900	0.9768	0.9300	0.8075	0.5976	0.4245	0.4610	0.7204	0.9390	0.9871	0.9954	(94)
Ext temp.	375.6167	397.4829	414.5143	415.1548	369.2361	265.2240	180.5126	188.6758	280.6923	346.6188	355.9838	362.5338	(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	711.1775	686.6560	620.9130	516.1845	397.6635	268.1322	180.7380	189.0723	290.7428	440.1355	584.9395	706.5844	(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	249.6572	194.3244	153.5606	72.7413	21.1500	0.0000	0.0000	0.0000	0.0000	69.5764	164.8482	255.9736	(98)
Space heating per m2												1181.8318	(98)
												20.2368	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												1263.9912 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	249.6572	194.3244	153.5606	72.7413	21.1500	0.0000	0.0000	0.0000	0.0000	69.5764	164.8482	255.9736 (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)	267.0131	207.8336	164.2359	77.7982	22.6203	0.0000	0.0000	0.0000	0.0000	74.4133	176.3082	273.7686 (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	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (64)
Efficiency of water heater (217)m	85.7253	85.3926	84.6287	83.0350	81.0168	79.8000	79.8000	79.8000	79.8000	82.8560	84.8646	79.8000 (216)
Fuel for water heating, kWh/month	206.9308	183.2497	194.5455	178.2472	179.4011	163.2903	157.3409	171.9377	171.4103	185.2067	190.5834	201.8153 (219)
Water heating fuel used												2183.9588 (219)
Annual totals kWh/year												
Space heating fuel - main system												1263.9912 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												323.2038 (232)
Total delivered energy for all uses												3846.1538 (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	1263.9912	0.2160	273.0221 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2183.9588	0.2160	471.7351 (264)
Space and water heating			744.7572 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	323.2038	0.5190	167.7428 (268)
Total CO2, kg/m2/year			951.4250 (272)
Emissions per m2 for space and water heating			12.7527 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.8723 (272b)
Emissions per m2 for pumps and fans			0.6665 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.7527 * 1.00) + 2.8723 + 0.6665, rounded to 2 d.p.			16.2900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000150_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.03_1B		
Property					
SAP Rating	84 B	DER	10.00	TER	17.32
Environmental	93 A	% DER<TER	42.25		
CO ₂ Emissions (t/year)	0.52	DFEE	37.72	TFEE	39.41
General Requirements Compliance	Pass	% DFEE<TFEE	4.27		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 58 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.32 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.00 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)39.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK

Based on:

Overshading:	Average
Windows facing North:	4.50 m ² , Overhang twice as wide as window, ratio 2.38
Windows facing West:	4.50 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							3.0000					
Infiltration rate							0.1500	(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) =	0.1275 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			9.0000	1.3258	11.9318		(27)					
External Wall 1	65.4820	9.0000	56.4820	0.1600	9.0371		(29a)					
Total net area of external elements Aum(A, m2)			65.4820				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.9689		(33)					
Party Floor 1			58.4000				(32d)					
Party Ceilings 1			58.4000				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							9.8223 (36)					
Total fabric heat loss	(33) + (36) =						30.7912 (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	13.2886	13.1351	12.9815	12.2136	12.0601	11.2922	11.2922	11.1386	11.5993	12.0601	12.3672	12.6744 (38)
Heat transfer coeff	44.0799	43.9263	43.7727	43.0049	42.8513	42.0834	42.0834	41.9299	42.3906	42.8513	43.1584	43.4656 (39)
Average = Sum(39)m / 12 =												42.9665 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7548	0.7522	0.7495	0.7364	0.7338	0.7206	0.7206	0.7180	0.7259	0.7338	0.7390	0.7443 (40)
HLP (average)												0.7357 (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												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
Daily hot water use	Jan 88.1994	Feb 84.9921	Mar 81.7849	Apr 78.5776	May 75.3704	Jun 72.1631	Jul 72.1631	Aug 75.3704	Sep 78.5776	Oct 81.7849	Nov 84.9921	Dec 88.1994 (44)
Energy conte	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Energy content (annual)												Total = Sum(45)m = 1261.5634 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)
Water storage loss:												110.0000 (47)
Store volume												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
Solar input	186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (62)	
	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	186.0739	164.3234	173.3232	156.4094	154.0269	138.7075	134.2399	145.8882	145.1872	162.1368	170.1397	181.9468 (64)	
								Total per year (kWh/year) = Sum(64)m =					1912.4032 (64)
Heat gains from water heating, kWh/month													
	87.7115	77.9786	83.4719	77.0144	77.0559	71.1285	70.4767	74.3497	73.2830	79.7524	81.5798	86.3392 (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	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.4336	13.7080	11.1481	8.4398	6.3089	5.3262	5.7552	7.4808	10.0407	12.7490	14.8799	15.8626 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803 (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)	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421 (71)
Water heating gains (Table 5)	117.8918	116.0396	112.1934	106.9645	103.5697	98.7896	94.7267	99.9324	101.7820	107.1941	113.3052	116.0474 (72)
Total internal gains	354.2606	352.4354	341.6128	324.2735	306.8792	289.9617	278.8757	284.0544	292.8803	310.4028	330.5135	345.3931 (73)

6. Solar gains

[Jan]		Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North		4.5000		10.6334		0.5000		0.8000		0.7700		13.2641 (74)
West		4.5000		19.6403		0.5000		0.8000		0.7700		24.4993 (80)
Solar gains	37.7634	73.2741	122.0000	184.2966	234.2722	244.1859	230.6378	192.0025	143.5830	87.0419	46.9107	31.2046 (83)
Total gains	392.0240	425.7095	463.6128	508.5700	541.1514	534.1476	509.5135	476.0569	436.4634	397.4447	377.4242	376.5977 (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	36.8019	36.9305	37.0601	37.7218	37.8570	38.5478	38.5478	38.6890	38.2685	37.8570	37.5876	37.3220
alpha	3.4535	3.4620	3.4707	3.5148	3.5238	3.5699	3.5699	3.5793	3.5512	3.5238	3.5058	3.4881
util living area	0.9435	0.9234	0.8799	0.7873	0.6483	0.4815	0.3571	0.3955	0.6065	0.8212	0.9166	0.9493 (86)
MIT	19.7018	19.8854	20.1945	20.5717	20.8295	20.9564	20.9885	20.9835	20.9004	20.5737	20.0941	19.6733 (87)
Th 2	20.2927	20.2950	20.2973	20.3088	20.3111	20.3227	20.3227	20.3250	20.3180	20.3111	20.3065	20.3019 (88)
util rest of house												
	0.9369	0.9145	0.8662	0.7643	0.6135	0.4361	0.3043	0.3406	0.5595	0.7965	0.9056	0.9433 (89)
MIT 2	18.5396	18.8038	19.2444	19.7757	20.1174	20.2811	20.3142	20.3122	20.2163	19.7898	19.1144	18.5051 (90)
Living area fraction												
MIT	19.2202	19.4372	19.8008	20.2419	20.5344	20.6766	20.7090	20.7053	20.6169	20.2488	19.6882	19.1892 (92)
Temperature adjustment												
adjusted MIT	19.2202	19.4372	19.8008	20.2419	20.5344	20.6766	20.7090	20.7053	20.6169	20.2488	19.6882	19.1892 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9248	0.9021	0.8554	0.7620	0.6251	0.4601	0.3346	0.3718	0.5806	0.7941	0.8944	0.9318 (94)
Useful gains	362.5596	384.0190	396.5554	387.5114	338.2718	245.7665	170.4927	176.9950	253.4260	315.6010	337.5726	350.9175 (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												
	657.6812	638.5660	582.2111	487.7552	378.5670	255.7231	172.9225	180.5211	276.2557	413.4651	543.2852	651.5159 (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												
	219.5704	171.0556	138.1279	72.1755	29.9796	0.0000	0.0000	0.0000	0.0000	72.8109	148.1130	223.6452 (98)
Space heating												1075.4781 (98)
Space heating per m2										(98) / (4) =		18.4157 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1075.4781	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	279.6243	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1118.4972	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1912.4032	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	497.2248	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1988.8993	(310b)
Electricity used for heat distribution	38.8425	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	93.5130	(330a)
Total electricity for the above, kWh/year	93.5130	(331)
Electricity for lighting (calculated in Appendix L)	272.5626	(332)
Total delivered energy for all uses	4250.3212	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	817.7359	0.2160	176.6310 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	2980.2750	0.2160	643.7394 (363)
less credit emissions for electricity	-1103.5958	0.5190	-572.7662 (364)
Water heating from Combined Heat and Power	5299.4920	0.2160	1144.6903 (365)
less credit emissions for electricity	-1962.4019	0.5190	-1018.4866 (366)
Electrical energy for heat distribution	38.8425	0.5190	20.1592 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			393.9670 (373)
Space and water heating			393.9670 (376)
Pumps and fans	93.5130	0.5190	48.5332 (378)
Energy for lighting	272.5626	0.5190	141.4600 (379)
Total CO2, kg/year			583.9603 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			10.0000 (384)

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

DER		10.0000	ZC1
Total Floor Area	TFA	58.4000	
Assumed number of occupants	N	1.9361	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1375	ZC2
CO2 emissions from cooking, equation (L16)		2.8333	ZC3
Total CO2 emissions		29.9709	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		29.9709	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.4000 (1b)	x 2.5000 (2b)	= 146.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.0000 (5)

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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) =						20.0000 / (5) =	0.1370	(8)
Pressure test							Yes		
Measured/design AP50							5.0000		
Infiltration rate								0.3870	(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) =	0.3289	(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												
	0.4194	0.4112	0.4029	0.3618	0.3536	0.3125	0.3125	0.3043	0.3289	0.3536	0.3701	0.3865 (22b)
Effective ac	0.5879	0.5845	0.5812	0.5655	0.5625	0.5488	0.5488	0.5463	0.5541	0.5625	0.5685	0.5747 (25)

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 Opening Type (Uw = 1.40)			9.0000	1.3258	11.9318			(27)					
External Wall 1	65.4820	9.0000	56.4820	0.1800	10.1668			(29a)					
Total net area of external elements Aum(A, m2)			65.4820					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			22.0986		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal Bridges (User defined value 0.050 * total exposed area)								3.2741 (36)					
Total fabric heat loss						(33) + (36) =		25.3727 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.3273	28.1627	28.0015	27.2439	27.1022	26.4424	26.4424	26.3202	26.6965	27.1022	27.3889	27.6887	(38)
Heat transfer coeff	53.6999	53.5354	53.3741	52.6166	52.4749	51.8151	51.8151	51.6929	52.0692	52.4749	52.7616	53.0613	(39)
Average = Sum(39)m / 12 =												52.6159	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9195	0.9167	0.9139	0.9010	0.8985	0.8872	0.8872	0.8852	0.8916	0.8985	0.9035	0.9086	(40)
HLP (average)												0.9010	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

Assumed occupancy												1.9361 (42)
Average daily hot water use (litres/day)												80.1813 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	88.1994	84.9921	81.7849	78.5776	75.3704	72.1631	72.1631	75.3704	78.5776	81.7849	84.9921	88.1994 (44)
Energy content (annual)	130.7971	114.3960	118.0464	102.9157	98.7501	85.2138	78.9631	90.6114	91.6936	106.8600	116.6460	126.6700 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1261.5634 (45)
	19.6196	17.1594	17.7070	15.4374	14.8125	12.7821	11.8445	13.5917	13.7540	16.0290	17.4969	19.0005 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (62)
	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												
	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649 (64)
Heat gains from water heating, kWh/month												
	80.7660	71.7052	76.5264	70.2930	70.1103	64.4071	63.5312	67.4042	66.5616	72.8069	74.8583	79.3937 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027	96.8027 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.8278	14.0581	11.4328	8.6554	6.4700	5.4622	5.9022	7.6718	10.2971	13.0746	15.2600	16.2677 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	168.8944	170.6470	166.2305	156.8284	144.9598	133.8050	126.3530	124.6004	129.0169	138.4190	150.2876	161.4423 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803	32.6803 (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)	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421	-77.4421 (71)
Water heating gains (Table 5)	108.5564	106.7042	102.8580	97.6291	94.2343	89.4543	85.3914	90.5970	92.4466	97.8587	103.9698	106.7120 (72)
Total internal gains	348.3194	346.4502	335.5622	318.1536	300.7049	283.7623	272.6873	277.9100	286.8014	304.3931	324.5582	339.4628 (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					4.5000	10.6334	0.6300	0.7000			0.7700	14.6237 (74)
West					4.5000	19.6403	0.6300	0.7000			0.7700	27.0104 (80)

Solar gains	41.6341	80.7847	134.5050	203.1870	258.2851	269.2150	254.2782	211.6828	158.3003	95.9637	51.7190	34.4031 (83)
Total gains	389.9535	427.2349	470.0671	521.3406	558.9900	552.9773	526.9655	489.5928	445.1017	400.3567	376.2772	373.8659 (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)												
tau	75.5225	75.7546	75.9835	77.0775	77.2857	78.2698	78.2698	78.4548	77.8878	77.2857	76.8657	76.4315
alpha	6.0348	6.0503	6.0656	6.1385	6.1524	6.2180	6.2180	6.2303	6.1925	6.1524	6.1244	6.0954
util living area	0.9963	0.9927	0.9803	0.9301	0.7957	0.5894	0.4313	0.4829	0.7546	0.9555	0.9918	0.9971 (86)
MIT	20.1468	20.2647	20.4739	20.7443	20.9271	20.9904	20.9988	20.9977	20.9605	20.7250	20.3935	20.1276 (87)
Th 2	20.1509	20.1533	20.1557	20.1667	20.1687	20.1784	20.1784	20.1801	20.1746	20.1687	20.1646	20.1602 (88)
util rest of house	0.9951	0.9904	0.9740	0.9087	0.7457	0.5182	0.3515	0.3983	0.6835	0.9373	0.9887	0.9962 (89)
MIT 2	19.0122	19.1855	19.4887	19.8729	20.1007	20.1723	20.1779	20.1792	20.1448	19.8556	19.3821	18.9913 (90)
Living area fraction									fLA = Living area / (4) =			0.5856 (91)
MIT	19.6766	19.8175	20.0656	20.3832	20.5847	20.6514	20.6586	20.6585	20.6225	20.3647	19.9744	19.6567 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6766	19.8175	20.0656	20.3832	20.5847	20.6514	20.6586	20.6585	20.6225	20.3647	19.9744	19.6567 (93)

8. Space heating requirement

Utilisation	0.9943	0.9893	0.9732	0.9148	0.7717	0.5597	0.3983	0.4479	0.7235	0.9422	0.9878	0.9955 (94)
Useful gains	387.7180	422.6665	457.4704	476.9399	431.3698	309.4986	209.8802	219.2997	322.0303	377.2109	371.7034	372.1659 (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	825.7252	798.6148	724.0527	604.2092	466.2221	313.5535	210.2986	220.1351	339.6215	512.4019	679.2735	820.1548 (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	325.8773	252.6373	198.3372	91.6340	25.9302	0.0000	0.0000	0.0000	0.0000	100.5821	221.4505	333.3037 (98)
Space heating												1549.7523 (98)
Space heating per m2												26.5369 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1657.4890 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	325.8773	252.6373	198.3372	91.6340	25.9302	0.0000	0.0000	0.0000	0.0000	100.5821	221.4505	333.3037	(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)	348.5319	270.2003	212.1254	98.0042	27.7328	0.0000	0.0000	0.0000	0.0000	107.5745	236.8454	356.4746	(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	177.3920	156.4817	164.6413	148.0076	145.3450	130.3057	125.5580	137.2063	136.7854	153.4549	161.7379	173.2649	(64)
Efficiency of water heater (217)m	86.4158	86.0851	85.3114	83.5785	81.2544	79.8000	79.8000	79.8000	79.8000	83.7191	85.6525	86.5315	(216)
Fuel for water heating, kWh/month	205.2773	181.7757	192.9886	177.0880	178.8764	163.2903	157.3409	171.9377	171.4103	183.2974	188.8304	200.2334	(219)
Water heating fuel used												2172.3464	(219)
Annual totals kWh/year													
Space heating fuel - main system												1657.4890	(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)												279.5239	(232)
Total delivered energy for all uses												4184.3593	(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	1657.4890	0.2160	358.0176 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2172.3464	0.2160	469.2268 (264)
Space and water heating			827.2445 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	279.5239	0.5190	145.0729 (268)
Total CO2, kg/m2/year			1011.2424 (272)
Emissions per m2 for space and water heating			14.1651 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4841 (272b)
Emissions per m2 for pumps and fans			0.6665 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1651 * 1.00) + 2.4841 + 0.6665, rounded to 2 d.p.			17.3200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000194_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.03_1B		
Property					
SAP Rating	86 B	DER	8.24	TER	15.39
Environmental	94 A	% DER<TER	46.45		
CO ₂ Emissions (t/year)	0.44	DFEE	23.20	TFEE	29.82
General Requirements Compliance	Fail	% DFEE<TFEE	22.19		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 57 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.24 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)29.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)23.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	11.59 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	56.6900 (1b)	x 2.5000 (2b)	= 141.7250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			11.5900	0.9615	11.1442		(27)					
External Wall 1	18.0683	11.5920	6.4763	0.1600	1.0362		(29a)					
Total net area of external elements Aum(A, m2)			18.0663				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		12.1804		(33)					
Party Floor 1			56.6900				(32d)					
Party Ceilings 1			56.6900				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							2.7099 (36)					
Total fabric heat loss						(33) + (36) =	14.8904 (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	12.2287	12.0928	11.9569	11.2772	11.1413	10.4617	10.4617	10.3258	10.7335	11.1413	11.4132	11.6850 (38)
Heat transfer coeff	27.1191	26.9832	26.8472	26.1676	26.0317	25.3521	25.3521	25.2162	25.6239	26.0317	26.3035	26.5754 (39)
Average = Sum(39)m / 12 =												26.1336 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.4784	0.4760	0.4736	0.4616	0.4592	0.4472	0.4472	0.4448	0.4520	0.4592	0.4640	0.4688 (40)
HLP (average)												0.4610 (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												1.8867 (42)
Average daily hot water use (litres/day)												79.0086 (43)
Daily hot water use	86.9094	83.7491	80.5887	77.4284	74.2680	71.1077	71.1077	74.2680	77.4284	80.5887	83.7491	86.9094 (44)
Energy conte	128.8842	112.7229	116.3199	101.4105	97.3058	83.9675	77.8083	89.2861	90.3525	105.2971	114.9400	124.8174 (45)
Energy content (annual)												Total = Sum(45)m = 1243.1123 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.3326	16.9084	17.4480	15.2116	14.5959	12.5951	11.6712	13.3929	13.5529	15.7946	17.2410	18.7226 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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												
	184.1610	162.6503	171.5967	154.9042	152.5826	137.4612	133.0851	144.5629	143.8462	160.5739	168.4337	180.0942 (62)
Solar input								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												
	184.1610	162.6503	171.5967	154.9042	152.5826	137.4612	133.0851	144.5629	143.8462	160.5739	168.4337	180.0942 (64)
								Total per year (kWh/year) = Sum(64)m =			1893.9521 (64)	
Heat gains from water heating, kWh/month												
	87.0754	77.4223	82.8978	76.5140	76.5756	70.7141	70.0927	73.9091	72.8371	79.2327	81.0125	85.7232 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.6679	13.0279	10.5950	8.0211	5.9959	5.0620	5.4696	7.1096	9.5425	12.1164	14.1416	15.0755 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	164.5289	166.2362	161.9339	152.7747	141.2129	130.3465	123.0870	121.3797	125.6821	134.8412	146.4030	157.2694 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334 (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)	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671 (71)
Water heating gains (Table 5)	117.0369	115.2118	111.4218	106.2694	102.9242	98.2141	94.2106	99.3402	101.1627	106.4956	112.5174	115.2194 (72)
Total internal gains	347.5338	345.7760	335.2508	318.3653	301.4332	284.9227	274.0674	279.1297	287.6874	304.7534	324.3621	338.8645 (73)

[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

Northeast					11.5920	11.2829	0.5000	0.8000			0.7700			36.2555 (75)

Solar gains	36.2555	73.7991	132.9625	218.3627	293.5223	312.9259	292.7357	233.3723	162.0169	90.1884	45.6188	29.6081	(83)	
Total gains	383.7893	419.5751	468.2133	536.7280	594.9555	597.8485	566.8031	512.5020	449.7044	394.9418	369.9809	368.4726	(84)	

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.0669	58.3594	58.6549	60.1783	60.4925	62.1141	62.1141	62.4489	61.4551	60.4925	59.8673	59.2549	
alpha	4.8711	4.8906	4.9103	5.0119	5.0328	5.1409	5.1409	5.1633	5.0970	5.0328	4.9912	4.9503	
util living area													
	0.8904	0.8443	0.7462	0.5720	0.4043	0.2712	0.1968	0.2262	0.3911	0.6496	0.8281	0.9008	
MIT	20.5435	20.6704	20.8357	20.9602	20.9935	20.9994	20.9999	20.9998	20.9962	20.9412	20.7551	20.5275	
Th 2	20.5407	20.5429	20.5451	20.5562	20.5584	20.5695	20.5695	20.5717	20.5650	20.5584	20.5540	20.5495	
util rest of house													
	0.8814	0.8327	0.7303	0.5533	0.3856	0.2530	0.1775	0.2052	0.3669	0.6270	0.8140	0.8925	
MIT 2	19.9260	20.1050	20.3334	20.5075	20.5511	20.5689	20.5694	20.5715	20.5611	20.4879	20.2348	19.9112	
Living area fraction									fLA = Living area / (4) =			0.4967	
MIT	20.2327	20.3859	20.5829	20.7324	20.7709	20.7827	20.7832	20.7843	20.7772	20.7131	20.4933	20.2174	
Temperature adjustment												0.0000	
adjusted MIT	20.2327	20.3859	20.5829	20.7324	20.7709	20.7827	20.7832	20.7843	20.7772	20.7131	20.4933	20.2174	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8748	0.8285	0.7317	0.5608	0.3946	0.2620	0.1871	0.2157	0.3787	0.6350	0.8120	0.8859 (94)
Useful gains	335.7569	347.6313	342.5794	300.9941	234.7643	156.6264	106.0384	110.5232	170.3247	250.7815	300.4372	326.4121 (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												
	432.0810	417.8577	378.0869	309.6254	236.1300	156.7450	106.0540	110.5548	171.0963	263.2604	352.2899	425.6680 (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												
	71.6651	47.1922	26.4176	6.2145	1.0161	0.0000	0.0000	0.0000	0.0000	9.2843	37.3339	73.8464 (98)
Space heating												272.9702 (98)
Space heating per m2												4.8151 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.09r14

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	272.9702	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	70.9722	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	283.8890	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1893.9521	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	492.4276	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1969.7102	(310b)
Electricity used for heat distribution	28.1700	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	90.7749	(330a)
Total electricity for the above, kWh/year	90.7749	(331)
Electricity for lighting (calculated in Appendix L)	259.0392	(332)
Total delivered energy for all uses	3166.8130	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	593.0524	0.2160	128.0993 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	756.4321	0.2160	163.3893 (363)
less credit emissions for electricity	-280.1068	0.5190	-145.3754 (364)
Water heating from Combined Heat and Power	5248.3618	0.2160	1133.6462 (365)
less credit emissions for electricity	-1943.4684	0.5190	-1008.6601 (366)
Electrical energy for heat distribution	28.1700	0.5190	14.6202 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			285.7195 (373)
Space and water heating			285.7195 (376)
Pumps and fans	90.7749	0.5190	47.1122 (378)
Energy for lighting	259.0392	0.5190	134.4413 (379)
Total CO2, kg/year			467.2730 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2400 (384)

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

DER		8.2400	ZC1
Total Floor Area	TFA	56.6900	
Assumed number of occupants	N	1.8867	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1982	ZC2
CO2 emissions from cooking, equation (L16)		2.8979	ZC3
Total CO2 emissions		28.3360	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		28.3360	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	56.6900 (1b)	x 2.5000 (2b)	= 141.7250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.1411 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3911 (18)
					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3031 (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	0.3865	0.3789	0.3713	0.3334	0.3259	0.2880	0.2880	0.2804	0.3031	0.3259	0.3410	0.3562 (22b)
Effective ac	0.5747	0.5718	0.5689	0.5556	0.5531	0.5415	0.5415	0.5393	0.5459	0.5531	0.5581	0.5634 (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 Opening Type (Uw = 1.40)			11.5900	1.3258	15.3655		(27)
External Wall 1	18.0683	11.5920	6.4763	0.1800	1.1657		(29a)
Total net area of external elements Aum(A, m ²)			18.0663				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.5313		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							0.9033 (36)
Total fabric heat loss						(33) + (36) =	17.4346 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	26.8774	26.7418	26.6088	25.9844	25.8676	25.3237	25.3237
Heat transfer coeff	44.3120	44.1764	44.0434	43.4190	43.3021	42.7583	42.7583
Average = Sum(39)m / 12 =						42.6576	42.9678
						43.3021	43.5385
						43.7856	43.4184 (39)
HLP	0.7817	0.7793	0.7769	0.7659	0.7638	0.7542	0.7542
HLP (average)						0.7525	0.7579
Days in month	31	28	31	30	31	30	31
						30	31
						30	30
						31	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.8867 (42)
Average daily hot water use (litres/day)												79.0086 (43)
Daily hot water use	86.9094	83.7491	80.5887	77.4284	74.2680	71.1077	71.1077	74.2680	77.4284	80.5887	83.7491	86.9094 (44)
Energy conte	128.8842	112.7229	116.3199	101.4105	97.3058	83.9675	77.8083	89.2861	90.3525	105.2971	114.9400	124.8174 (45)
Energy content (annual)										Total = Sum(45)m =		1243.1123 (45)
Distribution loss (46)m = 0.15 x (45)m	19.3326	16.9084	17.4480	15.2116	14.5959	12.5951	11.6712	13.3929	13.5529	15.7946	17.2410	18.7226 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	175.4791	154.8086	162.9148	146.5024	143.9007	129.0594	124.4032	135.8810	135.4443	151.8920	160.0319	171.4123 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	175.4791	154.8086	162.9148	146.5024	143.9007	129.0594	124.4032	135.8810	135.4443	151.8920	160.0319	171.4123 (64)
	80.1299	71.1489	75.9523	69.7925	69.6301	63.9927	63.1472	66.9636	66.1157	72.2872	74.2910	78.7777 (65)
								Total per year (kWh/year) =	Sum (64)m =			1791.7297 (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	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.7395	13.0915	10.6467	8.0602	6.0251	5.0867	5.4963	7.1443	9.5891	12.1756	14.2107	15.1491	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	164.5289	166.2362	161.9339	152.7747	141.2129	130.3465	123.0870	121.3797	125.6821	134.8412	146.4030	157.2694	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	(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)	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	(71)
Water heating gains (Table 5)	107.7015	105.8764	102.0864	96.9340	93.5889	88.8787	84.8752	90.0048	91.8273	97.1602	103.1820	105.8840	(72)
Total internal gains	341.2700	339.5042	328.9671	312.0691	295.1271	278.6120	267.7587	272.8290	281.3986	298.4771	318.0958	332.6027	(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		
-----								-----			-----		
Northeast				11.5920	11.2829	0.6300	0.7000			0.7700	39.9717 (75)		
-----								-----			-----		
Solar gains	39.9717	81.3635	146.5912	240.7449	323.6084	345.0008	322.7411	257.2930	178.6237	99.4327	50.2947	32.6429	(83)
Total gains	381.2417	420.8677	475.5583	552.8140	618.7354	623.6128	590.4999	530.1220	460.0223	397.9098	368.3905	365.2456	(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	88.8429	89.1157	89.3847	90.6702	90.9148	92.0712	92.0712	92.2885	91.6223	90.9148	90.4213	89.9110	
alpha	6.9229	6.9410	6.9590	7.0447	7.0610	7.1381	7.1381	7.1526	7.1082	7.0610	7.0281	6.9941	
util living area	0.9951	0.9891	0.9637	0.8523	0.6396	0.4381	0.3185	0.3700	0.6341	0.9230	0.9878	0.9962	(86)
MIT	20.3596	20.4760	20.6795	20.9034	20.9875	20.9992	20.9999	20.9998	20.9915	20.8520	20.5704	20.3387	(87)
Th 2	20.2693	20.2713	20.2734	20.2830	20.2848	20.2932	20.2932	20.2947	20.2899	20.2848	20.2811	20.2773	(88)
util rest of house	0.9936	0.9859	0.9536	0.8216	0.5941	0.3901	0.2674	0.3133	0.5731	0.8977	0.9837	0.9951	(89)
MIT 2	19.4140	19.5841	19.8747	20.1785	20.2740	20.2927	20.2931	20.2946	20.2839	20.1225	19.7295	19.3901	(90)
Living area fraction									fLA = Living area / (4) =			0.4967	(91)
MIT	19.8837	20.0271	20.2745	20.5386	20.6284	20.6437	20.6442	20.6449	20.6354	20.4849	20.1472	19.8613	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8837	20.0271	20.2745	20.5386	20.6284	20.6437	20.6442	20.6449	20.6354	20.4849	20.1472	19.8613	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9926	0.9847	0.9536	0.8330	0.6162	0.4139	0.2928	0.3415	0.6032	0.9055	0.9827	0.9943	(94)
Ext temp.	378.4214	414.4111	453.5039	460.5182	381.2574	258.1350	172.9052	181.0234	277.4742	360.2963	362.0227	363.1482	(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	690.5439	668.2622	606.6750	505.3355	386.6204	258.4164	172.9243	181.0783	280.8106	428.0366	568.0561	685.7391	(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	232.2192	170.5880	113.9593	32.2685	3.9901	0.0000	0.0000	0.0000	0.0000	50.3988	148.3441	240.0076	(98)
Space heating per m2												991.7755	(98)
												17.4947	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												1060.7224	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	232.2192	170.5880	113.9593	32.2685	3.9901	0.0000	0.0000	0.0000	0.0000	50.3988	148.3441	240.0076	(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)	248.3627	182.4470	121.8816	34.5117	4.2675	0.0000	0.0000	0.0000	0.0000	53.9024	158.6568	256.6926	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	175.4791	154.8086	162.9148	146.5024	143.9007	129.0594	124.4032	135.8810	135.4443	151.8920	160.0319	171.4123	(64)
Efficiency of water heater	85.5620	85.0731	83.8820	81.5402	80.0554	79.8000	79.8000	79.8000	79.8000	82.2220	84.6124	85.7117	(216)
(217)m	85.5620	85.0731	83.8820	81.5402	80.0554	79.8000	79.8000	79.8000	79.8000	82.2220	84.6124	85.7117	(217)
Fuel for water heating, kWh/month	205.0899	181.9714	194.2191	179.6690	179.7515	161.7285	155.8937	170.2770	169.7297	184.7341	189.1353	199.9870	(219)
Water heating fuel used												2172.1862	(219)
Annual totals kWh/year													
Space heating fuel - main system												1060.7224	(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)												260.3037	(232)
Total delivered energy for all uses												3568.2124	(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	1060.7224	0.2160	229.1160 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2172.1862	0.2160	469.1922 (264)
Space and water heating			698.3083 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	260.3037	0.5190	135.0976 (268)
Total CO2, kg/m2/year			872.3309 (272)
Emissions per m2 for space and water heating			12.3180 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3831 (272b)
Emissions per m2 for pumps and fans			0.6866 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.3180 * 1.00) + 2.3831 + 0.6866, rounded to 2 d.p.			15.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000222_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.04_1B		
Property					
SAP Rating	85 B	DER	8.79	TER	15.39
Environmental	94 A	% DER<TER	42.88		
CO ₂ Emissions (t/year)	0.46	DFEE	28.14	TFEE	29.82
General Requirements Compliance	Fail	% DFEE<TFEE	5.62		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 57 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.79 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)29.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)28.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	11.59 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	56.6900 (1b)	x 2.5000 (2b)	= 141.7250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			11.5900	1.3258	15.3655		(27)					
External Wall 1	18.0683	11.5920	6.4763	0.1600	1.0362		(29a)					
Total net area of external elements Aum(A, m2)			18.0663				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.4017		(33)					
Party Floor 1			56.6900				(32d)					
Party Ceilings 1			56.6900				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												
Thermal bridges (Default value 0.150 * total exposed area)							100.0000 (35)					
Total fabric heat loss							(33) + (36) = 19.1117 (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	12.2287	12.0928	11.9569	11.2772	11.1413	10.4617	10.4617	10.3258	10.7335	11.1413	11.4132	11.6850 (38)
Heat transfer coeff	31.3404	31.2045	31.0685	30.3889	30.2530	29.5734	29.5734	29.4375	29.8452	30.2530	30.5248	30.7967 (39)
Average = Sum(39)m / 12 =												30.3549 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.5528	0.5504	0.5480	0.5361	0.5337	0.5217	0.5217	0.5193	0.5265	0.5337	0.5385	0.5432 (40)
HLP (average)												0.5355 (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												1.8867 (42)
Average daily hot water use (litres/day)												79.0086 (43)
Daily hot water use	86.9094	83.7491	80.5887	77.4284	74.2680	71.1077	71.1077	74.2680	77.4284	80.5887	83.7491	86.9094 (44)
Energy conte	128.8842	112.7229	116.3199	101.4105	97.3058	83.9675	77.8083	89.2861	90.3525	105.2971	114.9400	124.8174 (45)
Energy content (annual)												Total = Sum(45)m = 1243.1123 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.3326	16.9084	17.4480	15.2116	14.5959	12.5951	11.6712	13.3929	13.5529	15.7946	17.2410	18.7226 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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												
	184.1610	162.6503	171.5967	154.9042	152.5826	137.4612	133.0851	144.5629	143.8462	160.5739	168.4337	180.0942 (62)
Solar input								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												
	184.1610	162.6503	171.5967	154.9042	152.5826	137.4612	133.0851	144.5629	143.8462	160.5739	168.4337	180.0942 (64)
								Total per year (kWh/year) = Sum(64)m =			1893.9521 (64)	
Heat gains from water heating, kWh/month												
	87.0754	77.4223	82.8978	76.5140	76.5756	70.7141	70.0927	73.9091	72.8371	79.2327	81.0125	85.7232 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.6679	13.0279	10.5950	8.0211	5.9959	5.0620	5.4696	7.1096	9.5425	12.1164	14.1416	15.0755 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	164.5289	166.2362	161.9339	152.7747	141.2129	130.3465	123.0870	121.3797	125.6821	134.8412	146.4030	157.2694 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334 (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)	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671 (71)
Water heating gains (Table 5)	117.0369	115.2118	111.4218	106.2694	102.9242	98.2141	94.2106	99.3402	101.1627	106.4956	112.5174	115.2194 (72)
Total internal gains	347.5338	345.7760	335.2508	318.3653	301.4332	284.9227	274.0674	279.1297	287.6874	304.7534	324.3621	338.8645 (73)

[Jan]													
	Area				Solar flux		g		FF		Access		Gains
	m2				Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast	11.5920				11.2829		0.3000		0.8000		0.7700		21.7533 (75)
Solar gains	21.7533	44.2795	79.7775	131.0176	176.1134	187.7555	175.6414	140.0234	97.2102	54.1130	27.3713	17.7648 (83)	
Total gains	369.2871	390.0555	415.0283	449.3829	477.5466	472.6782	449.7088	419.1530	384.8976	358.8664	351.7334	356.6294 (84)	

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.2458	50.4647	50.6854	51.8190	52.0518	53.2480	53.2480	53.4938	52.7630	52.0518	51.5882	51.1328
alpha	4.3497	4.3643	4.3790	4.4546	4.4701	4.5499	4.5499	4.5663	4.5175	4.4701	4.4392	4.4089
util living area	0.9236	0.9002	0.8459	0.7268	0.5651	0.3967	0.2886	0.3218	0.5198	0.7597	0.8837	0.9305 (86)
MIT	20.2755	20.3984	20.6040	20.8354	20.9539	20.9929	20.9987	20.9979	20.9764	20.8318	20.5462	20.2596 (87)
Th 2	20.4726	20.4748	20.4770	20.4879	20.4901	20.5010	20.5010	20.5032	20.4966	20.4901	20.4857	20.4813 (88)
util rest of house	0.9161	0.8908	0.8320	0.7058	0.5381	0.3667	0.2561	0.2875	0.4852	0.7362	0.8716	0.9236 (89)
MIT 2	19.4917	19.6678	19.9583	20.2829	20.4374	20.4940	20.5000	20.5015	20.4723	20.2845	19.8882	19.4760 (90)
Living area fraction									fLA = Living area / (4) =			0.4967 (91)
MIT	19.8811	20.0307	20.2791	20.5574	20.6940	20.7418	20.7477	20.7480	20.7227	20.5564	20.2151	19.8652 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8811	20.0307	20.2791	20.5574	20.6940	20.7418	20.7477	20.7480	20.7227	20.5564	20.2151	19.8652 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9068	0.8822	0.8265	0.7087	0.5490	0.3812	0.2722	0.3044	0.5009	0.7393	0.8648	0.9145 (94)
Useful gains	334.8635	344.0898	343.0154	318.4903	262.1668	180.1854	122.4196	127.6001	192.7970	265.3228	304.1690	326.1370 (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	488.3162	472.1445	428.0958	354.2545	272.0953	181.6338	122.6614	127.9955	197.6562	301.2097	400.3360	482.4366 (97)
Month fracti	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	114.1688	86.0528	63.2998	25.7502	7.3868	0.0000	0.0000	0.0000	0.0000	26.6998	69.2402	116.2869 (98)
Space heating												508.8853 (98)
Space heating per m2												8.9766 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.09r14

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	508.8853	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	132.3102	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	529.2408	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1893.9521	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	492.4276	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1969.7102	(310b)
Electricity used for heat distribution	31.2369	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	90.7749	(330a)
Total electricity for the above, kWh/year	90.7749	(331)
Electricity for lighting (calculated in Appendix L)	259.0392	(332)
Total delivered energy for all uses	3473.5027	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	657.6187	0.2160	142.0456 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1410.1805	0.2160	304.5990 (363)
less credit emissions for electricity	-522.1899	0.5190	-271.0165 (364)
Water heating from Combined Heat and Power	5248.3618	0.2160	1133.6462 (365)
less credit emissions for electricity	-1943.4684	0.5190	-1008.6601 (366)
Electrical energy for heat distribution	31.2369	0.5190	16.2119 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			316.8261 (373)
Space and water heating			316.8261 (376)
Pumps and fans	90.7749	0.5190	47.1122 (378)
Energy for lighting	259.0392	0.5190	134.4413 (379)
Total CO2, kg/year			498.3796 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.7900 (384)

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

DER		8.7900	ZC1
Total Floor Area	TFA	56.6900	
Assumed number of occupants	N	1.8867	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1982	ZC2
CO2 emissions from cooking, equation (L16)		2.8979	ZC3
Total CO2 emissions		28.8860	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		28.8860	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	56.6900 (1b)	x 2.5000 (2b)	= 141.7250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.1411 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3911 (18)
Number of sides sheltered					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3031 (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	0.3865	0.3789	0.3713	0.3334	0.3259	0.2880	0.2880	0.2804	0.3031	0.3259	0.3410	0.3562 (22b)
Effective ac	0.5747	0.5718	0.5689	0.5556	0.5531	0.5415	0.5415	0.5393	0.5459	0.5531	0.5581	0.5634 (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 Opening Type (Uw = 1.40)			11.5900	1.3258	15.3655			(27)					
External Wall 1	18.0683	11.5920	6.4763	0.1800	1.1657			(29a)					
Total net area of external elements Aum(A, m2)			18.0663					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			16.5313		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								0.9033 (36)					
Total fabric heat loss						(33) + (36) =	17.4346	(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	26.8774	26.7418	26.6088	25.9844	25.8676	25.3237	25.3237	25.2230	25.5332	25.8676	26.1039	26.3510	(38)
Heat transfer coeff	44.3120	44.1764	44.0434	43.4190	43.3021	42.7583	42.7583	42.6576	42.9678	43.3021	43.5385	43.7856	(39)
Average = Sum(39)m / 12 =												43.4184	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7817	0.7793	0.7769	0.7659	0.7638	0.7542	0.7542	0.7525	0.7579	0.7638	0.7680	0.7724	(40)
HLP (average)												0.7659	(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												1.8867 (42)
Average daily hot water use (litres/day)												79.0086 (43)
Daily hot water use	86.9094	83.7491	80.5887	77.4284	74.2680	71.1077	71.1077	74.2680	77.4284	80.5887	83.7491	86.9094 (44)
Energy conte	128.8842	112.7229	116.3199	101.4105	97.3058	83.9675	77.8083	89.2861	90.3525	105.2971	114.9400	124.8174 (45)
Energy content (annual)										Total = Sum(45)m =		1243.1123 (45)
Distribution loss (46)m = 0.15 x (45)m	19.3326	16.9084	17.4480	15.2116	14.5959	12.5951	11.6712	13.3929	13.5529	15.7946	17.2410	18.7226 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	175.4791	154.8086	162.9148	146.5024	143.9007	129.0594	124.4032	135.8810	135.4443	151.8920	160.0319	171.4123 (62)
	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	175.4791	154.8086	162.9148	146.5024	143.9007	129.0594	124.4032	135.8810	135.4443	151.8920	160.0319	171.4123 (64)
Heat gains from water heating, kWh/month	80.1299	71.1489	75.9523	69.7925	69.6301	63.9927	63.1472	66.9636	66.1157	72.2872	74.2910	78.7777 (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	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.7395	13.0915	10.6467	8.0602	6.0251	5.0867	5.4963	7.1443	9.5891	12.1756	14.2107	15.1491	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	164.5289	166.2362	161.9339	152.7747	141.2129	130.3465	123.0870	121.3797	125.6821	134.8412	146.4030	157.2694	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	(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)	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	(71)
Water heating gains (Table 5)	107.7015	105.8764	102.0864	96.9340	93.5889	88.8787	84.8752	90.0048	91.8273	97.1602	103.1820	105.8840	(72)
Total internal gains	341.2700	339.5042	328.9671	312.0691	295.1271	278.6120	267.7587	272.8290	281.3986	298.4771	318.0958	332.6027	(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		
-----								-----			-----		
Northeast				11.5920	11.2829	0.6300	0.7000			0.7700	39.9717 (75)		
-----								-----			-----		
Solar gains	39.9717	81.3635	146.5912	240.7449	323.6084	345.0008	322.7411	257.2930	178.6237	99.4327	50.2947	32.6429	(83)
Total gains	381.2417	420.8677	475.5583	552.8140	618.7354	623.6128	590.4999	530.1220	460.0223	397.9098	368.3905	365.2456	(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	88.8429	89.1157	89.3847	90.6702	90.9148	92.0712	92.0712	92.2885	91.6223	90.9148	90.4213	89.9110	
alpha	6.9229	6.9410	6.9590	7.0447	7.0610	7.1381	7.1381	7.1526	7.1082	7.0610	7.0281	6.9941	
util living area	0.9951	0.9891	0.9637	0.8523	0.6396	0.4381	0.3185	0.3700	0.6341	0.9230	0.9878	0.9962	(86)
MIT	20.3596	20.4760	20.6795	20.9034	20.9875	20.9992	20.9999	20.9998	20.9915	20.8520	20.5704	20.3387	(87)
Th 2	20.2693	20.2713	20.2734	20.2830	20.2848	20.2932	20.2932	20.2947	20.2899	20.2848	20.2811	20.2773	(88)
util rest of house	0.9936	0.9859	0.9536	0.8216	0.5941	0.3901	0.2674	0.3133	0.5731	0.8977	0.9837	0.9951	(89)
MIT 2	19.4140	19.5841	19.8747	20.1785	20.2740	20.2927	20.2931	20.2946	20.2839	20.1225	19.7295	19.3901	(90)
Living area fraction													
MIT	19.8837	20.0271	20.2745	20.5386	20.6284	20.6437	20.6442	20.6449	20.6354	20.4849	20.1472	19.8613	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8837	20.0271	20.2745	20.5386	20.6284	20.6437	20.6442	20.6449	20.6354	20.4849	20.1472	19.8613	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9926	0.9847	0.9536	0.8330	0.6162	0.4139	0.2928	0.3415	0.6032	0.9055	0.9827	0.9943	(94)
Ext temp.	378.4214	414.4111	453.5039	460.5182	381.2574	258.1350	172.9052	181.0234	277.4742	360.2963	362.0227	363.1482	(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	690.5439	668.2622	606.6750	505.3355	386.6204	258.4164	172.9243	181.0783	280.8106	428.0366	568.0561	685.7391	(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	232.2192	170.5880	113.9593	32.2685	3.9901	0.0000	0.0000	0.0000	0.0000	50.3988	148.3441	240.0076	(98)
Space heating per m2												991.7755	(98)
												17.4947	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												1060.7224	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	232.2192	170.5880	113.9593	32.2685	3.9901	0.0000	0.0000	0.0000	0.0000	50.3988	148.3441	240.0076	(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)	248.3627	182.4470	121.8816	34.5117	4.2675	0.0000	0.0000	0.0000	0.0000	53.9024	158.6568	256.6926	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	175.4791	154.8086	162.9148	146.5024	143.9007	129.0594	124.4032	135.8810	135.4443	151.8920	160.0319	171.4123	(64)
Efficiency of water heater	85.5620	85.0731	83.8820	81.5402	80.0554	79.8000	79.8000	79.8000	79.8000	82.2220	84.6124	85.7117	(216)
(217)m	85.5620	85.0731	83.8820	81.5402	80.0554	79.8000	79.8000	79.8000	79.8000	82.2220	84.6124	85.7117	(217)
Fuel for water heating, kWh/month	205.0899	181.9714	194.2191	179.6690	179.7515	161.7285	155.8937	170.2770	169.7297	184.7341	189.1353	199.9870	(219)
Water heating fuel used												2172.1862	(219)
Annual totals kWh/year													
Space heating fuel - main system												1060.7224	(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)												260.3037	(232)
Total delivered energy for all uses												3568.2124	(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	1060.7224	0.2160	229.1160 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2172.1862	0.2160	469.1922 (264)
Space and water heating			698.3083 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	260.3037	0.5190	135.0976 (268)
Total CO2, kg/m2/year			872.3309 (272)
Emissions per m2 for space and water heating			12.3180 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3831 (272b)
Emissions per m2 for pumps and fans			0.6866 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.3180 * 1.00) + 2.3831 + 0.6866, rounded to 2 d.p.			15.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000266_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.04_1B			
Property						
SAP Rating	86 B	DER	8.24	TER	15.39	
Environmental	94 A	% DER<TER	46.45			
CO ₂ Emissions (t/year)	0.44	DFEE	23.20	TFEE	29.82	
General Requirements Compliance	Fail	% DFEE<TFEE	22.19			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
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

Mid-floor flat, total floor area 57 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.24 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)29.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)23.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	11.59 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	56.6900 (1b)	x 2.5000 (2b)	= 141.7250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			11.5900	0.9615	11.1442		(27)					
External Wall 1	18.0683	11.5920	6.4763	0.1600	1.0362		(29a)					
Total net area of external elements Aum(A, m2)			18.0663				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		12.1804		(33)					
Party Floor 1			56.6900				(32d)					
Party Ceilings 1			56.6900				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												
Thermal bridges (Default value 0.150 * total exposed area)							100.0000 (35)					
Total fabric heat loss							(33) + (36) = 14.8904 (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	12.2287	12.0928	11.9569	11.2772	11.1413	10.4617	10.4617	10.3258	10.7335	11.1413	11.4132	11.6850 (38)
Heat transfer coeff	27.1191	26.9832	26.8472	26.1676	26.0317	25.3521	25.3521	25.2162	25.6239	26.0317	26.3035	26.5754 (39)
Average = Sum(39)m / 12 =												26.1336 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.4784	0.4760	0.4736	0.4616	0.4592	0.4472	0.4472	0.4448	0.4520	0.4592	0.4640	0.4688 (40)
HLP (average)												0.4610 (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												1.8867 (42)
Average daily hot water use (litres/day)												79.0086 (43)
Daily hot water use	86.9094	83.7491	80.5887	77.4284	74.2680	71.1077	71.1077	74.2680	77.4284	80.5887	83.7491	86.9094 (44)
Energy conte	128.8842	112.7229	116.3199	101.4105	97.3058	83.9675	77.8083	89.2861	90.3525	105.2971	114.9400	124.8174 (45)
Energy content (annual)												Total = Sum(45)m = 1243.1123 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.3326	16.9084	17.4480	15.2116	14.5959	12.5951	11.6712	13.3929	13.5529	15.7946	17.2410	18.7226 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144 (56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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 (58)	
Total heat required for water heating calculated for each month													
	184.1610	162.6503	171.5967	154.9042	152.5826	137.4612	133.0851	144.5629	143.8462	160.5739	168.4337	180.0942 (59)	
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	184.1610	162.6503	171.5967	154.9042	152.5826	137.4612	133.0851	144.5629	143.8462	160.5739	168.4337	180.0942 (64)	
								Total per year (kWh/year) = Sum (64)m =			1893.9521 (64)		
Heat gains from water heating, kWh/month													
	87.0754	77.4223	82.8978	76.5140	76.5756	70.7141	70.0927	73.9091	72.8371	79.2327	81.0125	85.7232 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.6679	13.0279	10.5950	8.0211	5.9959	5.0620	5.4696	7.1096	9.5425	12.1164	14.1416	15.0755 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	164.5289	166.2362	161.9339	152.7747	141.2129	130.3465	123.0870	121.3797	125.6821	134.8412	146.4030	157.2694 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334 (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)	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671 (71)
Water heating gains (Table 5)	117.0369	115.2118	111.4218	106.2694	102.9242	98.2141	94.2106	99.3402	101.1627	106.4956	112.5174	115.2194 (72)
Total internal gains	347.5338	345.7760	335.2508	318.3653	301.4332	284.9227	274.0674	279.1297	287.6874	304.7534	324.3621	338.8645 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
Northeast				11.5920	11.2829	0.5000		0.8000	0.7700		36.2555 (75)	
Solar gains	36.2555	73.7991	132.9625	218.3627	293.5223	312.9259	292.7357	233.3723	162.0169	90.1884	45.6188	29.6081 (83)
Total gains	383.7893	419.5751	468.2133	536.7280	594.9555	597.8485	566.8031	512.5020	449.7044	394.9418	369.9809	368.4726 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.0669	58.3594	58.6549	60.1783	60.4925	62.1141	62.1141	62.4489	61.4551	60.4925	59.8673	59.2549
alpha	4.8711	4.8906	4.9103	5.0119	5.0328	5.1409	5.1409	5.1633	5.0970	5.0328	4.9912	4.9503
util living area	0.8904	0.8443	0.7462	0.5720	0.4043	0.2712	0.1968	0.2262	0.3911	0.6496	0.8281	0.9008 (86)
MIT	20.5435	20.6704	20.8357	20.9602	20.9935	20.9994	20.9999	20.9998	20.9962	20.9412	20.7551	20.5275 (87)
Th 2	20.5407	20.5429	20.5451	20.5562	20.5584	20.5695	20.5695	20.5717	20.5650	20.5584	20.5540	20.5495 (88)
util rest of house	0.8814	0.8327	0.7303	0.5533	0.3856	0.2530	0.1775	0.2052	0.3669	0.6270	0.8140	0.8925 (89)
MIT 2	19.9260	20.1050	20.3334	20.5075	20.5511	20.5689	20.5694	20.5715	20.5611	20.4879	20.2348	19.9112 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.4967 (91)
MIT	20.2327	20.3859	20.5829	20.7324	20.7709	20.7827	20.7832	20.7843	20.7772	20.7131	20.4933	20.2174 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2327	20.3859	20.5829	20.7324	20.7709	20.7827	20.7832	20.7843	20.7772	20.7131	20.4933	20.2174 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8748	0.8285	0.7317	0.5608	0.3946	0.2620	0.1871	0.2157	0.3787	0.6350	0.8120	0.8859 (94)
Useful gains	335.7569	347.6313	342.5794	300.9941	234.7643	156.6264	106.0384	110.5232	170.3247	250.7815	300.4372	326.4121 (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												
	432.0810	417.8577	378.0869	309.6254	236.1300	156.7450	106.0540	110.5548	171.0963	263.2604	352.2899	425.6680 (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												
	71.6651	47.1922	26.4176	6.2145	1.0161	0.0000	0.0000	0.0000	0.0000	9.2843	37.3339	73.8464 (98)
Space heating												272.9702 (99)
Space heating per m2												4.8151 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.09r14

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	272.9702	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	70.9722	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	283.8890	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1893.9521	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	492.4276	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1969.7102	(310b)
Electricity used for heat distribution	28.1700	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	90.7749	(330a)
Total electricity for the above, kWh/year	90.7749	(331)
Electricity for lighting (calculated in Appendix L)	259.0392	(332)
Total delivered energy for all uses	3166.8130	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	593.0524	0.2160	128.0993 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	756.4321	0.2160	163.3893 (363)
less credit emissions for electricity	-280.1068	0.5190	-145.3754 (364)
Water heating from Combined Heat and Power	5248.3618	0.2160	1133.6462 (365)
less credit emissions for electricity	-1943.4684	0.5190	-1008.6601 (366)
Electrical energy for heat distribution	28.1700	0.5190	14.6202 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			285.7195 (373)
Space and water heating			285.7195 (376)
Pumps and fans	90.7749	0.5190	47.1122 (378)
Energy for lighting	259.0392	0.5190	134.4413 (379)
Total CO2, kg/year			467.2730 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2400 (384)

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

DER		8.2400	ZC1
Total Floor Area	TFA	56.6900	
Assumed number of occupants	N	1.8867	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1982	ZC2
CO2 emissions from cooking, equation (L16)		2.8979	ZC3
Total CO2 emissions		28.3360	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		28.3360	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	56.6900 (1b)	x 2.5000 (2b)	= 141.7250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.1411 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3911 (18)
Number of sides sheltered					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3031 (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	0.3865	0.3789	0.3713	0.3334	0.3259	0.2880	0.2880	0.2804	0.3031	0.3259	0.3410	0.3562 (22b)
Effective ac	0.5747	0.5718	0.5689	0.5556	0.5531	0.5415	0.5415	0.5393	0.5459	0.5531	0.5581	0.5634 (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 Opening Type (Uw = 1.40)			11.5900	1.3258	15.3655			(27)					
External Wall 1	18.0683	11.5920	6.4763	0.1800	1.1657			(29a)					
Total net area of external elements Aum(A, m2)			18.0663					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			16.5313		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								0.9033 (36)					
Total fabric heat loss						(33) + (36) =	17.4346	(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	26.8774	26.7418	26.6088	25.9844	25.8676	25.3237	25.3237	25.2230	25.5332	25.8676	26.1039	26.3510	(38)
Heat transfer coeff	44.3120	44.1764	44.0434	43.4190	43.3021	42.7583	42.7583	42.6576	42.9678	43.3021	43.5385	43.7856	(39)
Average = Sum(39)m / 12 =												43.4184	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7817	0.7793	0.7769	0.7659	0.7638	0.7542	0.7542	0.7525	0.7579	0.7638	0.7680	0.7724	(40)
HLP (average)												0.7659	(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												1.8867 (42)
Average daily hot water use (litres/day)												79.0086 (43)
Daily hot water use	86.9094	83.7491	80.5887	77.4284	74.2680	71.1077	71.1077	74.2680	77.4284	80.5887	83.7491	86.9094 (44)
Energy conte	128.8842	112.7229	116.3199	101.4105	97.3058	83.9675	77.8083	89.2861	90.3525	105.2971	114.9400	124.8174 (45)
Energy content (annual)										Total = Sum(45)m =		1243.1123 (45)
Distribution loss (46)m = 0.15 x (45)m	19.3326	16.9084	17.4480	15.2116	14.5959	12.5951	11.6712	13.3929	13.5529	15.7946	17.2410	18.7226 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	175.4791	154.8086	162.9148	146.5024	143.9007	129.0594	124.4032	135.8810	135.4443	151.8920	160.0319	171.4123 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	175.4791	154.8086	162.9148	146.5024	143.9007	129.0594	124.4032	135.8810	135.4443	151.8920	160.0319	171.4123 (64)
	80.1299	71.1489	75.9523	69.7925	69.6301	63.9927	63.1472	66.9636	66.1157	72.2872	74.2910	78.7777 (65)
								Total per year (kWh/year) =	Sum (64)m =			1791.7297 (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	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	94.3338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.7395	13.0915	10.6467	8.0602	6.0251	5.0867	5.4963	7.1443	9.5891	12.1756	14.2107	15.1491	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	164.5289	166.2362	161.9339	152.7747	141.2129	130.3465	123.0870	121.3797	125.6821	134.8412	146.4030	157.2694	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	32.4334	(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)	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	-75.4671	(71)
Water heating gains (Table 5)	107.7015	105.8764	102.0864	96.9340	93.5889	88.8787	84.8752	90.0048	91.8273	97.1602	103.1820	105.8840	(72)
Total internal gains	341.2700	339.5042	328.9671	312.0691	295.1271	278.6120	267.7587	272.8290	281.3986	298.4771	318.0958	332.6027	(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		
-----								-----			-----		
Northeast				11.5920	11.2829	0.6300	0.7000			0.7700	39.9717 (75)		
-----								-----			-----		
Solar gains	39.9717	81.3635	146.5912	240.7449	323.6084	345.0008	322.7411	257.2930	178.6237	99.4327	50.2947	32.6429	(83)
Total gains	381.2417	420.8677	475.5583	552.8140	618.7354	623.6128	590.4999	530.1220	460.0223	397.9098	368.3905	365.2456	(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	88.8429	89.1157	89.3847	90.6702	90.9148	92.0712	92.0712	92.2885	91.6223	90.9148	90.4213	89.9110	
alpha	6.9229	6.9410	6.9590	7.0447	7.0610	7.1381	7.1381	7.1526	7.1082	7.0610	7.0281	6.9941	
util living area	0.9951	0.9891	0.9637	0.8523	0.6396	0.4381	0.3185	0.3700	0.6341	0.9230	0.9878	0.9962	(86)
MIT	20.3596	20.4760	20.6795	20.9034	20.9875	20.9992	20.9999	20.9998	20.9915	20.8520	20.5704	20.3387	(87)
Th 2	20.2693	20.2713	20.2734	20.2830	20.2848	20.2932	20.2932	20.2947	20.2899	20.2848	20.2811	20.2773	(88)
util rest of house	0.9936	0.9859	0.9536	0.8216	0.5941	0.3901	0.2674	0.3133	0.5731	0.8977	0.9837	0.9951	(89)
MIT 2	19.4140	19.5841	19.8747	20.1785	20.2740	20.2927	20.2931	20.2946	20.2839	20.1225	19.7295	19.3901	(90)
Living area fraction									fLA = Living area / (4) =			0.4967	(91)
MIT	19.8837	20.0271	20.2745	20.5386	20.6284	20.6437	20.6442	20.6449	20.6354	20.4849	20.1472	19.8613	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8837	20.0271	20.2745	20.5386	20.6284	20.6437	20.6442	20.6449	20.6354	20.4849	20.1472	19.8613	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9926	0.9847	0.9536	0.8330	0.6162	0.4139	0.2928	0.3415	0.6032	0.9055	0.9827	0.9943	(94)
Ext temp.	378.4214	414.4111	453.5039	460.5182	381.2574	258.1350	172.9052	181.0234	277.4742	360.2963	362.0227	363.1482	(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	690.5439	668.2622	606.6750	505.3355	386.6204	258.4164	172.9243	181.0783	280.8106	428.0366	568.0561	685.7391	(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	232.2192	170.5880	113.9593	32.2685	3.9901	0.0000	0.0000	0.0000	0.0000	50.3988	148.3441	240.0076	(98)
Space heating per m2												991.7755	(98)
												17.4947	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1060.7224 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	232.2192	170.5880	113.9593	32.2685	3.9901	0.0000	0.0000	0.0000	0.0000	50.3988	148.3441	240.0076	(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)	248.3627	182.4470	121.8816	34.5117	4.2675	0.0000	0.0000	0.0000	0.0000	53.9024	158.6568	256.6926	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	175.4791	154.8086	162.9148	146.5024	143.9007	129.0594	124.4032	135.8810	135.4443	151.8920	160.0319	171.4123	(64)
Efficiency of water heater	85.5620	85.0731	83.8820	81.5402	80.0554	79.8000	79.8000	79.8000	79.8000	82.2220	84.6124	85.7117	(216)
(217)m	85.5620	85.0731	83.8820	81.5402	80.0554	79.8000	79.8000	79.8000	79.8000	82.2220	84.6124	85.7117	(217)
Fuel for water heating, kWh/month	205.0899	181.9714	194.2191	179.6690	179.7515	161.7285	155.8937	170.2770	169.7297	184.7341	189.1353	199.9870	(219)
Water heating fuel used												2172.1862	(219)
Annual totals kWh/year													
Space heating fuel - main system												1060.7224	(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)												260.3037	(232)
Total delivered energy for all uses												3568.2124	(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	1060.7224	0.2160	229.1160 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2172.1862	0.2160	469.1922 (264)
Space and water heating			698.3083 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	260.3037	0.5190	135.0976 (268)
Total CO2, kg/m2/year			872.3309 (272)
Emissions per m2 for space and water heating			12.3180 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3831 (272b)
Emissions per m2 for pumps and fans			0.6866 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.3180 * 1.00) + 2.3831 + 0.6866, rounded to 2 d.p.			15.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000294_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.05_2B		
Property					
SAP Rating	86 B	DER	8.34	TER	14.11
Environmental	93 A	% DER<TER	40.91		
CO ₂ Emissions (t/year)	0.70	DFEE	35.66	TFEE	37.92
General Requirements Compliance	Fail	% DFEE<TFEE	5.96		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 96 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.11 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.34 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)37.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)35.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.44
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	16.68 m ² , No overhang
Windows facing North West:	7.62 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	96.4800 (1b)	x 2.5000 (2b)	= 241.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 241.2000 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour		
					heating		heating						
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test											Yes		
Measured/design AP50											3.0000		
Infiltration rate											0.1500 (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) =		0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation:												0.5000 (23a)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)	
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			24.3000	1.3258	32.2159		(27)					
External Wall 1	49.3998	24.3000	25.0998	0.1600	4.0160		(29a)					
Total net area of external elements Aum(A, m2)			49.3998				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...	(30) + (32) =	36.2319		(33)					
Party Floor 1			96.4800				(32d)					
Party Ceilings 1			96.4800				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							7.4100 (36)					
Total fabric heat loss	(33) + (36) =						43.6418 (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	21.9536	21.6999	21.4461	20.1776	19.9239	18.6553	18.6553	18.4016	19.1627	19.9239	20.4313	20.9387 (38)
Heat transfer coeff	65.5954	65.3417	65.0880	63.8194	63.5657	62.2972	62.2972	62.0434	62.8046	63.5657	64.0731	64.5806 (39)
Average = Sum(39)m / 12 =												63.7560 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6799	0.6773	0.6746	0.6615	0.6588	0.6457	0.6457	0.6431	0.6510	0.6588	0.6641	0.6694 (40)
HLP (average)												0.6608 (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												2.7045 (42)
Average daily hot water use (litres/day)												98.4310 (43)
Daily hot water use	Jan 108.2741	Feb 104.3369	Mar 100.3996	Apr 96.4624	May 92.5251	Jun 88.5879	Jul 88.5879	Aug 92.5251	Sep 96.4624	Oct 100.3996	Nov 104.3369	Dec 108.2741 (44)
Energy conte	160.5674	140.4332	144.9145	126.3400	121.2262	104.6090	96.9356	111.2351	112.5636	131.1820	143.1954	155.5009 (45)
Energy content (annual)												Total = Sum(45)m = 1548.7030 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0851	21.0650	21.7372	18.9510	18.1839	15.6914	14.5403	16.6853	16.8845	19.6773	21.4793	23.3251 (46)
Water storage loss:												110.0000 (47)
Store volume												

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	215.8442	190.3607	200.1913	179.8337	176.5030	158.1027	152.2124	166.5119	166.0572	186.4588	196.6891	210.7777 (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	215.8442	190.3607	200.1913	179.8337	176.5030	158.1027	152.2124	166.5119	166.0572	186.4588	196.6891	210.7777 (64)	
												Total per year (kWh/year) = Sum (64)m =	2199.5428 (64)
Heat gains from water heating, kWh/month													
	97.6101	86.6360	92.4055	84.8030	84.5292	77.5774	76.4525	81.2071	80.2223	87.8395	90.4074	95.9255 (65)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9523	0.9350	0.8941	0.7988	0.6468	0.4664	0.3367	0.3859	0.6256	0.8458	0.9304	0.9576 (94)
Useful gains	488.7126	521.9752	552.2723	559.8247	498.3718	359.6039	245.8943	255.4030	365.7801	438.8209	456.7905	471.2914 (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	959.5676	931.4397	850.2375	713.7334	554.0689	371.3430	248.4395	259.6276	401.0063	600.6298	789.9501	949.4985 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	350.3161	275.1601	221.6861	110.8143	41.4386	0.0000	0.0000	0.0000	0.0000	120.3858	239.8749	355.7860 (98)
Space heating												1715.4621 (99)
Space heating per m2												17.7805 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	1715.4621 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	446.0201 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1784.0805 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2199.5428 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	571.8811 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2287.5245 (310b)
Electricity used for heat distribution	50.8951 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	161.8452 (330a)
Total electricity for the above, kWh/year	161.8452 (331)
Electricity for lighting (calculated in Appendix L)	394.4078 (332)
Total delivered energy for all uses	5645.7593 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1071.4750	0.2160	231.4386 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	4753.7451	0.2160	1026.8089 (363)
less credit emissions for electricity	-1760.3118	0.5190	-913.6018 (364)
Water heating from Combined Heat and Power	6095.1891	0.2160	1316.5609 (365)
less credit emissions for electricity	-2257.0485	0.5190	-1171.4082 (366)
Electrical energy for heat distribution	50.8951	0.5190	26.4145 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			516.2129 (373)
Space and water heating			516.2129 (376)
Pumps and fans	161.8452	0.5190	83.9977 (378)
Energy for lighting	394.4078	0.5190	204.6977 (379)
Total CO2, kg/year			804.9082 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3400 (384)

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

DER		8.3400 ZC1
Total Floor Area	TFA	96.4800
Assumed number of occupants	N	2.7045
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.3862 ZC2
CO2 emissions from cooking, equation (L16)		1.9062 ZC3
Total CO2 emissions		25.6324 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		25.6324 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	96.4800 (1b)	x 2.5000 (2b)	= 241.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 241.2000 (5)

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)
								Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1244	(8)
Pressure test							Yes		
Measured/design AP50								5.0000	
Infiltration rate								0.3744	(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) =	0.3182	(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												
	0.4057	0.3978	0.3898	0.3500	0.3421	0.3023	0.3023	0.2944	0.3182	0.3421	0.3580	0.3739 (22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699 (25)

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 Opening Type (Uw = 1.40)			24.1200	1.3258	31.9773			(27)					
External Wall 1	49.3998	24.1200	25.2798	0.1800	4.5504			(29a)					
Total net area of external elements Aum(A, m2)			49.3998					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			36.5276		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal Bridges (User defined value 0.050 * total exposed area)							2.4700	(36)					
Total fabric heat loss						(33) + (36) =	38.9976	(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	46.3495	46.0951	45.8457	44.6745	44.4553	43.4352	43.4352	43.2463	43.8281	44.4553	44.8986	45.3621	(38)
Heat transfer coeff	85.3471	85.0927	84.8434	83.6721	83.4530	82.4328	82.4328	82.2439	82.8258	83.4530	83.8963	84.3597	(39)
Average = Sum(39)m / 12 =												83.6710	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8846	0.8820	0.8794	0.8672	0.8650	0.8544	0.8544	0.8524	0.8585	0.8650	0.8696	0.8744	(40)
HLP (average)												0.8672	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

Assumed occupancy												2.7045 (42)
Average daily hot water use (litres/day)												98.4310 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	108.2741	104.3369	100.3996	96.4624	92.5251	88.5879	88.5879	92.5251	96.4624	100.3996	104.3369	108.2741 (44)
Energy conte	160.5674	140.4332	144.9145	126.3400	121.2262	104.6090	96.9356	111.2351	112.5636	131.1820	143.1954	155.5009 (45)
Energy content (annual)											Total = Sum(45)m =	1548.7030 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.0851	21.0650	21.7372	18.9510	18.1839	15.6914	14.5403	16.6853	16.8845	19.6773	21.4793	23.3251 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	207.1623	182.5190	191.5094	171.4318	167.8211	149.7009	143.5305	157.8300	157.6554	177.7769	188.2872	202.0958 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	207.1623	182.5190	191.5094	171.4318	167.8211	149.7009	143.5305	157.8300	157.6554	177.7769	188.2872	202.0958 (64)
	90.6646	80.3626	85.4600	78.0815	77.5836	70.8560	69.5070	74.2616	73.5009	80.8939	83.6859	88.9800 (65)
								Total per year (kWh/year) =	Sum (64)m =			2097.3204 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	22.3330	19.8360	16.1317	12.2127	9.1292	7.7072	8.3279	10.8250	14.5292	18.4482	21.5318	22.9537 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	250.5084	253.1079	246.5572	232.6117	215.0080	198.4629	187.4098	184.8103	191.3610	205.3065	222.9103	239.4553 (68)
Pumps, fans	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785 (71)
Total internal gains	121.8610	119.5872	114.8656	108.4466	104.2791	98.4111	93.4234	99.8140	102.0845	108.7284	116.2305	119.5967 (72)
	461.2693	459.0980	444.1215	419.8379	394.9832	371.1482	355.7281	362.0162	374.5417	399.0501	427.2394	448.5727 (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	
Northeast					16.5600	11.2829	0.6300	0.7000	0.7700		57.1024 (75)	
Northwest					7.5600	11.2829	0.6300	0.7000	0.7700		26.0685 (81)	
Solar gains	83.1709	169.2968	305.0190	500.9288	673.3466	717.8587	671.5421	535.3612	371.6704	206.8941	104.6505	67.9215 (83)
Total gains	544.4402	628.3948	749.1405	920.7667	1068.3297	1089.0069	1027.2702	897.3774	746.2121	605.9442	531.8900	516.4942 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	78.5029	78.7376	78.9691	80.0745	80.2848	81.2783	81.2783	81.4650	80.8927	80.2848	79.8605	79.4218
util living area	6.2335	6.2492	6.2646	6.3383	6.3523	6.4186	6.4186	6.4310	6.3928	6.3523	6.3240	6.2948
	0.9985	0.9958	0.9820	0.9011	0.6976	0.4821	0.3528	0.4206	0.7280	0.9668	0.9962	0.9989 (86)
MIT	20.0981	20.2384	20.4936	20.8125	20.9684	20.9973	20.9997	20.9991	20.9710	20.7104	20.3473	20.0763 (87)
Th 2	20.1806	20.1829	20.1851	20.1954	20.1974	20.2064	20.2064	20.2081	20.2029	20.1974	20.1934	20.1893 (88)
util rest of house	0.9980	0.9945	0.9762	0.8747	0.6464	0.4234	0.2893	0.3487	0.6582	0.9525	0.9947	0.9985 (89)
MIT 2	18.9641	19.1703	19.5406	19.9855	20.1695	20.2048	20.2063	20.2078	20.1814	19.8609	19.3379	18.9388 (90)
Living area fraction									fLA = Living area / (4) =			0.3377 (91)
MIT	19.3470	19.5310	19.8624	20.2647	20.4392	20.4724	20.4742	20.4750	20.4480	20.1478	19.6788	19.3229 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3470	19.5310	19.8624	20.2647	20.4392	20.4724	20.4742	20.4750	20.4480	20.1478	19.6788	19.3229 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9973	0.9930	0.9734	0.8772	0.6623	0.4432	0.3108	0.3731	0.6806	0.9514	0.9934	0.9980 (94)
Ext temp.	542.9470	624.0242	729.1996	807.7285	707.5209	482.5988	319.2421	334.7704	507.8704	576.5215	528.4034	515.4560 (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	1284.2206	1244.9895	1133.7114	950.9107	729.3148	484.0799	319.3639	335.1433	525.7784	796.7886	1055.3117	1275.7618 (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	551.5075	417.2887	300.9567	103.0912	16.2146	0.0000	0.0000	0.0000	0.0000	163.8787	379.3740	565.6675 (98)
Space heating per m2												2497.9791 (98)
										(98) / (4) =		25.8912 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2671.6354 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	551.5075	417.2887	300.9567	103.0912	16.2146	0.0000	0.0000	0.0000	0.0000	163.8787	379.3740	565.6675	(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)	589.8476	446.2981	321.8789	110.2580	17.3419	0.0000	0.0000	0.0000	0.0000	175.2714	405.7476	604.9920	(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	207.1623	182.5190	191.5094	171.4318	167.8211	149.7009	143.5305	157.8300	157.6554	177.7769	188.2872	202.0958	(64)
Efficiency of water heater	87.3035	86.9522	86.0149	83.5077	80.6400	79.8000	79.8000	79.8000	79.8000	84.5976	86.6464	87.4147	(217)
Fuel for water heating, kWh/month	237.2897	209.9072	222.6467	205.2887	208.1115	187.5951	179.8628	197.7819	197.5632	210.1440	217.3052	231.1920	(219)
Water heating fuel used												2504.6880	(219)
Annual totals kWh/year													
Space heating fuel - main system												2671.6354	(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)												394.4078	(232)
Total delivered energy for all uses												5645.7312	(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	2671.6354	0.2160	577.0732 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2504.6880	0.2160	541.0126 (264)
Space and water heating			1118.0859 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.4078	0.5190	204.6977 (268)
Total CO2, kg/m2/year			1361.7085 (272)
Emissions per m2 for space and water heating			11.5888 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1217 (272b)
Emissions per m2 for pumps and fans			0.4035 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.5888 * 1.00) + 2.1217 + 0.4035, rounded to 2 d.p.			14.1100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000338_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.05_2B		
Property					
SAP Rating	87 B	DER	7.50	TER	14.11
Environmental	94 A	% DER<TER	46.86		
CO ₂ Emissions (t/year)	0.65	DFEE	29.42	TFEE	37.92
General Requirements Compliance	Fail	% DFEE<TFEE	22.41		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 96 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 (c)
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.11 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.50 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 37.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 29.4 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room stats	OK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.44	
Maximum	1.5	OK
MVHR efficiency:	91%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	16.68 m ² , No overhang
Windows facing North West:	7.62 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	96.4800 (1b)	x 2.5000 (2b)	= 241.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 241.2000 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour		
					heating		heating						
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test											Yes		
Measured/design AP50											3.0000		
Infiltration rate											0.1500 (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) =		0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation:												0.5000 (23a)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)	
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			24.3000	0.9615	23.3654		(27)					
External Wall 1	49.3998	24.3000	25.0998	0.1600	4.0160		(29a)					
Total net area of external elements Aum(A, m2)			49.3998				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.3814		(33)					
Party Floor 1			96.4800				(32d)					
Party Ceilings 1			96.4800				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							7.4100 (36)					
Total fabric heat loss							(33) + (36) = 34.7913 (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	21.9536	21.6999	21.4461	20.1776	19.9239	18.6553	18.6553	18.4016	19.1627	19.9239	20.4313	20.9387 (38)
Heat transfer coeff	56.7449	56.4912	56.2375	54.9689	54.7152	53.4466	53.4466	53.1929	53.9541	54.7152	55.2226	55.7300 (39)
Average = Sum(39)m / 12 =												54.9055 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.5882	0.5855	0.5829	0.5697	0.5671	0.5540	0.5540	0.5513	0.5592	0.5671	0.5724	0.5776 (40)
HLP (average)												0.5691 (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												2.7045 (42)
Average daily hot water use (litres/day)												98.4310 (43)
Daily hot water use	Jan 108.2741	Feb 104.3369	Mar 100.3996	Apr 96.4624	May 92.5251	Jun 88.5879	Jul 88.5879	Aug 92.5251	Sep 96.4624	Oct 100.3996	Nov 104.3369	Dec 108.2741 (44)
Energy conte	160.5674	140.4332	144.9145	126.3400	121.2262	104.6090	96.9356	111.2351	112.5636	131.1820	143.1954	155.5009 (45)
Energy content (annual)												Total = Sum(45)m = 1548.7030 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0851	21.0650	21.7372	18.9510	18.1839	15.6914	14.5403	16.6853	16.8845	19.6773	21.4793	23.3251 (46)
Water storage loss:												110.0000 (47)
Store volume												

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	215.8442	190.3607	200.1913	179.8337	176.5030	158.1027	152.2124	166.5119	166.0572	186.4588	196.6891	210.7777 (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	215.8442	190.3607	200.1913	179.8337	176.5030	158.1027	152.2124	166.5119	166.0572	186.4588	196.6891	210.7777 (64)	
												Total per year (kWh/year) = Sum (64)m =	2199.5428 (64)
Heat gains from water heating, kWh/month													
	97.6101	86.6360	92.4055	84.8030	84.5292	77.5774	76.4525	81.2071	80.2223	87.8395	90.4074	95.9255 (65)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9388	0.9049	0.8253	0.6590	0.4684	0.3113	0.2216	0.2630	0.4767	0.7652	0.9045	0.9468 (94)
Useful gains	510.3557	561.1775	601.7587	582.4961	476.1360	321.6976	216.1786	225.5776	343.4811	454.8816	478.6834	489.4868 (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	857.1684	834.9068	764.1483	636.0500	487.3997	323.1252	216.4219	226.0764	351.8576	535.0928	704.3065	845.5743 (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	258.0286	183.9461	120.8179	38.5588	8.3802	0.0000	0.0000	0.0000	0.0000	59.6771	162.4486	264.9291 (98)
Space heating												1096.7863 (98)
Space heating per m2										(98) / (4) =		11.3680 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	1096.7863 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	285.1644 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1140.6578 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2199.5428 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	571.8811 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2287.5245 (310b)
Electricity used for heat distribution	42.8523 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	161.8452 (330a)
Total electricity for the above, kWh/year	161.8452 (331)
Electricity for lighting (calculated in Appendix L)	394.4078 (332)
Total delivered energy for all uses	4841.4809 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	902.1532	0.2160	194.8651 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	3039.3226	0.2160	656.4937 (363)
less credit emissions for electricity	-1125.4612	0.5190	-584.1143 (364)
Water heating from Combined Heat and Power	6095.1891	0.2160	1316.5609 (365)
less credit emissions for electricity	-2257.0485	0.5190	-1171.4082 (366)
Electrical energy for heat distribution	42.8523	0.5190	22.2403 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			434.6374 (373)
Space and water heating			434.6374 (376)
Pumps and fans	161.8452	0.5190	83.9977 (378)
Energy for lighting	394.4078	0.5190	204.6977 (379)
Total CO2, kg/year			723.3328 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.5000 (384)

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

DER		7.5000 ZC1
Total Floor Area	TFA	96.4800
Assumed number of occupants	N	2.7045
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.3862 ZC2
CO2 emissions from cooking, equation (L16)		1.9062 ZC3
Total CO2 emissions		24.7924 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		24.7924 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	96.4800 (1b)	x 2.5000 (2b)	= 241.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 241.2000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1244 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3744 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3182 (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	0.4057	0.3978	0.3898	0.3500	0.3421	0.3023	0.3023	0.2944	0.3182	0.3421	0.3580	0.3739 (22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699 (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 Opening Type (Uw = 1.40)			24.1200	1.3258	31.9773			(27)					
External Wall 1	49.3998	24.1200	25.2798	0.1800	4.5504			(29a)					
Total net area of external elements Aum(A, m2)			49.3998					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			36.5276		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								2.4700 (36)					
Total fabric heat loss						(33) + (36) =	38.9976	(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	46.3495	46.0951	45.8457	44.6745	44.4553	43.4352	43.4352	43.2463	43.8281	44.4553	44.8986	45.3621	(38)
Heat transfer coeff	85.3471	85.0927	84.8434	83.6721	83.4530	82.4328	82.4328	82.2439	82.8258	83.4530	83.8963	84.3597	(39)
Average = Sum(39)m / 12 =												83.6710	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8846	0.8820	0.8794	0.8672	0.8650	0.8544	0.8544	0.8524	0.8585	0.8650	0.8696	0.8744	(40)
HLP (average)												0.8672	(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												2.7045 (42)
Average daily hot water use (litres/day)												98.4310 (43)
Daily hot water use	108.2741	104.3369	100.3996	96.4624	92.5251	88.5879	88.5879	92.5251	96.4624	100.3996	104.3369	108.2741 (44)
Energy conte	160.5674	140.4332	144.9145	126.3400	121.2262	104.6090	96.9356	111.2351	112.5636	131.1820	143.1954	155.5009 (45)
Energy content (annual)										Total = Sum(45)m =		1548.7030 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0851	21.0650	21.7372	18.9510	18.1839	15.6914	14.5403	16.6853	16.8845	19.6773	21.4793	23.3251 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	207.1623	182.5190	191.5094	171.4318	167.8211	149.7009	143.5305	157.8300	157.6554	177.7769	188.2872	202.0958 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	207.1623	182.5190	191.5094	171.4318	167.8211	149.7009	143.5305	157.8300	157.6554	177.7769	188.2872	202.0958 (64)
	90.6646	80.3626	85.4600	78.0815	77.5836	70.8560	69.5070	74.2616	73.5009	80.8939	83.6859	88.9800 (65)
								Total per year (kWh/year) =	Sum (64)m =			2097.3204 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232	135.2232 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	22.3330	19.8360	16.1317	12.2127	9.1292	7.7072	8.3279	10.8250	14.5292	18.4482	21.5318	22.9537 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	250.5084	253.1079	246.5572	232.6117	215.0080	198.4629	187.4098	184.8103	191.3610	205.3065	222.9103	239.4553 (68)
Pumps, fans	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223	36.5223 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785	-108.1785 (71)
Total internal gains	121.8610	119.5872	114.8656	108.4466	104.2791	98.4111	93.4234	99.8140	102.0845	108.7284	116.2305	119.5967 (72)
	461.2693	459.0980	444.1215	419.8379	394.9832	371.1482	355.7281	362.0162	374.5417	399.0501	427.2394	448.5727 (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	
Northeast					16.5600	11.2829	0.6300	0.7000	0.7700		57.1024 (75)	
Northwest					7.5600	11.2829	0.6300	0.7000	0.7700		26.0685 (81)	
Solar gains	83.1709	169.2968	305.0190	500.9288	673.3466	717.8587	671.5421	535.3612	371.6704	206.8941	104.6505	67.9215 (83)
Total gains	544.4402	628.3948	749.1405	920.7667	1068.3297	1089.0069	1027.2702	897.3774	746.2121	605.9442	531.8900	516.4942 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	78.5029	78.7376	78.9691	80.0745	80.2848	81.2783	81.2783	81.4650	80.8927	80.2848	79.8605	79.4218
util living area	6.2335	6.2492	6.2646	6.3383	6.3523	6.4186	6.4186	6.4310	6.3928	6.3523	6.3240	6.2948
	0.9985	0.9958	0.9820	0.9011	0.6976	0.4821	0.3528	0.4206	0.7280	0.9668	0.9962	0.9989 (86)
MIT	20.0981	20.2384	20.4936	20.8125	20.9684	20.9973	20.9997	20.9991	20.9710	20.7104	20.3473	20.0763 (87)
Th 2	20.1806	20.1829	20.1851	20.1954	20.1974	20.2064	20.2064	20.2081	20.2029	20.1974	20.1934	20.1893 (88)
util rest of house	0.9980	0.9945	0.9762	0.8747	0.6464	0.4234	0.2893	0.3487	0.6582	0.9525	0.9947	0.9985 (89)
MIT 2	18.9641	19.1703	19.5406	19.9855	20.1695	20.2048	20.2063	20.2078	20.1814	19.8609	19.3379	18.9388 (90)
Living area fraction									fLA = Living area / (4) =			0.3377 (91)
MIT	19.3470	19.5310	19.8624	20.2647	20.4392	20.4724	20.4742	20.4750	20.4480	20.1478	19.6788	19.3229 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3470	19.5310	19.8624	20.2647	20.4392	20.4724	20.4742	20.4750	20.4480	20.1478	19.6788	19.3229 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9973	0.9930	0.9734	0.8772	0.6623	0.4432	0.3108	0.3731	0.6806	0.9514	0.9934	0.9980 (94)
Ext temp.	542.9470	624.0242	729.1996	807.7285	707.5209	482.5988	319.2421	334.7704	507.8704	576.5215	528.4034	515.4560 (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	1284.2206	1244.9895	1133.7114	950.9107	729.3148	484.0799	319.3639	335.1433	525.7784	796.7886	1055.3117	1275.7618 (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	551.5075	417.2887	300.9567	103.0912	16.2146	0.0000	0.0000	0.0000	0.0000	163.8787	379.3740	565.6675 (98)
Space heating per m2												2497.9791 (98)
										(98) / (4) =		25.8912 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2671.6354 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	551.5075	417.2887	300.9567	103.0912	16.2146	0.0000	0.0000	0.0000	0.0000	163.8787	379.3740	565.6675	(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)	589.8476	446.2981	321.8789	110.2580	17.3419	0.0000	0.0000	0.0000	0.0000	175.2714	405.7476	604.9920	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	207.1623	182.5190	191.5094	171.4318	167.8211	149.7009	143.5305	157.8300	157.6554	177.7769	188.2872	202.0958	(64)
Efficiency of water heater	87.3035	86.9522	86.0149	83.5077	80.6400	79.8000	79.8000	79.8000	79.8000	84.5976	86.6464	87.4147	(217)
Fuel for water heating, kWh/month	237.2897	209.9072	222.6467	205.2887	208.1115	187.5951	179.8628	197.7819	197.5632	210.1440	217.3052	231.1920	(219)
Water heating fuel used												2504.6880	(219)
Annual totals kWh/year													
Space heating fuel - main system												2671.6354	(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)												394.4078	(232)
Total delivered energy for all uses												5645.7312	(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	2671.6354	0.2160	577.0732 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2504.6880	0.2160	541.0126 (264)
Space and water heating			1118.0859 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.4078	0.5190	204.6977 (268)
Total CO2, kg/m2/year			1361.7085 (272)
Emissions per m2 for space and water heating			11.5888 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1217 (272b)
Emissions per m2 for pumps and fans			0.4035 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.5888 * 1.00) + 2.1217 + 0.4035, rounded to 2 d.p.			14.1100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000366_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.06_3B		
Property					
SAP Rating	86 B	DER	8.32	TER	13.20
Environmental	93 A	% DER<TER	36.99		
CO ₂ Emissions (t/year)	0.75	DFEE	37.17	TFEE	35.08
General Requirements Compliance	Fail	% DFEE<TFEE	-5.98		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 103 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.20 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.32 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)35.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.2 kWh/m²/yrFail
Excess energy =2.1 kWh/m²/yr (6.0%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.44
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail
Based on:		
Overshading:	Average	
Windows facing North East:	13.20 m ² , No overhang	
Windows facing South East:	15.60 m ² , No overhang	
Air change rate:	2.00 ach	
Blinds/curtains:	None	

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	102.8600 (1b)	x 2.5000 (2b)	= 257.1500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 257.1500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (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) =				0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			28.8000	1.3258	38.1818		(27)					
External Wall 1	66.5127	28.8000	37.7127	0.1600	6.0340		(29a)					
Total net area of external elements Aum(A, m2)			66.5127				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		44.2159		(33)					
Party Floor 1			102.8600				(32d)					
Party Ceilings 1			102.8600				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							9.9769 (36)					
Total fabric heat loss						(33) + (36) =	54.1928 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 23.4053	Feb 23.1348	Mar 22.8643	Apr 21.5119	May 21.2414	Jun 19.8889	Jul 19.8889	Aug 19.6185	Sep 20.4299	Oct 21.2414	Nov 21.7824	Dec 22.3234 (38)
Heat transfer coeff	77.5981	77.3276	77.0571	75.7046	75.4341	74.0817	74.0817	73.8112	74.6227	75.4341	75.9751	76.5161 (39)
Average = Sum(39)m / 12 =												75.6370 (39)
HLP	Jan 0.7544	Feb 0.7518	Mar 0.7491	Apr 0.7360	May 0.7334	Jun 0.7202	Jul 0.7202	Aug 0.7176	Sep 0.7255	Oct 0.7334	Nov 0.7386	Dec 0.7439 (40)
HLP (average)												0.7353 (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												2.7645 (42)
Average daily hot water use (litres/day)												99.8562 (43)
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418 (44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524 (45)
Energy content (annual)												Total = Sum(45)m = 1571.1266 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629 (46)
Water storage loss:												
Store volume												110.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	218.1690	192.3940	202.2895	181.6630	178.2583	159.6173	153.6160	168.1224	167.6870	188.3582	198.7624	213.0292 (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													
	218.1690	192.3940	202.2895	181.6630	178.2583	159.6173	153.6160	168.1224	167.6870	188.3582	198.7624	213.0292 (64)	
								Total per year (kWh/year) = Sum(64)m =					2221.9664 (64)
Heat gains from water heating, kWh/month													
	98.3831	87.3121	93.1032	85.4112	85.1128	78.0811	76.9192	81.7426	80.7642	88.4710	91.0968	96.6741 (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	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235 (66)
Lighting gains	(calculated in Appendix L, equation L9 or L9a), also see Table 5											
	23.2568	20.6565	16.7990	12.7179	9.5068	8.0260	8.6724	11.2727	15.1302	19.2113	22.4224	23.9031 (67)
Appliances gains	(calculated in Appendix L, equation L13 or L13a), also see Table 5											
	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599 (68)
Cooking gains	(calculated in Appendix L, equation L15 or L15a), also see Table 5											
	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224 (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)											
	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788 (71)
Water heating gains	(Table 5)											
	132.2354	129.9287	125.1387	118.6267	114.3989	108.4459	103.3860	109.8691	112.1726	118.9126	126.5233	129.9383 (72)
Total internal gains												
	480.8293	478.6294	463.1603	438.0449	412.2741	387.6110	371.6872	378.0635	391.0461	416.3896	445.5433	467.6684 (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	
Northeast				13.2000	11.2829	0.3000		0.8000		0.7700	24.7708 (75)	
Southeast				15.6000	36.7938	0.3000		0.8000		0.7700	95.4650 (77)	

Solar gains	120.2358	213.0339	313.3371	424.8716	509.3275	520.3516	495.5539	430.2976	351.6078	241.3405	145.5132	101.9272 (83)
Total gains	601.0652	691.6633	776.4973	862.9165	921.6015	907.9625	867.2411	808.3611	742.6538	657.7301	591.0564	569.5957 (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	36.8208	36.9496	37.0793	37.7417	37.8770	38.5685	38.5685	38.7099	38.2889	37.8770	37.6073	37.3414
alpha	3.4547	3.4633	3.4720	3.5161	3.5251	3.5712	3.5712	3.5807	3.5526	3.5251	3.5072	3.4894
util living area												
	0.9610	0.9374	0.8927	0.8012	0.6632	0.4963	0.3687	0.4089	0.6220	0.8420	0.9380	0.9666 (86)
MIT												
Th 2	19.5543	19.7979	20.1445	20.5445	20.8167	20.9521	20.9872	20.9816	20.8921	20.5317	19.9838	19.5145 (87)
util rest of house												
	20.2930	20.2953	20.2976	20.3091	20.3115	20.3230	20.3230	20.3253	20.3184	20.3115	20.3068	20.3022 (88)
MIT 2												
	0.9561	0.9299	0.8800	0.7789	0.6286	0.4500	0.3144	0.3525	0.5749	0.8190	0.9293	0.9624 (89)
Living area fraction	18.3287	18.6801	19.1753	19.7402	20.1024	20.2771	20.3136	20.3111	20.2077	19.7349	18.9595	18.2775 (90)
MIT												
	18.7115	19.0293	19.4780	19.9914	20.3255	20.4879	20.5240	20.5205	20.4215	19.9838	19.2794	18.6639 (92)
Temperature adjustment												
adjusted MIT	18.7115	19.0293	19.4780	19.9914	20.3255	20.4879	20.5240	20.5205	20.4215	19.9838	19.2794	18.6639 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9422	0.9134	0.8629	0.7678	0.6293	0.4615	0.3307	0.3691	0.5823	0.8067	0.9135	0.9496 (94)
Useful gains	566.3313	631.7838	670.0526	662.5656	579.9588	419.0581	286.7716	298.3482	432.4271	530.5870	539.9485	540.9147 (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												
	1118.3051	1092.5836	1000.0507	839.6719	650.6582	436.1886	290.6963	304.1419	471.7256	707.8587	925.3347	1106.7234 (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												
	410.6685	309.6575	245.5185	127.5166	52.6003	0.0000	0.0000	0.0000	0.0000	131.8901	277.4781	420.9616 (98)
Space heating												1976.2913 (98)
Space heating per m2											(98) / (4) =	19.2134 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1976.2913	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	513.8357	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	2055.3429	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2221.9664	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	577.7113	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2310.8450	(310b)
Electricity used for heat distribution	54.5773	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	172.5477	(330a)
Total electricity for the above, kWh/year	172.5477	(331)
Electricity for lighting (calculated in Appendix L)	410.7217	(332)
Total delivered energy for all uses	6041.0043	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1148.9968	0.2160	248.1833 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	5476.5333	0.2160	1182.9312 (363)
less credit emissions for electricity	-2027.9603	0.5190	-1052.5114 (364)
Water heating from Combined Heat and Power	6157.3276	0.2160	1329.9828 (365)
less credit emissions for electricity	-2280.0584	0.5190	-1183.3503 (366)
Electrical energy for heat distribution	54.5773	0.5190	28.3256 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			553.5612 (373)
Space and water heating			553.5612 (376)
Pumps and fans	172.5477	0.5190	89.5522 (378)
Energy for lighting	410.7217	0.5190	213.1646 (379)
Total CO2, kg/year			856.2780 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3200 (384)

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

DER		8.3200	ZC1
Total Floor Area	TFA	102.8600	
Assumed number of occupants	N	2.7645	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0288	ZC2
CO2 emissions from cooking, equation (L16)		1.8019	ZC3
Total CO2 emissions		25.1507	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		25.1507	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	102.8600 (1b)	x 2.5000 (2b)	= 257.1500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 257.1500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1556 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4056 (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) = 0.3447 (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	0.4395	0.4309	0.4223	0.3792	0.3706	0.3275	0.3275	0.3189	0.3447	0.3706	0.3878	0.4050 (22b)
Effective ac	0.5966	0.5928	0.5892	0.5719	0.5687	0.5536	0.5536	0.5508	0.5594	0.5687	0.5752	0.5820 (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 Opening Type (Uw = 1.40)			25.7100	1.3258	34.0852			(27)					
External Wall 1	66.5127	25.7100	40.8027	0.1800	7.3445			(29a)					
Total net area of external elements Aum(A, m2)			66.5127					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			41.4297		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (User defined value 0.050 * total exposed area)							3.3256	(36)					
Total fabric heat loss						(33) + (36) =	44.7553	(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	50.6261	50.3078	49.9958	48.5305	48.2564	46.9801	46.9801	46.7438	47.4717	48.2564	48.8110	49.3908	(38)
Heat transfer coeff	95.3814	95.0632	94.7512	93.2859	93.0117	91.7355	91.7355	91.4991	92.2271	93.0117	93.5663	94.1462	(39)
Average = Sum(39)m / 12 =												93.2846	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9273	0.9242	0.9212	0.9069	0.9043	0.8918	0.8918	0.8896	0.8966	0.9043	0.9096	0.9153	(40)
HLP (average)												0.9069	(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												2.7645 (42)
Average daily hot water use (litres/day)												99.8562 (43)
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418 (44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524 (45)
Energy content (annual)										Total = Sum(45)m =		1571.1266 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	209.4871	184.5523	193.6076	173.2611	169.5764	151.2155	144.9341	159.4405	159.2852	179.6763	190.3606	204.3473 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	209.4871	184.5523	193.6076	173.2611	169.5764	151.2155	144.9341	159.4405	159.2852	179.6763	190.3606	204.3473 (64)
	91.4376	81.0387	86.1577	78.6898	78.1673	71.3596	69.9737	74.7971	74.0428	81.5255	84.3753	89.7286 (65)
								Total per year (kWh/year) =	Sum (64)m =			2119.7440 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.2568	20.6565	16.7990	12.7179	9.5068	8.0260	8.6724	11.2727	15.1302	19.2113	22.4224	23.9031 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224 (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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788 (71)
Water heating gains (Table 5)	122.9000	120.5933	115.8033	109.2913	105.0635	99.1105	94.0507	100.5337	102.8372	109.5773	117.1879	120.6030 (72)
Total internal gains	474.4940	472.2940	456.8249	431.7095	405.9387	381.2756	365.3518	371.7282	384.7107	410.0542	439.2079	461.3330 (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		
Northeast					11.7800	11.2829	0.6300	0.7000	0.7700	40.6200 (75)		
Southeast					13.9300	36.7938	0.6300	0.7000	0.7700	156.6383 (77)		
Solar gains	197.2583	349.4961	514.0338	696.9827	835.5078	853.5833	812.9088	705.8758	576.8090	395.9305	238.7270	167.2220 (83)
Total gains	671.7522	821.7901	970.8587	1128.6922	1241.4465	1234.8589	1178.2606	1077.6039	961.5197	805.9847	677.9349	628.5551 (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)												
tau	74.8894	75.1401	75.3875	76.5717	76.7974	77.8658	77.8658	78.0669	77.4508	76.7974	76.3422	75.8720
alpha	5.9926	6.0093	6.0258	6.1048	6.1198	6.1911	6.1911	6.2045	6.1634	6.1198	6.0895	6.0581
util living area	0.9967	0.9888	0.9603	0.8593	0.6717	0.4729	0.3423	0.3899	0.6433	0.9249	0.9909	0.9977 (86)
MIT	20.1213	20.3164	20.5793	20.8482	20.9703	20.9970	20.9997	20.9993	20.9829	20.7879	20.3996	20.0896 (87)
Th 2	20.1444	20.1470	20.1495	20.1616	20.1639	20.1744	20.1744	20.1764	20.1704	20.1639	20.1593	20.1545 (88)
util rest of house	0.9957	0.9854	0.9489	0.8266	0.6193	0.4131	0.2782	0.3205	0.5734	0.8982	0.9875	0.9970 (89)
MIT 2	18.9702	19.2549	19.6304	19.9972	20.1380	20.1726	20.1743	20.1761	20.1584	19.9320	19.3867	18.9316 (90)
Living area fraction									fLA = Living area / (4) =			0.3124 (91)
MIT	19.3298	19.5865	19.9268	20.2630	20.3980	20.4302	20.4321	20.4332	20.4160	20.1994	19.7031	19.2933 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3298	19.5865	19.9268	20.2630	20.3980	20.4302	20.4321	20.4332	20.4160	20.1994	19.7031	19.2933 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	667.9328	807.4500	917.8136	937.8254	787.4916	533.1219	351.4038	368.7233	571.7480	724.9911	667.8334	626.0430 (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	1433.5602	1396.1453	1272.2032	1060.0072	809.0161	534.8317	351.5419	369.0378	582.5035	892.8562	1179.2233	1420.9782 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	569.6268	395.6032	263.6658	87.9709	16.0142	0.0000	0.0000	0.0000	0.0000	124.8916	368.2007	591.4318 (98)
Space heating												2417.4051 (98)
Space heating per m2												23.5019 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2585.4599 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	569.6268	395.6032	263.6658	87.9709	16.0142	0.0000	0.0000	0.0000	0.0000	124.8916	368.2007	591.4318	(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)	609.2265	423.1051	281.9956	94.0865	17.1275	0.0000	0.0000	0.0000	0.0000	133.5739	393.7976	632.5474	(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	209.4871	184.5523	193.6076	173.2611	169.5764	151.2155	144.9341	159.4405	159.2852	179.6763	190.3606	204.3473	(64)
Efficiency of water heater	87.3508	86.7978	85.6382	83.1090	80.6225	79.8000	79.8000	79.8000	79.8000	83.8660	86.5452	87.4877	(217)
Fuel for water heating, kWh/month	239.8229	212.6233	226.0762	208.4746	210.3338	189.4931	181.6216	199.8002	199.6055	214.2420	219.9552	233.5727	(219)
Water heating fuel used												2535.6211	(219)
Annual totals kWh/year													
Space heating fuel - main system												2585.4599	(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)												410.7217	(232)
Total delivered energy for all uses												5606.8028	(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	2585.4599	0.2160	558.4593 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2535.6211	0.2160	547.6942 (264)
Space and water heating			1106.1535 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	410.7217	0.5190	213.1646 (268)
Total CO2, kg/m2/year			1358.2431 (272)
Emissions per m2 for space and water heating			10.7540 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0724 (272b)
Emissions per m2 for pumps and fans			0.3784 (272c)
Target Carbon Dioxide Emission Rate (TER) = (10.7540 * 1.00) + 2.0724 + 0.3784, rounded to 2 d.p.			13.2000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000438_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.07_2B		
Property					
SAP Rating	85 B	DER	8.84	TER	13.96
Environmental	93 A	% DER<TER	36.66		
CO ₂ Emissions (t/year)	0.55	DFEE	31.64	TFEE	28.27
General Requirements Compliance	Fail	% DFEE<TFEE	-11.93		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 69 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.96 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.84 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)28.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)31.6 kWh/m²/yrFail
Excess energy =3.3 kWh/m²/yr (11.7%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.44
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail
Based on:		
Overshading:	Average	
Windows facing North East:	2.40 m ² , No overhang	
Windows facing South East:	15.60 m ² , No overhang	
Air change rate:	2.00 ach	
Blinds/curtains:	None	

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	68.8700 (1b)	x 2.5000 (2b)	= 172.1750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.1750 (5)

2. Ventilation rate

					main		secondary			other		total	m3 per hour			
					heating	+	heating				=	0 * 40 =	0.0000 (6a)			
					0	+	0	+		0	=	0 * 20 =	0.0000 (6b)			
					0	+	0	+		0	=	0 * 10 =	0.0000 (7a)			
Number of intermittent fans												0 * 10 =	0.0000 (7b)			
Number of passive vents												0 * 10 =	0.0000 (7c)			
Number of flueless gas fires												0 * 40 =	0.0000 (7c)			
													Air changes per hour			
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =													0.0000 / (5) =		0.0000 (8)	
Pressure test													Yes			
Measured/design AP50													3.0000			
Infiltration rate													0.1500		(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) =		0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)			
Balanced mechanical ventilation with heat recovery																
If mechanical ventilation:															0.5000 (23a)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =															77.3500 (23c)	
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631	(25)			

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			18.0000	1.3258	23.8636		(27)					
External Wall 1	36.8672	18.0000	18.8672	0.1600	3.0188		(29a)					
Total net area of external elements Aum(A, m2)			36.8672				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8824		(33)					
Party Floor 1			68.8700				(32d)					
Party Ceilings 1			68.8700				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							5.5301 (36)					
Total fabric heat loss	(33) + (36) =						32.4125 (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	15.6710	15.4899	15.3088	14.4033	14.2222	13.3167	13.3167	13.1356	13.6789	14.2222	14.5844	14.9466 (38)
Heat transfer coeff	48.0835	47.9024	47.7213	46.8158	46.6347	45.7291	45.7291	45.5480	46.0913	46.6347	46.9969	47.3591 (39)
Average = Sum(39)m / 12 =												46.7705 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6982	0.6955	0.6929	0.6798	0.6771	0.6640	0.6640	0.6614	0.6693	0.6771	0.6824	0.6877 (40)
HLP (average)												0.6791 (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												2.2184 (42)
Average daily hot water use (litres/day)												86.8865 (43)
Daily hot water use	Jan 95.5752	Feb 92.0997	Mar 88.6243	Apr 85.1488	May 81.6734	Jun 78.1979	Jul 78.1979	Aug 81.6734	Sep 85.1488	Oct 88.6243	Nov 92.0997	Dec 95.5752 (44)
Energy conte	141.7353	123.9626	127.9183	111.5222	107.0082	92.3400	85.5666	98.1889	99.3616	115.7963	126.4008	137.2630 (45)
Energy content (annual)												Total = Sum(45)m = 1367.0637 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.2603	18.5944	19.1877	16.7283	16.0512	13.8510	12.8350	14.7283	14.9042	17.3695	18.9601	20.5895 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	197.0121	173.8900	183.1951	165.0159	162.2851	145.8337	140.8434	153.4657	152.8553	171.0731	179.8944	192.5398	(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	197.0121	173.8900	183.1951	165.0159	162.2851	145.8337	140.8434	153.4657	152.8553	171.0731	179.8944	192.5398	(64)
								Total per year (kWh/year) = Sum (64)m =					2017.9035 (64)
Heat gains from water heating, kWh/month													
	91.3484	81.1595	86.7543	79.8761	79.8017	73.4980	72.6723	76.8692	75.8327	82.7237	84.8232	89.8614	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3528	15.4126	12.5344	9.4893	7.0934	5.9885	6.4708	8.4110	11.2892	14.3343	16.7302	17.8351 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.6455	196.6653	191.5754	180.7397	167.0616	154.2061	145.6178	143.5980	148.6878	159.5235	173.2017	186.0572 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919 (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)	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352 (71)
Water heating gains (Table 5)	122.7801	120.7731	116.6052	110.9390	107.2603	102.0805	97.6779	103.3189	105.3231	111.1878	117.8100	120.7815 (72)
Total internal gains	391.0541	389.1266	376.9907	357.4438	337.6910	318.5508	306.0422	311.6036	321.5759	341.3213	364.0176	380.9494 (73)

[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		
Northeast				2.4000	11.2829		0.3000	0.8000	0.7700	4.5038 (75)		
Southeast				15.6000	36.7938		0.3000	0.8000	0.7700	95.4650 (77)		
Solar gains	99.9688	171.7798	239.0102	302.8055	345.2467	345.4241	331.9128	299.8410	261.0393	190.9246	120.0120	85.3762 (83)
Total gains	491.0229	560.9064	616.0009	660.2493	682.9377	663.9749	637.9550	611.4446	582.6152	532.2460	484.0296	466.3256 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.7861	39.9365	40.0881	40.8635	41.0222	41.8345	41.8345	42.0008	41.5057	41.0222	40.7060	40.3947
alpha	3.6524	3.6624	3.6725	3.7242	3.7348	3.7890	3.7890	3.8001	3.7670	3.7348	3.7137	3.6930
util living area	0.9283	0.8902	0.8291	0.7242	0.5869	0.4295	0.3127	0.3388	0.5190	0.7507	0.8876	0.9373 (86)
MIT	19.9322	20.1627	20.4415	20.7264	20.8980	20.9766	20.9946	20.9926	20.9513	20.7349	20.3077	19.8925 (87)
Th 2	20.3424	20.3448	20.3471	20.3587	20.3611	20.3727	20.3727	20.3751	20.3681	20.3611	20.3564	20.3517 (88)
util rest of house	0.9205	0.8790	0.8127	0.7000	0.5544	0.3902	0.2690	0.2941	0.4774	0.7233	0.8744	0.9304 (89)
MIT 2	18.9036	19.2318	19.6239	20.0217	20.2460	20.3504	20.3687	20.3694	20.3191	20.0418	19.4507	18.8540 (90)
Living area fraction									fLA = Living area / (4) =			0.4703 (91)
MIT	19.3873	19.6696	20.0084	20.3531	20.5527	20.6449	20.6630	20.6625	20.6164	20.3678	19.8537	19.3424 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3873	19.6696	20.0084	20.3531	20.5527	20.6449	20.6630	20.6625	20.6164	20.3678	19.8537	19.3424 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9072	0.8661	0.8035	0.6998	0.5643	0.4074	0.2893	0.3147	0.4940	0.7236	0.8630	0.9177 (94)
Useful gains	445.4702	485.8136	494.9380	462.0390	385.3922	270.5086	184.5666	192.4464	287.8257	385.1126	417.6958	427.9547 (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	725.4524	707.4992	644.6390	536.1848	412.8418	276.4295	185.7991	194.1474	300.3508	455.5177	599.3846	717.1308 (97)
Month fracti	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	208.3068	148.9727	111.3775	53.3850	20.4225	0.0000	0.0000	0.0000	0.0000	52.3814	130.8159	215.1470 (98)
Space heating												940.8088 (98)
Space heating per m2												13.6606 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	940.8088 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	244.6103 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	978.4412 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2017.9035 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	524.6549 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2098.6196 (310b)
Electricity used for heat distribution	38.4633 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	115.5294 (330a)
Total electricity for the above, kWh/year	115.5294 (331)
Electricity for lighting (calculated in Appendix L)	306.4556 (332)
Total delivered energy for all uses	4268.3111 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	809.7529	0.2160	174.9066 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	2607.0908	0.2160	563.1316 (363)
less credit emissions for electricity	-965.4057	0.5190	-501.0456 (364)
Water heating from Combined Heat and Power	5591.8456	0.2160	1207.8386 (365)
less credit emissions for electricity	-2070.6604	0.5190	-1074.6728 (366)
Electrical energy for heat distribution	38.4633	0.5190	19.9624 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			390.1210 (373)
Space and water heating			390.1210 (376)
Pumps and fans	115.5294	0.5190	59.9598 (378)
Energy for lighting	306.4556	0.5190	159.0505 (379)
Total CO2, kg/year			609.1312 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8400 (384)

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

DER	8.8400 ZC1
Total Floor Area	68.8700
Assumed number of occupants	2.2184
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190
CO2 emissions from appliances, equation (L14)	16.7479 ZC2
CO2 emissions from cooking, equation (L16)	2.5010 ZC3
Total CO2 emissions	28.0889 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	28.0889 ZC8

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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	68.8700 (1b)	x 2.5000 (2b)	= 172.1750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.1750 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1162 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3662 (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) = 0.3112 (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	0.3968	0.3890	0.3813	0.3424	0.3346	0.2957	0.2957	0.2879	0.3112	0.3346	0.3501	0.3657 (22b)
Effective ac	0.5787	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5414	0.5484	0.5560	0.5613	0.5669 (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 Opening Type (Uw = 1.40)			17.2200	1.3258	22.8295		(27)
External Wall 1	36.8672	17.2200	19.6472	0.1800	3.5365		(29a)
Total net area of external elements Aum(A, m ²)			36.8672				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 26.3660		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							1.8434 (36)
Total fabric heat loss						(33) + (36) = 28.2094	(37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	32.8825	32.7087	32.5385	31.7387	31.5891	30.8925	30.8925
Heat transfer coeff	61.0919	60.9182	60.7479	59.9481	59.7985	59.1019	59.1019
Average = Sum(39)m / 12 =						58.9729	59.3702
HLP	0.8871	0.8845	0.8821	0.8705	0.8683	0.8582	0.8582
HLP (average)						0.8563	0.8621
Days in month	31	28	31	30	31	30	31
						30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2184 (42)
Average daily hot water use (litres/day)												86.8865 (43)
Daily hot water use	95.5752	92.0997	88.6243	85.1488	81.6734	78.1979	78.1979	81.6734	85.1488	88.6243	92.0997	95.5752 (44)
Energy conte	141.7353	123.9626	127.9183	111.5222	107.0082	92.3400	85.5666	98.1889	99.3616	115.7963	126.4008	137.2630 (45)
Energy content (annual)										Total = Sum(45)m =		1367.0637 (45)
Distribution loss (46)m = 0.15 x (45)m	21.2603	18.5944	19.1877	16.7283	16.0512	13.8510	12.8350	14.7283	14.9042	17.3695	18.9601	20.5895 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1915.6811 (64)
	84.4029	74.8861	79.8087	73.1546	72.8562	66.7765	65.7268	69.9237	69.1112	75.7782	78.1017	82.9159 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	17.3528	15.4126	12.5344	9.4893	7.0934	5.9885	6.4708	8.4110	11.2892	14.3343	16.7302	17.8351 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	194.6455	196.6653	191.5754	180.7397	167.0616	154.2061	145.6178	143.5980	148.6878	159.5235	173.2017	186.0572 (68)
Pumps, fans	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352 (71)
Total internal gains	113.4448	111.4377	107.2698	101.6036	97.9250	92.7452	88.3425	93.9835	95.9878	101.8524	108.4746	111.4461 (72)
	384.7187	382.7913	370.6553	351.1084	331.3556	312.2155	299.7068	305.2682	315.2406	334.9860	357.6822	374.6141 (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	
Northeast				2.3000	11.2829	0.6300	0.7000	0.7700			7.9309 (75)	
Southeast				14.9200	36.7938	0.6300	0.7000	0.7700			167.7705 (77)	
Solar gains	175.7014	301.9188	420.0958	532.2474	606.8667	607.1870	583.4334	527.0442	458.8226	335.5713	210.9295	150.0534 (83)
Total gains	560.4201	684.7101	790.7511	883.3558	938.2223	919.4024	883.1402	832.3124	774.0631	670.5572	568.6118	524.6674 (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	78.2860	78.5093	78.7293	79.7797	79.9793	80.9219	80.9219	81.0989	80.5562	79.9793	79.5765	79.1596
alpha	6.2191	6.2340	6.2486	6.3186	6.3320	6.3948	6.3948	6.4066	6.3704	6.3320	6.3051	6.2773
util living area	0.9890	0.9653	0.9039	0.7658	0.5837	0.4106	0.2944	0.3258	0.5249	0.8290	0.9700	0.9923 (86)
MIT	20.3326	20.5417	20.7619	20.9297	20.9879	20.9989	20.9999	20.9998	20.9951	20.9051	20.5923	20.2905 (87)
Th 2	20.1785	20.1807	20.1828	20.1927	20.1945	20.2032	20.2032	20.2048	20.1999	20.1945	20.1908	20.1869 (88)
util rest of house	0.9858	0.9563	0.8826	0.7275	0.5362	0.3599	0.2411	0.2695	0.4659	0.7881	0.9605	0.9900 (89)
MIT 2	19.3025	19.6012	19.9029	20.1204	20.1844	20.2026	20.2032	20.2047	20.1966	20.0992	19.6847	19.2485 (90)
Living area fraction									fLA = Living area / (4) =			0.4703 (91)
MIT	19.7870	20.0435	20.3069	20.5010	20.5623	20.5771	20.5779	20.5787	20.5722	20.4782	20.1115	19.7386 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7870	20.0435	20.3069	20.5010	20.5623	20.5771	20.5779	20.5787	20.5722	20.4782	20.1115	19.7386 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9839	0.9545	0.8861	0.7426	0.5581	0.3837	0.2662	0.2960	0.4935	0.8033	0.9595	0.9884 (94)
Ext temp.	551.4168	653.5872	700.6752	655.9553	523.6578	352.7766	235.0633	246.3563	382.0076	538.6344	545.5577	518.5781 (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	946.1280	922.5151	838.7399	695.4604	529.9491	353.2568	235.0998	246.4275	384.2545	590.7022	782.0083	938.8043 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	293.6651	180.7195	102.7201	28.4437	4.6808	0.0000	0.0000	0.0000	0.0000	38.7385	170.2444	312.6483 (98)
												1131.8605 (98)
										(98) / (4) =		16.4347 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1210.5460 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	293.6651	180.7195	102.7201	28.4437	4.6808	0.0000	0.0000	0.0000	0.0000	38.7385	170.2444	312.6483	(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)	314.0804	193.2829	109.8611	30.4210	5.0062	0.0000	0.0000	0.0000	0.0000	41.4315	182.0796	334.3833	(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	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579	(64)
Efficiency of water heater (217)m	85.9946	85.0399	83.4560	81.2770	80.0800	79.8000	79.8000	79.8000	79.8000	81.6596	84.7944	86.2190	(217)
Fuel for water heating, kWh/month	219.0022	195.2592	209.1081	192.6918	191.8122	172.2203	165.6159	181.4333	181.0193	198.8637	202.2452	213.2452	(219)
Water heating fuel used												2322.5164	(219)
Annual totals kWh/year													
Space heating fuel - main system												1210.5460	(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)												306.4556	(232)
Total delivered energy for all uses												3914.5179	(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	1210.5460	0.2160	261.4779 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2322.5164	0.2160	501.6635 (264)
Space and water heating			763.1415 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	306.4556	0.5190	159.0505 (268)
Total CO2, kg/m2/year			961.1169 (272)
Emissions per m2 for space and water heating			11.0809 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3094 (272b)
Emissions per m2 for pumps and fans			0.5652 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.0809 * 1.00) + 2.3094 + 0.5652, rounded to 2 d.p.			13.9600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000482_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.07_2B		
Property					
SAP Rating	86 B	DER	7.95	TER	13.96
Environmental	94 A	% DER<TER	43.03		
CO ₂ Emissions (t/year)	0.51	DFEE	24.26	TFEE	28.27
General Requirements Compliance	Fail	% DFEE<TFEE	14.17		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 69 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 (c)
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.96 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.95 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 28.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 24.3 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor (no floor)			
Roof (no roof)			
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room stats	OK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.44	
Maximum	1.5	OK
MVHR efficiency:	91%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	2.40 m ² , No overhang
Windows facing South East:	15.60 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	68.8700 (1b)	x 2.5000 (2b)	= 172.1750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.1750 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							3.0000					
Infiltration rate							0.1500	(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) =	0.1275 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			18.0000	0.9615	17.3077		(27)					
External Wall 1	36.8672	18.0000	18.8672	0.1600	3.0188		(29a)					
Total net area of external elements Aum(A, m2)			36.8672				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.3264		(33)					
Party Floor 1			68.8700				(32d)					
Party Ceilings 1			68.8700				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							5.5301 (36)					
Total fabric heat loss	(33) + (36) =						25.8565 (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	15.6710	15.4899	15.3088	14.4033	14.2222	13.3167	13.3167	13.1356	13.6789	14.2222	14.5844	14.9466 (38)
Heat transfer coeff	41.5276	41.3465	41.1654	40.2598	40.0787	39.1732	39.1732	38.9921	39.5354	40.0787	40.4409	40.8031 (39)
Average = Sum(39)m / 12 =												40.2145 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6030	0.6004	0.5977	0.5846	0.5819	0.5688	0.5688	0.5662	0.5741	0.5819	0.5872	0.5925 (40)
HLP (average)												0.5839 (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												2.2184 (42)
Average daily hot water use (litres/day)												86.8865 (43)
Daily hot water use	Jan 95.5752	Feb 92.0997	Mar 88.6243	Apr 85.1488	May 81.6734	Jun 78.1979	Jul 78.1979	Aug 81.6734	Sep 85.1488	Oct 88.6243	Nov 92.0997	Dec 95.5752 (44)
Energy conte	141.7353	123.9626	127.9183	111.5222	107.0082	92.3400	85.5666	98.1889	99.3616	115.7963	126.4008	137.2630 (45)
Energy content (annual)												Total = Sum(45)m = 1367.0637 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.2603	18.5944	19.1877	16.7283	16.0512	13.8510	12.8350	14.7283	14.9042	17.3695	18.9601	20.5895 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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												
	197.0121	173.8900	183.1951	165.0159	162.2851	145.8337	140.8434	153.4657	152.8553	171.0731	179.8944	192.5398 (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												
	197.0121	173.8900	183.1951	165.0159	162.2851	145.8337	140.8434	153.4657	152.8553	171.0731	179.8944	192.5398 (64)
								Total per year (kWh/year) =	Sum (64)m =			2017.9035 (64)
Heat gains from water heating, kWh/month												
	91.3484	81.1595	86.7543	79.8761	79.8017	73.4980	72.6723	76.8692	75.8327	82.7237	84.8232	89.8614 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3528	15.4126	12.5344	9.4893	7.0934	5.9885	6.4708	8.4110	11.2892	14.3343	16.7302	17.8351 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.6455	196.6653	191.5754	180.7397	167.0616	154.2061	145.6178	143.5980	148.6878	159.5235	173.2017	186.0572 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919 (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)	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352 (71)
Water heating gains (Table 5)	122.7801	120.7731	116.6052	110.9390	107.2603	102.0805	97.6779	103.3189	105.3231	111.1878	117.8100	120.7815 (72)
Total internal gains	391.0541	389.1266	376.9907	357.4438	337.6910	318.5508	306.0422	311.6036	321.5759	341.3213	364.0176	380.9494 (73)

[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
Northeast	2.4000	11.2829	0.5000	0.8000	0.7700	7.5063 (75)
Southeast	15.6000	36.7938	0.5000	0.8000	0.7700	159.1083 (77)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	474.8119 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	123.4511 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	493.8044 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2017.9035 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	524.6549 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2098.6196 (310b)
Electricity used for heat distribution	32.4053 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	115.5294 (330a)
Total electricity for the above, kWh/year	115.5294 (331)
Electricity for lighting (calculated in Appendix L)	306.4556 (332)
Total delivered energy for all uses	3662.5150 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	682.2168	0.2160	147.3588 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1315.7590	0.2160	284.2039 (363)
less credit emissions for electricity	-487.2256	0.5190	-252.8701 (364)
Water heating from Combined Heat and Power	5591.8456	0.2160	1207.8386 (365)
less credit emissions for electricity	-2070.6604	0.5190	-1074.6728 (366)
Electrical energy for heat distribution	32.4053	0.5190	16.8184 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			328.6770 (373)
Space and water heating			328.6770 (376)
Pumps and fans	115.5294	0.5190	59.9598 (378)
Energy for lighting	306.4556	0.5190	159.0505 (379)
Total CO2, kg/year			547.6872 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.9500 (384)

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

DER		7.9500 ZC1
Total Floor Area	TFA	68.8700
Assumed number of occupants	N	2.2184
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.7479 ZC2
CO2 emissions from cooking, equation (L16)		2.5010 ZC3
Total CO2 emissions		27.1989 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		27.1989 ZC8

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

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.8700 (1b)	x 2.5000 (2b)	= 172.1750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.1750 (5)

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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) =						20.0000 / (5) =	0.1162	(8)
Pressure test							Yes		
Measured/design AP50								5.0000	
Infiltration rate								0.3662	(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) =	0.3112	(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												
	0.3968	0.3890	0.3813	0.3424	0.3346	0.2957	0.2957	0.2879	0.3112	0.3346	0.3501	0.3657 (22b)
Effective ac	0.5787	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5414	0.5484	0.5560	0.5613	0.5669 (25)

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 Opening Type (Uw = 1.40)			17.2200	1.3258	22.8295			(27)					
External Wall 1	36.8672	17.2200	19.6472	0.1800	3.5365			(29a)					
Total net area of external elements Aum(A, m2)			36.8672					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	26.3660			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal Bridges (User defined value 0.050 * total exposed area)								1.8434 (36)					
Total fabric heat loss						(33) + (36) =	28.2094	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.8825	32.7087	32.5385	31.7387	31.5891	30.8925	30.8925	30.7635	31.1608	31.5891	31.8918	32.2082	(38)
Heat transfer coeff	61.0919	60.9182	60.7479	59.9481	59.7985	59.1019	59.1019	58.9729	59.3702	59.7985	60.1012	60.4176	(39)
Average = Sum(39)m / 12 =												59.9474	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8871	0.8845	0.8821	0.8705	0.8683	0.8582	0.8582	0.8563	0.8621	0.8683	0.8727	0.8773	(40)
HLP (average)												0.8704	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

Assumed occupancy												2.2184 (42)
Average daily hot water use (litres/day)												86.8865 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	95.5752	92.0997	88.6243	85.1488	81.6734	78.1979	78.1979	81.6734	85.1488	88.6243	92.0997	95.5752 (44)
Energy content (annual)	141.7353	123.9626	127.9183	111.5222	107.0082	92.3400	85.5666	98.1889	99.3616	115.7963	126.4008	137.2630 (45)
Distribution loss (46)m = 0.15 x (45)m											Total = Sum(45)m =	1367.0637 (45)
	21.2603	18.5944	19.1877	16.7283	16.0512	13.8510	12.8350	14.7283	14.9042	17.3695	18.9601	20.5895 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579 (64)
	84.4029	74.8861	79.8087	73.1546	72.8562	66.7765	65.7268	69.9237	69.1112	75.7782	78.1017	82.9159 (65)
								Total per year (kWh/year) =	Sum (64)m =			1915.6811 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	17.3528	15.4126	12.5344	9.4893	7.0934	5.9885	6.4708	8.4110	11.2892	14.3343	16.7302	17.8351 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	194.6455	196.6653	191.5754	180.7397	167.0616	154.2061	145.6178	143.5980	148.6878	159.5235	173.2017	186.0572 (68)
Pumps, fans	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352 (71)
Total internal gains	113.4448	111.4377	107.2698	101.6036	97.9250	92.7452	88.3425	93.9835	95.9878	101.8524	108.4746	111.4461 (72)
	384.7187	382.7913	370.6553	351.1084	331.3556	312.2155	299.7068	305.2682	315.2406	334.9860	357.6822	374.6141 (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	
Northeast				2.3000	11.2829	0.6300	0.7000	0.7700			7.9309 (75)	
Southeast				14.9200	36.7938	0.6300	0.7000	0.7700			167.7705 (77)	
Solar gains	175.7014	301.9188	420.0958	532.2474	606.8667	607.1870	583.4334	527.0442	458.8226	335.5713	210.9295	150.0534 (83)
Total gains	560.4201	684.7101	790.7511	883.3558	938.2223	919.4024	883.1402	832.3124	774.0631	670.5572	568.6118	524.6674 (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)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	78.2860	78.5093	78.7293	79.7797	79.9793	80.9219	80.9219	81.0989	80.5562	79.9793	79.5765	79.1596	
util living area	6.2191	6.2340	6.2486	6.3186	6.3320	6.3948	6.3948	6.4066	6.3704	6.3320	6.3051	6.2773	
	0.9890	0.9653	0.9039	0.7658	0.5837	0.4106	0.2944	0.3258	0.5249	0.8290	0.9700	0.9923 (86)	
MIT	20.3326	20.5417	20.7619	20.9297	20.9879	20.9989	20.9999	20.9998	20.9951	20.9051	20.5923	20.2905 (87)	
Th 2	20.1785	20.1807	20.1828	20.1927	20.1945	20.2032	20.2032	20.2048	20.1999	20.1945	20.1908	20.1869 (88)	
util rest of house	0.9858	0.9563	0.8826	0.7275	0.5362	0.3599	0.2411	0.2695	0.4659	0.7881	0.9605	0.9900 (89)	
MIT 2	19.3025	19.6012	19.9029	20.1204	20.1844	20.2026	20.2032	20.2047	20.1966	20.0992	19.6847	19.2485 (90)	
Living area fraction									fLA = Living area / (4) =			0.4703 (91)	
MIT	19.7870	20.0435	20.3069	20.5010	20.5623	20.5771	20.5779	20.5787	20.5722	20.4782	20.1115	19.7386 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.7870	20.0435	20.3069	20.5010	20.5623	20.5771	20.5779	20.5787	20.5722	20.4782	20.1115	19.7386 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9839	0.9545	0.8861	0.7426	0.5581	0.3837	0.2662	0.2960	0.4935	0.8033	0.9595	0.9884 (94)	
Ext temp.	551.4168	653.5872	700.6752	655.9553	523.6578	352.7766	235.0633	246.3563	382.0076	538.6344	545.5577	518.5781 (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	946.1280	922.5151	838.7399	695.4604	529.9491	353.2568	235.0998	246.4275	384.2545	590.7022	782.0083	938.8043 (97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating per m2	293.6651	180.7195	102.7201	28.4437	4.6808	0.0000	0.0000	0.0000	0.0000	38.7385	170.2444	312.6483 (98)	
												1131.8605 (98)	
												16.4347 (99)	

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1210.5460 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	293.6651	180.7195	102.7201	28.4437	4.6808	0.0000	0.0000	0.0000	0.0000	38.7385	170.2444	312.6483	(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)	314.0804	193.2829	109.8611	30.4210	5.0062	0.0000	0.0000	0.0000	0.0000	41.4315	182.0796	334.3833	(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	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579	(64)
Efficiency of water heater (217)m	85.9946	85.0399	83.4560	81.2770	80.0800	79.8000	79.8000	79.8000	79.8000	81.6596	84.7944	86.2190	(217)
Fuel for water heating, kWh/month	219.0022	195.2592	209.1081	192.6918	191.8122	172.2203	165.6159	181.4333	181.0193	198.8637	202.2452	213.2452	(219)
Water heating fuel used												2322.5164	(219)
Annual totals kWh/year													
Space heating fuel - main system												1210.5460	(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)												306.4556	(232)
Total delivered energy for all uses												3914.5179	(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	1210.5460	0.2160	261.4779 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2322.5164	0.2160	501.6635 (264)
Space and water heating			763.1415 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	306.4556	0.5190	159.0505 (268)
Total CO2, kg/m2/year			961.1169 (272)
Emissions per m2 for space and water heating			11.0809 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3094 (272b)
Emissions per m2 for pumps and fans			0.5652 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.0809 * 1.00) + 2.3094 + 0.5652, rounded to 2 d.p.			13.9600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000510_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.08_1B		
Property					
SAP Rating	83 B	DER	10.74	TER	15.63
Environmental	93 A	% DER<TER	31.30		
CO ₂ Emissions (t/year)	0.52	DFEE	42.16	TFEE	29.72
General Requirements Compliance	Fail	% DFEE<TFEE	-41.86		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 53 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.63 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.74 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)29.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.2 kWh/m²/yrFail
Excess energy =12.5 kWh/m²/yr (42.1%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail
Based on:		
Overshading:	Average	
Windows facing South East:	12.00 m ² , No overhang	
Windows facing South West:	13.20 m ² , No overhang	
Air change rate:	2.00 ach	
Blinds/curtains:	None	

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	53.4500 (1b)	x 2.5000 (2b)	= 133.6250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6250 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour		
					heating		heating						
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =		0.0000 (8)
Pressure test											Yes		
Measured/design AP50													3.0000
Infiltration rate													0.1500 (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) =		0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation:													0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			25.2000	1.3258	33.4091		(27)					
External Wall 1	40.0425	25.2000	14.8425	0.1600	2.3748		(29a)					
Total net area of external elements Aum(A, m2)			40.0425				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7839		(33)					
Party Floor 1			53.4500				(32d)					
Party Ceilings 1			53.4500				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							6.0064 (36)					
Total fabric heat loss	(33) + (36) =						41.7903 (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	12.1623	12.0217	11.8812	11.1784	11.0378	10.3351	10.3351	10.1945	10.6162	11.0378	11.3190	11.6001 (38)
Heat transfer coeff	53.9526	53.8120	53.6714	52.9687	52.8281	52.1253	52.1253	51.9848	52.4064	52.8281	53.1092	53.3903 (39)
Average = Sum(39)m / 12 =												52.9335 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0094	1.0068	1.0041	0.9910	0.9884	0.9752	0.9752	0.9726	0.9805	0.9884	0.9936	0.9989 (40)
HLP (average)												0.9903 (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												1.7918 (42)
Average daily hot water use (litres/day)												76.7557 (43)
Daily hot water use	Jan 84.4313	Feb 81.3610	Mar 78.2908	Apr 75.2206	May 72.1503	Jun 69.0801	Jul 69.0801	Aug 72.1503	Sep 75.2206	Oct 78.2908	Nov 81.3610	Dec 84.4313 (44)
Energy conte	125.2091	109.5087	113.0032	98.5189	94.5312	81.5733	75.5896	86.7402	87.7761	102.2946	111.6626	121.2583 (45)
Energy content (annual)												Total = Sum(45)m = 1207.6658 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7814	16.4263	16.9505	14.7778	14.1797	12.2360	11.3384	13.0110	13.1664	15.3442	16.7494	18.1888 (46)
Water storage loss:												110.0000 (47)
Store volume												

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	180.4859	159.4361	168.2800	152.0126	149.8080	135.0669	130.8664	142.0170	141.2698	157.5714	165.1563	176.5351	(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	180.4859	159.4361	168.2800	152.0126	149.8080	135.0669	130.8664	142.0170	141.2698	157.5714	165.1563	176.5351	(64)
												Total per year (kWh/year) = Sum (64)m =	1858.5056 (64)
Heat gains from water heating, kWh/month													
	85.8535	76.3536	81.7950	75.5525	75.6531	69.9181	69.3550	73.0626	71.9805	78.2344	79.9228	84.5398	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8782	0.8219	0.7484	0.6442	0.5184	0.3790	0.2687	0.2941	0.4597	0.6787	0.8282	0.8918 (94)
Useful gains	429.9582	490.1507	511.1887	484.9262	409.5627	292.1253	199.5295	208.0677	306.8153	396.9478	412.4266	409.3899 (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												
	772.1939	761.1319	699.1349	587.7622	454.0890	305.0190	202.9866	212.6399	330.1754	496.8775	645.2979	764.9971 (97)
Month fracti	1.0000	1.0000			1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	254.6234	182.0994	139.8320	74.0419	33.1276	0.0000	0.0000	0.0000	0.0000	74.3477	167.6673	264.5717 (98)
Space heating												1190.3110 (99)
Space heating per m2												22.2696 (99)
										(98) / (4) =		

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8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1190.3110	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	309.4809	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1237.9234	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1858.5056	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	483.2115	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1932.8458	(310b)
Electricity used for heat distribution	39.6346	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	85.5868	(330a)
Total electricity for the above, kWh/year	85.5868	(331)
Electricity for lighting (calculated in Appendix L)	245.8986	(332)
Total delivered energy for all uses	4294.9469	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	834.4130	0.2160	180.2332 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	3298.4903	0.2160	712.4739 (363)
less credit emissions for electricity	-1221.4310	0.5190	-633.9227 (364)
Water heating from Combined Heat and Power	5150.1354	0.2160	1112.4292 (365)
less credit emissions for electricity	-1907.0951	0.5190	-989.7824 (366)
Electrical energy for heat distribution	39.6346	0.5190	20.5704 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			402.0017 (373)
Space and water heating			402.0017 (376)
Pumps and fans	85.5868	0.5190	44.4196 (378)
Energy for lighting	245.8986	0.5190	127.6214 (379)
Total CO2, kg/year			574.0426 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			10.7400 (384)

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

DER		10.7400	ZC1
Total Floor Area	TFA	53.4500	
Assumed number of occupants	N	1.7918	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3154	ZC2
CO2 emissions from cooking, equation (L16)		3.0309	ZC3
Total CO2 emissions		31.0863	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		31.0863	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.4500 (1b)	x 2.5000 (2b)	= 133.6250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6250 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1497 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3997 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3397 (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	0.4331	0.4247	0.4162	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3992 (22b)
Effective ac	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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 Opening Type (Uw = 1.40)			13.3700	1.3258	17.7254			(27)					
External Wall 1	40.0425	13.3700	26.6725	0.1800	4.8011			(29a)					
Total net area of external elements Aum(A, m2)			40.0425					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			22.5264		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								2.0021 (36)					
Total fabric heat loss						(33) + (36) =	24.5286	(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	26.1847	26.0241	25.8666	25.1271	24.9887	24.3446	24.3446	24.2253	24.5927	24.9887	25.2686	25.5613	(38)
Heat transfer coeff	50.7132	50.5526	50.3952	49.6556	49.5173	48.8732	48.8732	48.7539	49.1213	49.5173	49.7972	50.0898	(39)
Average = Sum(39)m / 12 =												49.6550	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9488	0.9458	0.9428	0.9290	0.9264	0.9144	0.9144	0.9121	0.9190	0.9264	0.9317	0.9371	(40)
HLP (average)												0.9290	(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												1.7918 (42)
Average daily hot water use (litres/day)												76.7557 (43)
Daily hot water use	84.4313	81.3610	78.2908	75.2206	72.1503	69.0801	69.0801	72.1503	75.2206	78.2908	81.3610	84.4313 (44)
Energy conte	125.2091	109.5087	113.0032	98.5189	94.5312	81.5733	75.5896	86.7402	87.7761	102.2946	111.6626	121.2583 (45)
Energy content (annual)										Total = Sum(45)m =		1207.6658 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7814	16.4263	16.9505	14.7778	14.1797	12.2360	11.3384	13.0110	13.1664	15.3442	16.7494	18.1888 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	171.8040	151.5944	159.5981	143.6107	141.1261	126.6651	122.1845	133.3351	132.8680	148.8895	156.7544	167.8532 (62)
	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								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	171.8040	151.5944	159.5981	143.6107	141.1261	126.6651	122.1845	133.3351	132.8680	148.8895	156.7544	167.8532 (64)
	78.9080	70.0802	74.8495	68.8310	68.7076	63.1966	62.4095	66.1170	65.2590	71.2889	73.2013	77.5943 (65)
								Total per year (kWh/year) = Sum (64)m =				1756.2832 (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	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9238	12.3670	10.0575	7.6142	5.6917	4.8052	5.1922	6.7490	9.0584	11.5018	13.4243	14.3108	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.1827	157.8033	153.7193	145.0247	134.0495	123.7343	116.8431	115.2224	119.3065	128.0010	138.9763	149.2915	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	(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)	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	(71)
Water heating gains (Table 5)	106.0591	104.2860	100.6041	95.5986	92.3489	87.7730	83.8837	88.8670	90.6376	95.8184	101.6684	104.2934	(72)
Total internal gains	329.0428	327.3336	317.2582	301.1148	284.9673	269.1897	258.7962	263.7156	271.8797	288.1984	306.9462	320.7730	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W			
Southeast					6.3700	36.7938	0.6300	0.7000	0.7700	71.6286 (77)			
Southwest					7.0000	36.7938	0.6300	0.7000	0.7700	78.7127 (79)			

Solar gains	150.3413	256.0868	350.3892	434.1492	486.2832	482.7667	465.4386	426.5443	379.3974	283.0305	180.0742	128.6608	(83)
Total gains	479.3841	583.4205	667.6473	735.2640	771.2505	751.9564	724.2348	690.2599	651.2771	571.2289	487.0204	449.4338	(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	73.1921	73.4246	73.6540	74.7509	74.9598	75.9477	75.9477	76.1335	75.5641	74.9598	74.5385	74.1030	
alpha	5.8795	5.8950	5.9103	5.9834	5.9973	6.0632	6.0632	6.0756	6.0376	5.9973	5.9692	5.9402	
util living area	0.9844	0.9558	0.8909	0.7581	0.5859	0.4148	0.2968	0.3247	0.5155	0.8091	0.9602	0.9886	(86)
MIT	20.3160	20.5323	20.7518	20.9205	20.9841	20.9984	20.9998	20.9997	20.9942	20.9033	20.5891	20.2740	(87)
Th 2	20.1262	20.1288	20.1312	20.1429	20.1451	20.1553	20.1553	20.1572	20.1514	20.1451	20.1407	20.1361	(88)
util rest of house	0.9800	0.9446	0.8672	0.7181	0.5358	0.3606	0.2399	0.2653	0.4542	0.7650	0.9481	0.9853	(89)
MIT 2	19.2371	19.5440	19.8425	20.0617	20.1318	20.1543	20.1552	20.1571	20.1475	20.0494	19.6378	19.1845	(90)
Living area fraction	19.7254	19.9913	20.2540	20.4504	20.5176	20.5363	20.5375	20.5384	20.5307	20.4359	20.0684	19.6776	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7254	19.9913	20.2540	20.4504	20.5176	20.5363	20.5375	20.5384	20.5307	20.4359	20.0684	19.6776	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9775	0.9426	0.8708	0.7329	0.5579	0.3851	0.2656	0.2922	0.4818	0.7808	0.9470	0.9831	(94)
Ext temp.	468.5844	549.9096	581.3929	538.8889	430.2575	289.5723	192.3912	201.6832	313.8104	446.0083	461.1853	441.8543	(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	782.2721	762.9033	693.1359	573.5404	436.6222	290.1264	192.4369	201.7644	315.8841	487.0453	645.7874	775.2692	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	233.3837	143.1318	83.1368	24.9491	4.7354	0.0000	0.0000	0.0000	0.0000	30.5315	132.9135	248.0607	(98)
												900.8424	(98)
												16.8539	(99)

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													963.4679 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	233.3837	143.1318	83.1368	24.9491	4.7354	0.0000	0.0000	0.0000	0.0000	30.5315	132.9135	248.0607	(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)	249.6082	153.0821	88.9164	26.6836	5.0646	0.0000	0.0000	0.0000	0.0000	32.6540	142.1534	265.3055	(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	171.8040	151.5944	159.5981	143.6107	141.1261	126.6651	122.1845	133.3351	132.8680	148.8895	156.7544	167.8532	(64)
Efficiency of water heater	85.6315	84.6611	83.1678	81.2214	80.1075	79.8000	79.8000	79.8000	79.8000	81.4385	84.3775	85.8541	(217)
Fuel for water heating, kWh/month	200.6317	179.0602	191.8988	176.8140	176.1710	158.7282	153.1134	167.0866	166.5012	182.8246	185.7775	195.5098	(219)
Water heating fuel used												2134.1169	(219)
Annual totals kWh/year													
Space heating fuel - main system												963.4679	(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)												245.8986	(232)
Total delivered energy for all uses												3418.4834	(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	963.4679	0.2160	208.1091 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2134.1169	0.2160	460.9693 (264)
Space and water heating			669.0783 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	245.8986	0.5190	127.6214 (268)
Total CO2, kg/m2/year			835.6247 (272)
Emissions per m2 for space and water heating			12.5178 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3877 (272b)
Emissions per m2 for pumps and fans			0.7283 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.5178 * 1.00) + 2.3877 + 0.7283, rounded to 2 d.p.			15.6300 (273)

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Calculation Type: New Build (As Designed)

Property Reference	INDEX_000554_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.08_1B		
Property					
SAP Rating	85 B	DER	9.21	TER	15.63
Environmental	94 A	% DER<TER	41.09		
CO ₂ Emissions (t/year)	0.46	DFEE	31.16	TFEE	29.72
General Requirements Compliance	Fail	% DFEE<TFEE	-4.85		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 53 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.63 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.21 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)29.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)31.2 kWh/m²/yrFail
Excess energy =1.5 kWh/m²/yr (5.1%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail
Based on:		
Overshading:	Average	
Windows facing South East:	12.00 m ² , No overhang	
Windows facing South West:	13.20 m ² , No overhang	
Air change rate:	2.00 ach	
Blinds/curtains:	None	

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	53.4500 (1b)	x 2.5000 (2b)	= 133.6250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6250 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour	
					heating		heating					
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)	
Pressure test										Yes		
Measured/design AP50										3.0000		
Infiltration rate										0.1500 (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) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			25.2000	0.9615	24.2308		(27)					
External Wall 1	40.0425	25.2000	14.8425	0.1600	2.3748		(29a)					
Total net area of external elements Aum(A, m2)			40.0425				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.6056		(33)					
Party Floor 1			53.4500				(32d)					
Party Ceilings 1			53.4500				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							6.0064 (36)					
Total fabric heat loss	(33) + (36) =						32.6119 (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	12.1623	12.0217	11.8812	11.1784	11.0378	10.3351	10.3351	10.1945	10.6162	11.0378	11.3190	11.6001 (38)
Heat transfer coeff	44.7742	44.6337	44.4931	43.7903	43.6498	42.9470	42.9470	42.8064	43.2281	43.6498	43.9309	44.2120 (39)
Average = Sum(39)m / 12 =												43.7552 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8377	0.8351	0.8324	0.8193	0.8166	0.8035	0.8035	0.8009	0.8088	0.8166	0.8219	0.8272 (40)
HLP (average)												0.8186 (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												1.7918 (42)
Average daily hot water use (litres/day)												76.7557 (43)
Daily hot water use	Jan 84.4313	Feb 81.3610	Mar 78.2908	Apr 75.2206	May 72.1503	Jun 69.0801	Jul 69.0801	Aug 72.1503	Sep 75.2206	Oct 78.2908	Nov 81.3610	Dec 84.4313 (44)
Energy conte	125.2091	109.5087	113.0032	98.5189	94.5312	81.5733	75.5896	86.7402	87.7761	102.2946	111.6626	121.2583 (45)
Energy content (annual)												Total = Sum(45)m = 1207.6658 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7814	16.4263	16.9505	14.7778	14.1797	12.2360	11.3384	13.0110	13.1664	15.3442	16.7494	18.1888 (46)
Water storage loss:												110.0000 (47)
Store volume												

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	180.4859	159.4361	168.2800	152.0126	149.8080	135.0669	130.8664	142.0170	141.2698	157.5714	165.1563	176.5351 (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	180.4859	159.4361	168.2800	152.0126	149.8080	135.0669	130.8664	142.0170	141.2698	157.5714	165.1563	176.5351 (64)	
								Total per year (kWh/year) = Sum (64)m =					1858.5056 (64)
Heat gains from water heating, kWh/month													
	85.8535	76.3536	81.7950	75.5525	75.6531	69.9181	69.3550	73.0626	71.9805	78.2344	79.9228	84.5398 (65)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8121	0.7069	0.5908	0.4580	0.3370	0.2319	0.1611	0.1789	0.2976	0.5132	0.7281	0.8356 (94)
Useful gains	481.0756	545.3151	545.0594	480.7351	378.3160	255.3022	170.9244	178.7980	275.8391	399.4620	452.2215	457.1384 (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	679.8108	670.3833	611.4788	506.1808	386.1460	256.9120	171.2713	179.2953	279.6522	429.3848	565.8348	671.4672 (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	147.8590	84.0458	49.4161	18.3209	5.8255	0.0000	0.0000	0.0000	0.0000	22.2626	81.8016	159.4606 (98)
Space heating												568.9921 (98)
Space heating per m2												10.6453 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	568.9921 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	147.9379 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	591.7517 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1858.5056 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	483.2115 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1932.8458 (310b)
Electricity used for heat distribution	31.5575 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	85.5868 (330a)
Total electricity for the above, kWh/year	85.5868 (331)
Electricity for lighting (calculated in Appendix L)	245.8986 (332)
Total delivered energy for all uses	3487.2324 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	664.3678	0.2160	143.5034 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1576.7433	0.2160	340.5765 (363)
less credit emissions for electricity	-583.8680	0.5190	-303.0275 (364)
Water heating from Combined Heat and Power	5150.1354	0.2160	1112.4292 (365)
less credit emissions for electricity	-1907.0951	0.5190	-989.7824 (366)
Electrical energy for heat distribution	31.5575	0.5190	16.3783 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			320.0777 (373)
Space and water heating			320.0777 (376)
Pumps and fans	85.5868	0.5190	44.4196 (378)
Energy for lighting	245.8986	0.5190	127.6214 (379)
Total CO2, kg/year			492.1186 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.2100 (384)

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

DER		9.2100 ZC1
Total Floor Area	TFA	53.4500
Assumed number of occupants	N	1.7918
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.3154 ZC2
CO2 emissions from cooking, equation (L16)		3.0309 ZC3
Total CO2 emissions		29.5563 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		29.5563 ZC8

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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	53.4500 (1b)	x 2.5000 (2b)	= 133.6250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6250 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1497 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3997 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3397 (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	0.4331	0.4247	0.4162	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3992 (22b)
Effective ac	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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 Opening Type (Uw = 1.40)			13.3700	1.3258	17.7254			(27)					
External Wall 1	40.0425	13.3700	26.6725	0.1800	4.8011			(29a)					
Total net area of external elements Aum(A, m2)			40.0425					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			22.5264		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								2.0021 (36)					
Total fabric heat loss						(33) + (36) =	24.5286	(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	26.1847	26.0241	25.8666	25.1271	24.9887	24.3446	24.3446	24.2253	24.5927	24.9887	25.2686	25.5613	(38)
Heat transfer coeff	50.7132	50.5526	50.3952	49.6556	49.5173	48.8732	48.8732	48.7539	49.1213	49.5173	49.7972	50.0898	(39)
Average = Sum(39)m / 12 =												49.6550	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9488	0.9458	0.9428	0.9290	0.9264	0.9144	0.9144	0.9121	0.9190	0.9264	0.9317	0.9371	(40)
HLP (average)												0.9290	(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												1.7918 (42)
Average daily hot water use (litres/day)												76.7557 (43)
Daily hot water use	84.4313	81.3610	78.2908	75.2206	72.1503	69.0801	69.0801	72.1503	75.2206	78.2908	81.3610	84.4313 (44)
Energy conte	125.2091	109.5087	113.0032	98.5189	94.5312	81.5733	75.5896	86.7402	87.7761	102.2946	111.6626	121.2583 (45)
Energy content (annual)										Total = Sum(45)m =		1207.6658 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7814	16.4263	16.9505	14.7778	14.1797	12.2360	11.3384	13.0110	13.1664	15.3442	16.7494	18.1888 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	171.8040	151.5944	159.5981	143.6107	141.1261	126.6651	122.1845	133.3351	132.8680	148.8895	156.7544	167.8532 (62)
	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								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	171.8040	151.5944	159.5981	143.6107	141.1261	126.6651	122.1845	133.3351	132.8680	148.8895	156.7544	167.8532 (64)
	78.9080	70.0802	74.8495	68.8310	68.7076	63.1966	62.4095	66.1170	65.2590	71.2889	73.2013	77.5943 (65)
								Total per year (kWh/year) = Sum (64)m =				1756.2832 (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	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	89.5909	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9238	12.3670	10.0575	7.6142	5.6917	4.8052	5.1922	6.7490	9.0584	11.5018	13.4243	14.3108	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.1827	157.8033	153.7193	145.0247	134.0495	123.7343	116.8431	115.2224	119.3065	128.0010	138.9763	149.2915	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	31.9591	(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)	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	-71.6727	(71)
Water heating gains (Table 5)	106.0591	104.2860	100.6041	95.5986	92.3489	87.7730	83.8837	88.8670	90.6376	95.8184	101.6684	104.2934	(72)
Total internal gains	329.0428	327.3336	317.2582	301.1148	284.9673	269.1897	258.7962	263.7156	271.8797	288.1984	306.9462	320.7730	(73)

6. Solar gains

[Jan]													Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Southeast													6.3700	36.7938	0.6300	0.7000	0.7700	71.6286 (77)
Southwest													7.0000	36.7938	0.6300	0.7000	0.7700	78.7127 (79)
Solar gains	150.3413	256.0868	350.3892	434.1492	486.2832	482.7667	465.4386	426.5443	379.3974	283.0305	180.0742	128.6608	(83)					
Total gains	479.3841	583.4205	667.6473	735.2640	771.2505	751.9564	724.2348	690.2599	651.2771	571.2289	487.0204	449.4338	(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	73.1921	73.4246	73.6540	74.7509	74.9598	75.9477	75.9477	76.1335	75.5641	74.9598	74.5385	74.1030	
alpha	5.8795	5.8950	5.9103	5.9834	5.9973	6.0632	6.0632	6.0756	6.0376	5.9973	5.9692	5.9402	
util living area	0.9844	0.9558	0.8909	0.7581	0.5859	0.4148	0.2968	0.3247	0.5155	0.8091	0.9602	0.9886	(86)
MIT	20.3160	20.5323	20.7518	20.9205	20.9841	20.9984	20.9998	20.9997	20.9942	20.9033	20.5891	20.2740	(87)
Th 2	20.1262	20.1288	20.1312	20.1429	20.1451	20.1553	20.1553	20.1572	20.1514	20.1451	20.1407	20.1361	(88)
util rest of house	0.9800	0.9446	0.8672	0.7181	0.5358	0.3606	0.2399	0.2653	0.4542	0.7650	0.9481	0.9853	(89)
MIT 2	19.2371	19.5440	19.8425	20.0617	20.1318	20.1543	20.1552	20.1571	20.1475	20.0494	19.6378	19.1845	(90)
Living area fraction									fLA = Living area / (4) =			0.4526	(91)
MIT	19.7254	19.9913	20.2540	20.4504	20.5176	20.5363	20.5375	20.5384	20.5307	20.4359	20.0684	19.6776	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7254	19.9913	20.2540	20.4504	20.5176	20.5363	20.5375	20.5384	20.5307	20.4359	20.0684	19.6776	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9775	0.9426	0.8708	0.7329	0.5579	0.3851	0.2656	0.2922	0.4818	0.7808	0.9470	0.9831	(94)
Ext temp.	468.5844	549.9096	581.3929	538.8889	430.2575	289.5723	192.3912	201.6832	313.8104	446.0083	461.1853	441.8543	(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	782.2721	762.9033	693.1359	573.5404	436.6222	290.1264	192.4369	201.7644	315.8841	487.0453	645.7874	775.2692	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	233.3837	143.1318	83.1368	24.9491	4.7354	0.0000	0.0000	0.0000	0.0000	30.5315	132.9135	248.0607	(98)
												900.8424	(98)
												16.8539	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													963.4679 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	233.3837	143.1318	83.1368	24.9491	4.7354	0.0000	0.0000	0.0000	0.0000	30.5315	132.9135	248.0607	(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)	249.6082	153.0821	88.9164	26.6836	5.0646	0.0000	0.0000	0.0000	0.0000	32.6540	142.1534	265.3055	(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	171.8040	151.5944	159.5981	143.6107	141.1261	126.6651	122.1845	133.3351	132.8680	148.8895	156.7544	167.8532	(64)
Efficiency of water heater	85.6315	84.6611	83.1678	81.2214	80.1075	79.8000	79.8000	79.8000	79.8000	81.4385	84.3775	85.8541	(217)
Fuel for water heating, kWh/month	200.6317	179.0602	191.8988	176.8140	176.1710	158.7282	153.1134	167.0866	166.5012	182.8246	185.7775	195.5098	(219)
Water heating fuel used												2134.1169	(219)
Annual totals kWh/year													
Space heating fuel - main system												963.4679	(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)												245.8986	(232)
Total delivered energy for all uses												3418.4834	(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	963.4679	0.2160	208.1091 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2134.1169	0.2160	460.9693 (264)
Space and water heating			669.0783 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	245.8986	0.5190	127.6214 (268)
Total CO2, kg/m2/year			835.6247 (272)
Emissions per m2 for space and water heating			12.5178 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3877 (272b)
Emissions per m2 for pumps and fans			0.7283 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.5178 * 1.00) + 2.3877 + 0.7283, rounded to 2 d.p.			15.6300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000582_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.09_2B		
Property					
SAP Rating	84 B	DER	9.69	TER	14.69
Environmental	92 A	% DER<TER	34.02		
CO ₂ Emissions (t/year)	0.64	DFEE	41.03	TFEE	34.26
General Requirements Compliance	Fail	% DFEE<TFEE	-19.78		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 75 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.69 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.69 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)34.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.0 kWh/m²/yrFail
Excess energy =6.7 kWh/m²/yr (19.5%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.44	
Maximum	1.5	OK
MVHR efficiency:	91%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail
Based on:		
Overshading:	Average	
Windows facing South West:	14.40 m ² , No overhang	
Windows facing North West:	14.40 m ² , No overhang	
Air change rate:	2.00 ach	
Blinds/curtains:	None	

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	74.6000 (1b)	x 2.5000 (2b)	= 186.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.5000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					0 * 10 = 0.0000 (7a)							
Number of passive vents					0 * 10 = 0.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					3.0000							
Infiltration rate					0.1500 (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) =				0.1275 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			28.8000	1.3258	38.1818		(27)					
External Wall 1	50.1023	28.8000	21.3023	0.1600	3.4084		(29a)					
Total net area of external elements Aum(A, m2)			50.1023				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.5902		(33)					
Party Floor 1			74.6000				(32d)					
Party Ceilings 1			74.6000				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							7.5153 (36)					
Total fabric heat loss							(33) + (36) = 49.1055 (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	16.9749	16.7787	16.5825	15.6017	15.4055	14.4246	14.4246	14.2284	14.8170	15.4055	15.7978	16.1902 (38)
Heat transfer coeff	66.0804	65.8842	65.6881	64.7072	64.5110	63.5301	63.5301	63.3340	63.9225	64.5110	64.9034	65.2957 (39)
Average = Sum(39)m / 12 =												64.6581 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8858	0.8832	0.8805	0.8674	0.8648	0.8516	0.8516	0.8490	0.8569	0.8648	0.8700	0.8753 (40)
HLP (average)												0.8667 (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												2.3524 (42)
Average daily hot water use (litres/day)												90.0704 (43)
Daily hot water use	Jan 99.0774	Feb 95.4746	Mar 91.8718	Apr 88.2690	May 84.6661	Jun 81.0633	Jul 81.0633	Aug 84.6661	Sep 88.2690	Oct 91.8718	Nov 95.4746	Dec 99.0774 (44)
Energy conte	146.9289	128.5050	132.6056	115.6088	110.9294	95.7236	88.7020	101.7869	103.0025	120.0395	131.0325	142.2928 (45)
Energy content (annual)												Total = Sum(45)m = 1417.1577 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.0393	19.2757	19.8908	17.3413	16.6394	14.3585	13.3053	15.2680	15.4504	18.0059	19.6549	21.3439 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	202.2057	178.4324	187.8824	169.1025	166.2062	149.2173	143.9788	157.0637	156.4962	175.3163	184.5262	197.5696 (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	202.2057	178.4324	187.8824	169.1025	166.2062	149.2173	143.9788	157.0637	156.4962	175.3163	184.5262	197.5696 (64)	
								Total per year (kWh/year) = Sum (64)m =					2067.9974 (64)
Heat gains from water heating, kWh/month													
	93.0753	82.6699	88.3128	81.2349	81.1055	74.6231	73.7149	78.0656	77.0433	84.1346	86.3633	91.5338 (65)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9196	0.8833	0.8228	0.7173	0.5761	0.4186	0.2992	0.3367	0.5384	0.7647	0.8847	0.9289 (94)
Useful gains	482.6634	541.2700	575.4103	567.7080	493.7581	355.4281	242.5846	252.3606	365.7140	451.2546	460.5235	461.1463 (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	939.7928	921.0633	845.7349	713.1345	552.9052	370.9975	246.5312	258.1270	400.5311	599.8518	781.0931	931.1950 (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	340.1043	255.2211	201.1215	104.7071	44.0055	0.0000	0.0000	0.0000	0.0000	110.5563	230.8101	349.7162 (98)
Space heating												1636.2420 (99)
Space heating per m2												21.9335 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	1636.2420 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	425.4229 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1701.6917 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2067.9974 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	537.6793 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2150.7173 (310b)
Electricity used for heat distribution	48.1551 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	125.1415 (330a)
Total electricity for the above, kWh/year	125.1415 (331)
Electricity for lighting (calculated in Appendix L)	327.1458 (332)
Total delivered energy for all uses	5267.7986 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1013.7918	0.2160	218.9790 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	4534.2171	0.2160	979.3909 (363)
less credit emissions for electricity	-1679.0206	0.5190	-871.4117 (364)
Water heating from Combined Heat and Power	5730.6617	0.2160	1237.8229 (365)
less credit emissions for electricity	-2122.0640	0.5190	-1101.3512 (366)
Electrical energy for heat distribution	48.1551	0.5190	24.9925 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			488.4224 (373)
Space and water heating			488.4224 (376)
Pumps and fans	125.1415	0.5190	64.9484 (378)
Energy for lighting	327.1458	0.5190	169.7887 (379)
Total CO2, kg/year			723.1596 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.6900 (384)

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

DER	9.6900 ZC1
Total Floor Area	TFA 74.6000
Assumed number of occupants	N 2.3524
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	16.5054 ZC2
CO2 emissions from cooking, equation (L16)	2.3520 ZC3
Total CO2 emissions	28.5474 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	28.5474 ZC8

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

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6000 (1b)	x 2.5000 (2b)	= 186.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.5000 (5)

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)
Air changes per hour									
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1609	(8)
Pressure test							Yes		
Measured/design AP50							5.0000		
Infiltration rate								0.4109	(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) =	0.3492	(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												
	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (25)

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 Opening Type (Uw = 1.40)			18.6500	1.3258	24.7254		(27)					
External Wall 1	50.1023	18.6500	31.4523	0.1800	5.6614		(29a)					
Total net area of external elements Aum(A, m2)			50.1023				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.3868		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal Bridges (User defined value 0.050 * total exposed area)							2.5051 (36)					
Total fabric heat loss						(33) + (36) =	32.8919 (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	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596	33.9837	34.5255	35.1096	35.5224	35.9540 (38)
Heat transfer coeff												
	69.7655	69.5285	69.2963	68.2056	68.0015	67.0515	67.0515	66.8756	67.4175	68.0015	68.4144	68.8460 (39)
Average = Sum(39)m / 12 =												68.2046 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988	0.8965	0.9037	0.9115	0.9171	0.9229 (40)
HLP (average)												0.9143 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

Assumed occupancy												2.3524 (42)
Average daily hot water use (litres/day)												90.0704 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	99.0774	95.4746	91.8718	88.2690	84.6661	81.0633	81.0633	84.6661	88.2690	91.8718	95.4746	99.0774 (44)
Energy content (annual)	146.9289	128.5050	132.6056	115.6088	110.9294	95.7236	88.7020	101.7869	103.0025	120.0395	131.0325	142.2928 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1417.1577 (45)
	22.0393	19.2757	19.8908	17.3413	16.6394	14.3585	13.3053	15.2680	15.4504	18.0059	19.6549	21.3439 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1965.7751 (64)
	86.1298	76.3965	81.3673	74.5134	74.1599	67.9016	66.7693	71.1201	70.3218	77.1891	79.6418	84.5883 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	18.5244	16.4532	13.3806	10.1300	7.5723	6.3928	6.9077	8.9789	12.0514	15.3021	17.8598	19.0392 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Pumps, fans	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Total internal gains	115.7659	113.6852	109.3646	103.4908	99.6773	94.3078	89.7437	95.5915	97.6692	103.7487	110.6136	113.6939 (72)
	403.3636	401.3680	388.5414	367.8496	346.8769	326.6044	313.3871	319.1498	329.7336	350.6311	374.6552	392.6385 (73)

6. Solar gains

[Jan]												Gains
	Area				Solar flux	g		FF		Access	Gains	
	m2				Table 6a	Specific data		Specific data		factor	W	
					W/m2	or Table 6b		or Table 6c		Table 6d		
Southwest	9.3200				36.7938	0.6300		0.7000		0.7700	104.8004 (79)	
Northwest	9.3300				11.2829	0.6300		0.7000		0.7700	32.1718 (81)	
Solar gains	136.9722	244.0005	362.2365	496.4052	599.4410	614.2077	584.2125	504.4230	408.2395	277.3257	166.0072	115.9604 (83)
Total gains	540.3358	645.3685	750.7779	864.2549	946.3178	940.8120	897.5996	823.5728	737.9731	627.9567	540.6624	508.5989 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	74.2567	74.5098	74.7595	75.9550	76.1829	77.2623	77.2623	77.4655	76.8429	76.1829	75.7232	75.2485
util living area	5.9504	5.9673	5.9840	6.0637	6.0789	6.1508	6.1508	6.1644	6.1229	6.0789	6.0482	6.0166
	0.9944	0.9838	0.9492	0.8379	0.6480	0.4541	0.3284	0.3730	0.6160	0.9044	0.9855	0.9960 (86)
MIT	20.1775	20.3649	20.6167	20.8670	20.9747	20.9975	20.9997	20.9994	20.9860	20.8166	20.4503	20.1463 (87)
Th 2	20.1377	20.1404	20.1430	20.1554	20.1577	20.1685	20.1685	20.1705	20.1643	20.1577	20.1530	20.1481 (88)
util rest of house	0.9927	0.9791	0.9352	0.8029	0.5959	0.3961	0.2665	0.3060	0.5473	0.8731	0.9805	0.9947 (89)
MIT 2	19.0467	19.3190	19.6756	20.0133	20.1360	20.1670	20.1684	20.1703	20.1547	19.9617	19.4542	19.0093 (90)
Living area fraction									fLA = Living area / (4) =			0.3606 (91)
MIT	19.4545	19.6961	20.0150	20.3211	20.4384	20.4665	20.4682	20.4693	20.4545	20.2700	19.8134	19.4193 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4545	19.6961	20.0150	20.3211	20.4384	20.4665	20.4682	20.4693	20.4545	20.2700	19.8134	19.4193 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9909	0.9760	0.9328	0.8102	0.6136	0.4170	0.2889	0.3302	0.5716	0.8777	0.9779	0.9933 (94)
Ext temp.	535.4227	629.8829	700.3457	700.2396	580.6572	392.2834	259.2778	271.9364	421.8341	551.1765	528.7084	505.1949 (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	1057.2582	1028.7515	936.5382	778.9835	594.2261	393.3576	259.3668	272.1342	428.4038	657.5728	869.7777	1047.7890 (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	388.2456	268.0397	175.7272	56.6956	10.0952	0.0000	0.0000	0.0000	0.0000	79.1588	245.5699	403.6900 (98)
Space heating per m2												1627.2220 (98)
										(98) / (4) =		21.8126 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1740.3444 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	388.2456	268.0397	175.7272	56.6956	10.0952	0.0000	0.0000	0.0000	0.0000	79.1588	245.5699	403.6900	(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)	415.2359	286.6735	187.9435	60.6370	10.7971	0.0000	0.0000	0.0000	0.0000	84.6618	262.6416	431.7540	(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	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877	(64)
Efficiency of water heater	86.6358	86.0145	84.7617	82.3389	80.3723	79.8000	79.8000	79.8000	79.8000	82.9588	85.7006	86.7905	(217)
Fuel for water heating, kWh/month	223.3763	198.3278	211.4168	195.1699	195.9932	176.4605	169.5450	185.9421	185.5819	200.8640	205.5112	217.6363	(219)
Water heating fuel used												2365.8251	(219)
Annual totals kWh/year													
Space heating fuel - main system												1740.3444	(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)												327.1458	(232)
Total delivered energy for all uses												4508.3153	(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	1740.3444	0.2160	375.9144 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2365.8251	0.2160	511.0182 (264)
Space and water heating			886.9326 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	327.1458	0.5190	169.7887 (268)
Total CO2, kg/m2/year			1095.6463 (272)
Emissions per m2 for space and water heating			11.8892 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2760 (272b)
Emissions per m2 for pumps and fans			0.5218 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.8892 * 1.00) + 2.2760 + 0.5218, rounded to 2 d.p.			14.6900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000626_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.09_2B		
Property					
SAP Rating	86 B	DER	8.40	TER	14.69
Environmental	93 A	% DER<TER	42.81		
CO ₂ Emissions (t/year)	0.57	DFEE	31.64	TFEE	34.26
General Requirements Compliance	Fail	% DFEE<TFEE	7.63		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 75 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 (c)
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.69 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.40 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 34.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 31.6 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room stats	OK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.44	
Maximum	1.5	OK
MVHR efficiency:	91%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South West:	14.40 m ² , No overhang
Windows facing North West:	14.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	74.6000 (1b)	x 2.5000 (2b)	= 186.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.5000 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							3.0000					
Infiltration rate							0.1500	(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) =	0.1275 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			28.8000	0.9615	27.6923		(27)					
External Wall 1	50.1023	28.8000	21.3023	0.1600	3.4084		(29a)					
Total net area of external elements Aum(A, m2)			50.1023				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.1007		(33)					
Party Floor 1			74.6000				(32d)					
Party Ceilings 1			74.6000				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							7.5153 (36)					
Total fabric heat loss							(33) + (36) = 38.6160 (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	16.9749	16.7787	16.5825	15.6017	15.4055	14.4246	14.4246	14.2284	14.8170	15.4055	15.7978	16.1902 (38)
Heat transfer coeff	55.5909	55.3947	55.1986	54.2177	54.0215	53.0406	53.0406	52.8445	53.4330	54.0215	54.4139	54.8062 (39)
Average = Sum(39)m / 12 =												54.1686 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7452	0.7426	0.7399	0.7268	0.7241	0.7110	0.7110	0.7084	0.7163	0.7241	0.7294	0.7347 (40)
HLP (average)												0.7261 (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												2.3524 (42)
Average daily hot water use (litres/day)												90.0704 (43)
Daily hot water use	Jan 99.0774	Feb 95.4746	Mar 91.8718	Apr 88.2690	May 84.6661	Jun 81.0633	Jul 81.0633	Aug 84.6661	Sep 88.2690	Oct 91.8718	Nov 95.4746	Dec 99.0774 (44)
Energy conte	146.9289	128.5050	132.6056	115.6088	110.9294	95.7236	88.7020	101.7869	103.0025	120.0395	131.0325	142.2928 (45)
Energy content (annual)	Total = Sum(45)m =											1417.1577 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.0393	19.2757	19.8908	17.3413	16.6394	14.3585	13.3053	15.2680	15.4504	18.0059	19.6549	21.3439 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	202.2057	178.4324	187.8824	169.1025	166.2062	149.2173	143.9788	157.0637	156.4962	175.3163	184.5262	197.5696 (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	202.2057	178.4324	187.8824	169.1025	166.2062	149.2173	143.9788	157.0637	156.4962	175.3163	184.5262	197.5696 (64)	
								Total per year (kWh/year) = Sum (64)m =					2067.9974 (64)
Heat gains from water heating, kWh/month													
	93.0753	82.6699	88.3128	81.2349	81.1055	74.6231	73.7149	78.0656	77.0433	84.1346	86.3633	91.5338 (65)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8832	0.8104	0.7014	0.5440	0.3903	0.2635	0.1847	0.2130	0.3719	0.6306	0.8232	0.8990 (94)
Useful gains	531.3383	607.4309	632.8677	581.7920	465.5808	314.4564	210.2265	219.7823	337.6881	470.0780	505.0794	504.7361 (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												
	831.7453	818.5723	750.2039	623.7875	476.7066	316.4034	210.6190	220.4372	344.3786	526.5459	690.3458	821.3261 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	223.5029	141.8870	87.2981	30.2368	8.2776	0.0000	0.0000	0.0000	0.0000	42.0121	133.3918	235.5430 (98)
Space heating												902.1493 (98)
Space heating per m2												12.0932 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	902.1493 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	234.5588 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	938.2353 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2067.9974 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	537.6793 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2150.7173 (310b)
Electricity used for heat distribution	38.6119 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	125.1415 (330a)
Total electricity for the above, kWh/year	125.1415 (331)
Electricity for lighting (calculated in Appendix L)	327.1458 (332)
Total delivered energy for all uses	4313.4781 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	812.8823	0.2160	175.5826 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	2499.9609	0.2160	539.9915 (363)
less credit emissions for electricity	-925.7355	0.5190	-480.4567 (364)
Water heating from Combined Heat and Power	5730.6617	0.2160	1237.8229 (365)
less credit emissions for electricity	-2122.0640	0.5190	-1101.3512 (366)
Electrical energy for heat distribution	38.6119	0.5190	20.0396 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			391.6287 (373)
Space and water heating			391.6287 (376)
Pumps and fans	125.1415	0.5190	64.9484 (378)
Energy for lighting	327.1458	0.5190	169.7887 (379)
Total CO2, kg/year			626.3658 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.4000 (384)

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

DER		8.4000 ZC1
Total Floor Area	TFA	74.6000
Assumed number of occupants	N	2.3524
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.5054 ZC2
CO2 emissions from cooking, equation (L16)		2.3520 ZC3
Total CO2 emissions		27.2574 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		27.2574 ZC8

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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	74.6000 (1b)	x 2.5000 (2b)	= 186.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.5000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1609 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4109 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3492 (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	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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 Opening Type (Uw = 1.40)			18.6500	1.3258	24.7254			(27)					
External Wall 1	50.1023	18.6500	31.4523	0.1800	5.6614			(29a)					
Total net area of external elements Aum(A, m2)			50.1023					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			30.3868		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								2.5051 (36)					
Total fabric heat loss						(33) + (36) =	32.8919	(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	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596	33.9837	34.5255	35.1096	35.5224	35.9540	(38)
Heat transfer coeff	69.7655	69.5285	69.2963	68.2056	68.0015	67.0515	67.0515	66.8756	67.4175	68.0015	68.4144	68.8460	(39)
Average = Sum(39)m / 12 =												68.2046	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988	0.8965	0.9037	0.9115	0.9171	0.9229	(40)
HLP (average)												0.9143	(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												2.3524 (42)
Average daily hot water use (litres/day)												90.0704 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	99.0774	95.4746	91.8718	88.2690	84.6661	81.0633	81.0633	84.6661	88.2690	91.8718	95.4746	99.0774 (44)
Energy conte	146.9289	128.5050	132.6056	115.6088	110.9294	95.7236	88.7020	101.7869	103.0025	120.0395	131.0325	142.2928 (45)
Energy content (annual)											Total = Sum(45)m =	1417.1577 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.0393	19.2757	19.8908	17.3413	16.6394	14.3585	13.3053	15.2680	15.4504	18.0059	19.6549	21.3439 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877 (64)
	86.1298	76.3965	81.3673	74.5134	74.1599	67.9016	66.7693	71.1201	70.3218	77.1891	79.6418	84.5883 (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	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5244	16.4532	13.3806	10.1300	7.5723	6.3928	6.9077	8.9789	12.0514	15.3021	17.8598	19.0392	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	(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)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	(71)
Water heating gains (Table 5)	115.7659	113.6852	109.3646	103.4908	99.6773	94.3078	89.7437	95.5915	97.6692	103.7487	110.6136	113.6939	(72)
Total internal gains	403.3636	401.3680	388.5414	367.8496	346.8769	326.6044	313.3871	319.1498	329.7336	350.6311	374.6552	392.6385	(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	
Southwest					9.3200	36.7938	0.6300	0.7000	0.7700		104.8004 (79)	
Northwest					9.3300	11.2829	0.6300	0.7000	0.7700		32.1718 (81)	
Solar gains	136.9722	244.0005	362.2365	496.4052	599.4410	614.2077	584.2125	504.4230	408.2395	277.3257	166.0072	115.9604 (83)
Total gains	540.3358	645.3685	750.7779	864.2549	946.3178	940.8120	897.5996	823.5728	737.9731	627.9567	540.6624	508.5989 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.2567	74.5098	74.7595	75.9550	76.1829	77.2623	77.2623	77.4655	76.8429	76.1829	75.7232	75.2485	
alpha	5.9504	5.9673	5.9840	6.0637	6.0789	6.1508	6.1508	6.1644	6.1229	6.0789	6.0482	6.0166	
util living area	0.9944	0.9838	0.9492	0.8379	0.6480	0.4541	0.3284	0.3730	0.6160	0.9044	0.9855	0.9960 (86)	
MIT	20.1775	20.3649	20.6167	20.8670	20.9747	20.9975	20.9997	20.9994	20.9860	20.8166	20.4503	20.1463 (87)	
Th 2	20.1377	20.1404	20.1430	20.1554	20.1577	20.1685	20.1685	20.1705	20.1643	20.1577	20.1530	20.1481 (88)	
util rest of house	0.9927	0.9791	0.9352	0.8029	0.5959	0.3961	0.2665	0.3060	0.5473	0.8731	0.9805	0.9947 (89)	
MIT 2	19.0467	19.3190	19.6756	20.0133	20.1360	20.1670	20.1684	20.1703	20.1547	19.9617	19.4542	19.0093 (90)	
Living area fraction	19.4545	19.6961	20.0150	20.3211	20.4384	20.4665	20.4682	20.4693	20.4545	20.2700	19.8134	19.4193 (92)	
Temperature adjustment	19.4545	19.6961	20.0150	20.3211	20.4384	20.4665	20.4682	20.4693	20.4545	20.2700	19.8134	19.4193 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9909	0.9760	0.9328	0.8102	0.6136	0.4170	0.2889	0.3302	0.5716	0.8777	0.9779	0.9933 (94)	
Ext temp.	535.4227	629.8829	700.3457	700.2396	580.6572	392.2834	259.2778	271.9364	421.8341	551.1765	528.7084	505.1949 (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	1057.2582	1028.7515	936.5382	778.9835	594.2261	393.3576	259.3668	272.1342	428.4038	657.5728	869.7777	1047.7890 (97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating per m2	388.2456	268.0397	175.7272	56.6956	10.0952	0.0000	0.0000	0.0000	0.0000	79.1588	245.5699	403.6900 (98)	
												1627.2220 (98)	
												21.8126 (99)	

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1740.3444 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	388.2456	268.0397	175.7272	56.6956	10.0952	0.0000	0.0000	0.0000	0.0000	79.1588	245.5699	403.6900	(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)	415.2359	286.6735	187.9435	60.6370	10.7971	0.0000	0.0000	0.0000	0.0000	84.6618	262.6416	431.7540	(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	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877	(64)
Efficiency of water heater	86.6358	86.0145	84.7617	82.3389	80.3723	79.8000	79.8000	79.8000	79.8000	82.9588	85.7006	86.7905	(217)
Fuel for water heating, kWh/month	223.3763	198.3278	211.4168	195.1699	195.9932	176.4605	169.5450	185.9421	185.5819	200.8640	205.5112	217.6363	(219)
Water heating fuel used												2365.8251	(219)
Annual totals kWh/year													
Space heating fuel - main system												1740.3444	(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)												327.1458	(232)
Total delivered energy for all uses												4508.3153	(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	1740.3444	0.2160	375.9144 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2365.8251	0.2160	511.0182 (264)
Space and water heating			886.9326 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	327.1458	0.5190	169.7887 (268)
Total CO2, kg/m2/year			1095.6463 (272)
Emissions per m2 for space and water heating			11.8892 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2760 (272b)
Emissions per m2 for pumps and fans			0.5218 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.8892 * 1.00) + 2.2760 + 0.5218, rounded to 2 d.p.			14.6900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000654_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.10_1B		
Property					
SAP Rating	85 B	DER	9.06	TER	14.75
Environmental	94 A	% DER<TER	38.57		
CO ₂ Emissions (t/year)	0.45	DFEE	28.37	TFEE	22.97
General Requirements Compliance	Fail	% DFEE<TFEE	-23.48		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 54 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 (c)
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.75 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.06 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 23.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 28.4 kWh/m²/yr Fail
Excess energy = 5.4 kWh/m²/yr (23.5%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room stats OK

Hot water controls: No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system
Specific fan power: 0.42
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature

Overheating risk (Thames Valley): High Fail

Based on:

Overshading: Average
Windows facing South West: 13.51 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features

Air permeability 3.0 m³/m²h
Community CHP, Mains gas

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	53.5700 (1b)	x 2.5000 (2b)	= 133.9250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.5700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.9250 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											3.0000	
Infiltration rate											0.1500	(18)
Number of sides sheltered											3	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1163 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			13.5100	1.3258	17.9110		(27)					
External Wall 1	21.6370	13.5120	8.1250	0.1600	1.3000		(29a)					
Total net area of external elements Aum(A, m2)			21.6350				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2110		(33)					
Party Floor 1			53.5700				(32d)					
Party Ceilings 1			53.5700				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							3.2453 (36)					
Total fabric heat loss	(33) + (36) =						22.4562 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	11.5557	11.4272	11.2988	10.6566	10.5281	9.8859	9.8859	9.7575	10.1428	10.5281	10.7850	11.0419 (38)
	34.0119	33.8835	33.7550	33.1128	32.9844	32.3422	32.3422	32.2137	32.5990	32.9844	33.2413	33.4981 (39)
Average = Sum(39)m / 12 =												33.0807 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6349	0.6325	0.6301	0.6181	0.6157	0.6037	0.6037	0.6013	0.6085	0.6157	0.6205	0.6253 (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												1.7954 (42)
Average daily hot water use (litres/day)												76.8396 (43)
Daily hot water use	Jan 84.5236	Feb 81.4500	Mar 78.3764	Apr 75.3028	May 72.2292	Jun 69.1556	Jul 69.1556	Aug 72.2292	Sep 75.3028	Oct 78.3764	Nov 81.4500	Dec 84.5236 (44)
Energy conte	125.3460	109.6284	113.1267	98.6266	94.6346	81.6624	75.6723	86.8350	87.8721	102.4065	111.7847	121.3909 (45)
Energy content (annual)												Total = Sum(45)m = 1208.9861 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8019	16.4443	16.9690	14.7940	14.1952	12.2494	11.3508	13.0253	13.1808	15.3610	16.7677	18.2086 (46)
Water storage loss:												110.0000 (47)
Store volume												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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												
	180.6228	159.5558	168.4035	152.1203	149.9114	135.1561	130.9491	142.1118	141.3658	157.6833	165.2783	176.6677 (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												
	180.6228	159.5558	168.4035	152.1203	149.9114	135.1561	130.9491	142.1118	141.3658	157.6833	165.2783	176.6677 (64)
Total per year (kWh/year) = Sum(64)m =												1859.8258 (64)
Heat gains from water heating, kWh/month												
	85.8990	76.3934	81.8361	75.5883	75.6874	69.9477	69.3825	73.0941	72.0124	78.2716	79.9633	84.5839 (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	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9515	12.3916	10.0775	7.6293	5.7030	4.8147	5.2025	6.7624	9.0764	11.5246	13.4509	14.3392 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.4931	158.1170	154.0248	145.3130	134.3159	123.9802	117.0753	115.4514	119.5436	128.2554	139.2525	149.5882 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768 (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)	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141 (71)
Water heating gains (Table 5)	115.4556	113.6806	109.9947	104.9837	101.7304	97.1496	93.2560	98.2447	100.0172	105.2038	111.0602	113.6881 (72)
Total internal gains	335.8305	334.1195	324.0273	307.8563	291.6796	275.8748	265.4641	270.3888	278.5676	294.9141	313.6939	327.5458 (73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
Southwest	13.5120		36.7938		0.3000		0.8000		0.7700		82.6874 (79)	
Solar gains	82.6874	140.8472	192.7132	238.7810	267.4547	265.5206	255.9902	234.5984	208.6677	155.6661	99.0404	70.7632 (83)
Total gains	418.5178	474.9667	516.7405	546.6374	559.1343	541.3954	521.4542	504.9872	487.2352	450.5802	412.7343	398.3089 (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	43.7510	43.9169	44.0840	44.9390	45.1140	46.0098	46.0098	46.1932	45.6472	45.1140	44.7653	44.4220
alpha	3.9167	3.9278	3.9389	3.9959	4.0076	4.0673	4.0673	4.0795	4.0431	4.0076	3.9844	3.9615
util living area												
	0.8976	0.8482	0.7753	0.6612	0.5251	0.3776	0.2719	0.2920	0.4505	0.6795	0.8418	0.9094 (86)
MIT	20.2192	20.4204	20.6388	20.8396	20.9462	20.9894	20.9978	20.9971	20.9777	20.8492	20.5319	20.1825 (87)
Th 2	20.3987	20.4008	20.4030	20.4137	20.4159	20.4266	20.4266	20.4288	20.4223	20.4159	20.4116	20.4073 (88)
util rest of house												
	0.8878	0.8351	0.7574	0.6375	0.4962	0.3450	0.2368	0.2563	0.4154	0.6521	0.8262	0.9005 (89)
MIT 2	19.3523	19.6355	19.9389	20.2176	20.3555	20.4165	20.4250	20.4265	20.4000	20.2363	19.8044	19.3074 (90)
Living area fraction												0.5865 (91)
MIT	19.8608	20.0958	20.3494	20.5824	20.7020	20.7525	20.7610	20.7612	20.7388	20.5958	20.2311	19.8207 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8608	20.0958	20.3494	20.5824	20.7020	20.7525	20.7610	20.7612	20.7388	20.5958	20.2311	19.8207 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8782	0.8279	0.7558	0.6445	0.5105	0.3636	0.2573	0.2771	0.4347	0.6607	0.8211	0.8908 (94)
Useful gains	367.5217	393.2260	390.5346	352.2984	285.4203	196.8246	134.1703	139.9401	211.8215	297.7113	338.8951	354.8013 (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												
	529.2524	514.8872	467.4864	386.8384	296.9245	198.9851	134.5751	140.4896	216.4195	329.7038	436.4934	523.2639 (97)
Month fracti	1.0000	1.0000		1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000		1.0000 (97a)
Space heating kWh												
	120.3276	81.7563	57.2521	24.8688	8.5592	0.0000	0.0000	0.0000	0.0000	23.8024	70.2708	125.3362 (98)
Space heating												
Space heating per m2												
										(98) / (4) =		9.5608 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	512.1734 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	133.1651 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	532.6603 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1859.8258 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	483.5547 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1934.2189 (310b)
Electricity used for heat distribution	30.8360 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	85.7790 (330a)
Total electricity for the above, kWh/year	85.7790 (331)
Electricity for lighting (calculated in Appendix L)	246.3874 (332)
Total delivered energy for all uses	3415.7653 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	649.1787	0.2160	140.2226 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1419.2920	0.2160	306.5671 (363)
less credit emissions for electricity	-525.5638	0.5190	-272.7676 (364)
Water heating from Combined Heat and Power	5153.7940	0.2160	1113.2195 (365)
less credit emissions for electricity	-1908.4499	0.5190	-990.4855 (366)
Electrical energy for heat distribution	30.8360	0.5190	16.0039 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			312.7599 (373)
Space and water heating			312.7599 (376)
Pumps and fans	85.7790	0.5190	44.5193 (378)
Energy for lighting	246.3874	0.5190	127.8751 (379)
Total CO2, kg/year			485.1543 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0600 (384)

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

DER		9.0600 ZC1
Total Floor Area	TFA	53.5700
Assumed number of occupants	N	1.7954
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.3109 ZC2
CO2 emissions from cooking, equation (L16)		3.0257 ZC3
Total CO2 emissions		29.3966 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		29.3966 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	53.5700 (1b)	x 2.5000 (2b)	= 133.9250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.5700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.9250 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1493 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3993 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3095 (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	0.3946	0.3869	0.3791	0.3404	0.3327	0.2940	0.2940	0.2863	0.3095	0.3327	0.3482	0.3636 (22b)
Effective ac	0.5779	0.5748	0.5719	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661 (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 Opening Type (Uw = 1.40)			13.4000	1.3258	17.7652			(27)					
External Wall 1	21.6370	13.4000	8.2370	0.1800	1.4827			(29a)					
Total net area of external elements Aum(A, m2)			21.6370					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			19.2478		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								1.0819 (36)					
Total fabric heat loss						(33) + (36) =	20.3297	(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	25.5383	25.4047	25.2738	24.6587	24.5436	24.0078	24.0078	23.9086	24.2142	24.5436	24.7764	25.0198	(38)
Heat transfer coeff	45.8680	45.7344	45.6034	44.9883	44.8732	44.3375	44.3375	44.2383	44.5438	44.8732	45.1060	45.3495	(39)
Average = Sum(39)m / 12 =												44.9878	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8562	0.8537	0.8513	0.8398	0.8377	0.8277	0.8277	0.8258	0.8315	0.8377	0.8420	0.8465	(40)
HLP (average)												0.8398	(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												1.7954 (42)
Average daily hot water use (litres/day)												76.8396 (43)
Daily hot water use	84.5236	81.4500	78.3764	75.3028	72.2292	69.1556	69.1556	72.2292	75.3028	78.3764	81.4500	84.5236 (44)
Energy conte	125.3460	109.6284	113.1267	98.6266	94.6346	81.6624	75.6723	86.8350	87.8721	102.4065	111.7847	121.3909 (45)
Energy content (annual)										Total = Sum(45)m =		1208.9861 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8019	16.4443	16.9690	14.7940	14.1952	12.2494	11.3508	13.0253	13.1808	15.3610	16.7677	18.2086 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858 (64)
	78.9535	70.1200	74.8905	68.8668	68.7419	63.2262	62.4369	66.1486	65.2909	71.3261	73.2419	77.6384 (65)
								Total per year (kWh/year) =	Sum (64)m =			1757.6035 (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	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9515	12.3916	10.0775	7.6293	5.7030	4.8147	5.2025	6.7624	9.0764	11.5246	13.4509	14.3392	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.4931	158.1170	154.0248	145.3130	134.3159	123.9802	117.0753	115.4514	119.5436	128.2554	139.2525	149.5882	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	(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)	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	(71)
Water heating gains (Table 5)	106.1202	104.3453	100.6593	95.6484	92.3950	87.8142	83.9206	88.9094	90.6819	95.8684	101.7248	104.3527	(72)
Total internal gains	329.4951	327.7841	317.6919	301.5210	285.3442	269.5394	259.1287	264.0534	272.2322	288.5787	307.3585	321.2104	(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

Southwest				13.4000	36.7938	0.6300	0.7000			0.7700			150.6786 (79)

Solar gains	150.6786	256.6614	351.1754	435.1233	487.3744	483.8500	466.4830	427.5014	380.2487	283.6656	180.4783	128.9495	(83)
Total gains	480.1737	584.4456	668.8673	736.6443	772.7186	753.3894	725.6117	691.5548	652.4809	572.2443	487.8368	450.1599	(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	81.1053	81.3423	81.5758	82.6912	82.9033	83.9051	83.9051	84.0932	83.5164	82.9033	82.4754	82.0327	(86)
alpha	6.4070	6.4228	6.4384	6.5127	6.5269	6.5937	6.5937	6.6062	6.5678	6.5269	6.4984	6.4688	
util living area	0.9807	0.9430	0.8606	0.7090	0.5356	0.3763	0.2688	0.2942	0.4693	0.7649	0.9487	0.9861	(86)
MIT	20.4534	20.6568	20.8412	20.9590	20.9935	20.9995	21.0000	20.9999	20.9978	20.9461	20.6951	20.4100	(87)
Th 2	20.2049	20.2070	20.2091	20.2190	20.2208	20.2294	20.2294	20.2310	20.2261	20.2208	20.2171	20.2132	(88)
util rest of house	0.9755	0.9298	0.8346	0.6707	0.4923	0.3311	0.2218	0.2451	0.4174	0.7210	0.9345	0.9823	(89)
MIT 2	19.4964	19.7819	20.0274	20.1778	20.2155	20.2291	20.2294	20.2310	20.2247	20.1687	19.8477	19.4412	(90)
Living area fraction									fLA = Living area / (4) =			0.5865	(91)
MIT	20.0577	20.2950	20.5047	20.6359	20.6718	20.6809	20.6814	20.6820	20.6782	20.6247	20.3447	20.0094	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0577	20.2950	20.5047	20.6359	20.6718	20.6809	20.6814	20.6820	20.6782	20.6247	20.3447	20.0094	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9743	0.9314	0.8448	0.6915	0.5174	0.3576	0.2494	0.2739	0.4478	0.7443	0.9371	0.9811	(94)
Useful gains	467.8455	544.3568	565.0262	509.3631	399.8384	269.4162	180.9425	189.4011	292.1741	425.9310	457.1389	441.6446	(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	722.7746	704.0817	638.6621	527.9805	402.5945	269.6139	180.9569	189.4276	293.0165	449.8388	597.4181	716.9484	(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	189.6672	107.3351	54.7851	13.4046	2.0506	0.0000	0.0000	0.0000	0.0000	17.7874	101.0011	204.8260	(98)
Space heating												690.8570	(98)
Space heating per m2												12.8963	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												738.8845	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	189.6672	107.3351	54.7851	13.4046	2.0506	0.0000	0.0000	0.0000	0.0000	17.7874	101.0011	204.8260	(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)	202.8526	114.7969	58.5937	14.3364	2.1931	0.0000	0.0000	0.0000	0.0000	19.0239	108.0225	219.0653	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858	(64)
Efficiency of water heater	85.0759	83.9107	82.2847	80.6131	79.9353	79.8000	79.8000	79.8000	79.8000	80.8190	83.6747	85.3437	(216)
(217)m	85.0759	83.9107	82.2847	80.6131	79.9353	79.8000	79.8000	79.8000	79.8000	80.8190	83.6747	85.3437	(217)
Fuel for water heating, kWh/month	202.1030	180.8043	194.1085	178.2817	176.6798	158.8399	153.2170	167.2054	166.6215	184.3642	187.4837	196.8344	(219)
Water heating fuel used												2146.5434	(219)
Annual totals kWh/year													
Space heating fuel - main system												738.8845	(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)												246.3874	(232)
Total delivered energy for all uses												3206.8153	(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	738.8845	0.2160	159.5991 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2146.5434	0.2160	463.6534 (264)
Space and water heating			623.2524 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	246.3874	0.5190	127.8751 (268)
Total CO2, kg/m2/year			790.0525 (272)
Emissions per m2 for space and water heating			11.6344 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3871 (272b)
Emissions per m2 for pumps and fans			0.7266 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.6344 * 1.00) + 2.3871 + 0.7266, rounded to 2 d.p.			14.7500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000698_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_2_14.10_1B		
Property					
SAP Rating	85 B	DER	8.33	TER	14.75
Environmental	94 A	% DER<TER	43.52		
CO ₂ Emissions (t/year)	0.43	DFEE	21.41	TFEE	22.97
General Requirements Compliance	Fail	% DFEE<TFEE	6.82		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 54 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.75 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.33 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)23.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)21.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South West:	13.51 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	53.5700 (1b)	x 2.5000 (2b)	= 133.9250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.5700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.9250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			13.5100	0.9615	12.9904		(27)					
External Wall 1	21.6370	13.5120	8.1250	0.1600	1.3000		(29a)					
Total net area of external elements Aum(A, m2)			21.6350				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.2904		(33)					
Party Floor 1			53.5700				(32d)					
Party Ceilings 1			53.5700				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												
Thermal bridges (Default value 0.150 * total exposed area)							100.0000 (35)					
Total fabric heat loss							(33) + (36) = 17.5356 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.5557	Feb 11.4272	Mar 11.2988	Apr 10.6566	May 10.5281	Jun 9.8859	Jul 9.8859	Aug 9.7575	Sep 10.1428	Oct 10.5281	Nov 10.7850	Dec 11.0419 (38)
Heat transfer coeff	29.0913	28.9629	28.8344	28.1922	28.0638	27.4216	27.4216	27.2931	27.6784	28.0638	28.3207	28.5775 (39)
Average = Sum(39)m / 12 =												28.1601 (39)
HLP	Jan 0.5431	Feb 0.5407	Mar 0.5383	Apr 0.5263	May 0.5239	Jun 0.5119	Jul 0.5119	Aug 0.5095	Sep 0.5167	Oct 0.5239	Nov 0.5287	Dec 0.5335 (40)
HLP (average)												0.5257 (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												1.7954 (42)
Average daily hot water use (litres/day)												76.8396 (43)
Daily hot water use	84.5236	81.4500	78.3764	75.3028	72.2292	69.1556	69.1556	72.2292	75.3028	78.3764	81.4500	84.5236 (44)
Energy conte	125.3460	109.6284	113.1267	98.6266	94.6346	81.6624	75.6723	86.8350	87.8721	102.4065	111.7847	121.3909 (45)
Energy content (annual)												Total = Sum(45)m = 1208.9861 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8019	16.4443	16.9690	14.7940	14.1952	12.2494	11.3508	13.0253	13.1808	15.3610	16.7677	18.2086 (46)
Water storage loss:												110.0000 (47)
Store volume												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	215.7325	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	56.0905	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	224.3618	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1859.8258	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	483.5547	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1934.2189	(310b)
Electricity used for heat distribution	26.9823	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	85.7790	(330a)
Total electricity for the above, kWh/year	85.7790	(331)
Electricity for lighting (calculated in Appendix L)	246.3874	(332)
Total delivered energy for all uses	3030.3922	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	568.0476	0.2160	122.6983 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	597.8200	0.2160	129.1291 (363)
less credit emissions for electricity	-221.3727	0.5190	-114.8924 (364)
Water heating from Combined Heat and Power	5153.7940	0.2160	1113.2195 (365)
less credit emissions for electricity	-1908.4499	0.5190	-990.4855 (366)
Electrical energy for heat distribution	26.9823	0.5190	14.0038 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			273.6727 (373)
Space and water heating			273.6727 (376)
Pumps and fans	85.7790	0.5190	44.5193 (378)
Energy for lighting	246.3874	0.5190	127.8751 (379)
Total CO2, kg/year			446.0671 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3300 (384)

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

DER	8.3300	ZC1
Total Floor Area	53.5700	TFA
Assumed number of occupants	1.7954	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	17.3109	ZC2
CO2 emissions from cooking, equation (L16)	3.0257	ZC3
Total CO2 emissions	28.6666	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	28.6666	ZC8

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	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.5700 (1b)	x 2.5000 (2b)	= 133.9250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.5700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.9250 (5)

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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) =						20.0000 / (5) =	0.1493	(8)
Pressure test							Yes		
Measured/design AP50							5.0000		
Infiltration rate							0.3993		(18)
Number of sides sheltered							3		(19)
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3095	(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												
	0.3946	0.3869	0.3791	0.3404	0.3327	0.2940	0.2940	0.2863	0.3095	0.3327	0.3482	0.3636 (22b)
Effective ac	0.5779	0.5748	0.5719	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661 (25)

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 Opening Type (Uw = 1.40)			13.4000	1.3258	17.7652			(27)					
External Wall 1	21.6370	13.4000	8.2370	0.1800	1.4827			(29a)					
Total net area of external elements Aum(A, m2)			21.6370					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	19.2478			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal Bridges (User defined value 0.050 * total exposed area)								1.0819 (36)					
Total fabric heat loss						(33) + (36) =	20.3297	(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	25.5383	25.4047	25.2738	24.6587	24.5436	24.0078	24.0078	23.9086	24.2142	24.5436	24.7764	25.0198	(38)
Heat transfer coeff	45.8680	45.7344	45.6034	44.9883	44.8732	44.3375	44.3375	44.2383	44.5438	44.8732	45.1060	45.3495	(39)
Average = Sum(39)m / 12 =												44.9878	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8562	0.8537	0.8513	0.8398	0.8377	0.8277	0.8277	0.8258	0.8315	0.8377	0.8420	0.8465	(40)
HLP (average)												0.8398	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

Assumed occupancy												1.7954 (42)
Average daily hot water use (litres/day)												76.8396 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	84.5236	81.4500	78.3764	75.3028	72.2292	69.1556	69.1556	72.2292	75.3028	78.3764	81.4500	84.5236 (44)
Energy content (annual)	125.3460	109.6284	113.1267	98.6266	94.6346	81.6624	75.6723	86.8350	87.8721	102.4065	111.7847	121.3909 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1208.9861 (45)
	18.8019	16.4443	16.9690	14.7940	14.1952	12.2494	11.3508	13.0253	13.1808	15.3610	16.7677	18.2086 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858 (64)
	78.9535	70.1200	74.8905	68.8668	68.7419	63.2262	62.4369	66.1486	65.2909	71.3261	73.2419	77.6384 (65)
								Total per year (kWh/year) =	Sum (64)m =			1757.6035 (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	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9515	12.3916	10.0775	7.6293	5.7030	4.8147	5.2025	6.7624	9.0764	11.5246	13.4509	14.3392	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.4931	158.1170	154.0248	145.3130	134.3159	123.9802	117.0753	115.4514	119.5436	128.2554	139.2525	149.5882	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	(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)	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	(71)
Water heating gains (Table 5)	106.1202	104.3453	100.6593	95.6484	92.3950	87.8142	83.9206	88.9094	90.6819	95.8684	101.7248	104.3527	(72)
Total internal gains	329.4951	327.7841	317.6919	301.5210	285.3442	269.5394	259.1287	264.0534	272.2322	288.5787	307.3585	321.2104	(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

Southwest				13.4000	36.7938	0.6300	0.7000			0.7700			150.6786 (79)

Solar gains	150.6786	256.6614	351.1754	435.1233	487.3744	483.8500	466.4830	427.5014	380.2487	283.6656	180.4783	128.9495	(83)
Total gains	480.1737	584.4456	668.8673	736.6443	772.7186	753.3894	725.6117	691.5548	652.4809	572.2443	487.8368	450.1599	(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	81.1053	81.3423	81.5758	82.6912	82.9033	83.9051	83.9051	84.0932	83.5164	82.9033	82.4754	82.0327	(86)
alpha	6.4070	6.4228	6.4384	6.5127	6.5269	6.5937	6.5937	6.6062	6.5678	6.5269	6.4984	6.4688	
util living area	0.9807	0.9430	0.8606	0.7090	0.5356	0.3763	0.2688	0.2942	0.4693	0.7649	0.9487	0.9861	(86)
MIT	20.4534	20.6568	20.8412	20.9590	20.9935	20.9995	21.0000	20.9999	20.9978	20.9461	20.6951	20.4100	(87)
Th 2	20.2049	20.2070	20.2091	20.2190	20.2208	20.2294	20.2294	20.2310	20.2261	20.2208	20.2171	20.2132	(88)
util rest of house	0.9755	0.9298	0.8346	0.6707	0.4923	0.3311	0.2218	0.2451	0.4174	0.7210	0.9345	0.9823	(89)
MIT 2	19.4964	19.7819	20.0274	20.1778	20.2155	20.2291	20.2294	20.2310	20.2247	20.1687	19.8477	19.4412	(90)
Living area fraction									fLA = Living area / (4) =			0.5865	(91)
MIT	20.0577	20.2950	20.5047	20.6359	20.6718	20.6809	20.6814	20.6820	20.6782	20.6247	20.3447	20.0094	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0577	20.2950	20.5047	20.6359	20.6718	20.6809	20.6814	20.6820	20.6782	20.6247	20.3447	20.0094	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9743	0.9314	0.8448	0.6915	0.5174	0.3576	0.2494	0.2739	0.4478	0.7443	0.9371	0.9811	(94)
Useful gains	467.8455	544.3568	565.0262	509.3631	399.8384	269.4162	180.9425	189.4011	292.1741	425.9310	457.1389	441.6446	(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	722.7746	704.0817	638.6621	527.9805	402.5945	269.6139	180.9569	189.4276	293.0165	449.8388	597.4181	716.9484	(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	189.6672	107.3351	54.7851	13.4046	2.0506	0.0000	0.0000	0.0000	0.0000	17.7874	101.0011	204.8260	(98)
Space heating												690.8570	(98)
Space heating per m2												12.8963	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												738.8845	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	189.6672	107.3351	54.7851	13.4046	2.0506	0.0000	0.0000	0.0000	0.0000	17.7874	101.0011	204.8260	(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)	202.8526	114.7969	58.5937	14.3364	2.1931	0.0000	0.0000	0.0000	0.0000	19.0239	108.0225	219.0653	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858	(64)
Efficiency of water heater	85.0759	83.9107	82.2847	80.6131	79.9353	79.8000	79.8000	79.8000	79.8000	80.8190	83.6747	85.3437	(216)
(217)m	85.0759	83.9107	82.2847	80.6131	79.9353	79.8000	79.8000	79.8000	79.8000	80.8190	83.6747	85.3437	(217)
Fuel for water heating, kWh/month	202.1030	180.8043	194.1085	178.2817	176.6798	158.8399	153.2170	167.2054	166.6215	184.3642	187.4837	196.8344	(219)
Water heating fuel used												2146.5434	(219)
Annual totals kWh/year													
Space heating fuel - main system												738.8845	(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)												246.3874	(232)
Total delivered energy for all uses												3206.8153	(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	738.8845	0.2160	159.5991 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2146.5434	0.2160	463.6534 (264)
Space and water heating			623.2524 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	246.3874	0.5190	127.8751 (268)
Total CO2, kg/m2/year			790.0525 (272)
Emissions per m2 for space and water heating			11.6344 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3871 (272b)
Emissions per m2 for pumps and fans			0.7266 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.6344 * 1.00) + 2.3871 + 0.7266, rounded to 2 d.p.			14.7500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000726_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.11_1B		
Property					
SAP Rating	85 B	DER	9.06	TER	14.75
Environmental	94 A	% DER<TER	38.57		
CO ₂ Emissions (t/year)	0.45	DFEE	28.37	TFEE	22.97
General Requirements Compliance	Fail	% DFEE<TFEE	-23.48		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 54 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.75 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.06 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)23.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)28.4 kWh/m²/yrFail
Excess energy =5.4 kWh/m²/yr (23.5%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South West:	13.51 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	53.5700 (1b)	x 2.5000 (2b)	= 133.9250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.5700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.9250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			13.5100	1.3258	17.9110		(27)					
External Wall 1	21.6370	13.5120	8.1250	0.1600	1.3000		(29a)					
Total net area of external elements Aum(A, m2)			21.6350				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		19.2110		(33)					
Party Floor 1			53.5700				(32d)					
Party Ceilings 1			53.5700				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							3.2453 (36)					
Total fabric heat loss							(33) + (36) = 22.4562 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.5557	Feb 11.4272	Mar 11.2988	Apr 10.6566	May 10.5281	Jun 9.8859	Jul 9.8859	Aug 9.7575	Sep 10.1428	Oct 10.5281	Nov 10.7850	Dec 11.0419 (38)
Heat transfer coeff	34.0119	33.8835	33.7550	33.1128	32.9844	32.3422	32.3422	32.2137	32.5990	32.9844	33.2413	33.4981 (39)
Average = Sum(39)m / 12 =												33.0807 (39)
HLP	Jan 0.6349	Feb 0.6325	Mar 0.6301	Apr 0.6181	May 0.6157	Jun 0.6037	Jul 0.6037	Aug 0.6013	Sep 0.6085	Oct 0.6157	Nov 0.6205	Dec 0.6253 (40)
HLP (average)												0.6175 (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												1.7954 (42)
Average daily hot water use (litres/day)												76.8396 (43)
Daily hot water use	84.5236	81.4500	78.3764	75.3028	72.2292	69.1556	69.1556	72.2292	75.3028	78.3764	81.4500	84.5236 (44)
Energy conte	125.3460	109.6284	113.1267	98.6266	94.6346	81.6624	75.6723	86.8350	87.8721	102.4065	111.7847	121.3909 (45)
Energy content (annual)												Total = Sum(45)m = 1208.9861 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8019	16.4443	16.9690	14.7940	14.1952	12.2494	11.3508	13.0253	13.1808	15.3610	16.7677	18.2086 (46)
Water storage loss:												110.0000 (47)
Store volume												

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	180.6228	159.5558	168.4035	152.1203	149.9114	135.1561	130.9491	142.1118	141.3658	157.6833	165.2783	176.6677 (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	180.6228	159.5558	168.4035	152.1203	149.9114	135.1561	130.9491	142.1118	141.3658	157.6833	165.2783	176.6677 (64)	
								Total per year (kWh/year) = Sum(64)m =					1859.8258 (64)
Heat gains from water heating, kWh/month													
	85.8990	76.3934	81.8361	75.5883	75.6874	69.9477	69.3825	73.0941	72.0124	78.2716	79.9633	84.5839 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9515	12.3916	10.0775	7.6293	5.7030	4.8147	5.2025	6.7624	9.0764	11.5246	13.4509	14.3392 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.4931	158.1170	154.0248	145.3130	134.3159	123.9802	117.0753	115.4514	119.5436	128.2554	139.2525	149.5882 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768 (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)	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141 (71)
Water heating gains (Table 5)	115.4556	113.6806	109.9947	104.9837	101.7304	97.1496	93.2560	98.2447	100.0172	105.2038	111.0602	113.6881 (72)
Total internal gains	335.8305	334.1195	324.0273	307.8563	291.6796	275.8748	265.4641	270.3888	278.5676	294.9141	313.6939	327.5458 (73)

[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
Southwest				13.5120	36.7938		0.3000		0.8000		0.7700		82.6874 (79)
Solar gains	82.6874	140.8472	192.7132	238.7810	267.4547	265.5206	255.9902	234.5984	208.6677	155.6661	99.0404	70.7632	(83)
Total gains	418.5178	474.9667	516.7405	546.6374	559.1343	541.3954	521.4542	504.9872	487.2352	450.5802	412.7343	398.3089	(84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.7510	43.9169	44.0840	44.9390	45.1140	46.0098	46.0098	46.1932	45.6472	45.1140	44.7653	44.4220
alpha	3.9167	3.9278	3.9389	3.9959	4.0076	4.0673	4.0673	4.0795	4.0431	4.0076	3.9844	3.9615
util living area	0.8976	0.8482	0.7753	0.6612	0.5251	0.3776	0.2719	0.2920	0.4505	0.6795	0.8418	0.9094 (86)
MIT	20.2192	20.4204	20.6388	20.8396	20.9462	20.9894	20.9978	20.9971	20.9777	20.8492	20.5319	20.1825 (87)
Th 2	20.3987	20.4008	20.4030	20.4137	20.4159	20.4266	20.4266	20.4288	20.4223	20.4159	20.4116	20.4073 (88)
util rest of house	0.8878	0.8351	0.7574	0.6375	0.4962	0.3450	0.2368	0.2563	0.4154	0.6521	0.8262	0.9005 (89)
MIT 2	19.3523	19.6355	19.9389	20.2176	20.3555	20.4165	20.4250	20.4265	20.4000	20.2363	19.8044	19.3074 (90)
Living area fraction												0.5865 (91)
									fLA = Living area / (4) =			0.5865 (91)
MIT	19.8608	20.0958	20.3494	20.5824	20.7020	20.7525	20.7612	20.7612	20.7388	20.5958	20.2311	19.8207 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8608	20.0958	20.3494	20.5824	20.7020	20.7525	20.7610	20.7612	20.7388	20.5958	20.2311	19.8207 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8782	0.8279	0.7558	0.6445	0.5105	0.3636	0.2573	0.2771	0.4347	0.6607	0.8211	0.8908 (94)
Useful gains	367.5217	393.2260	390.5346	352.2984	285.4203	196.8246	134.1703	139.9401	211.8215	297.7113	338.8951	354.8013 (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	529.2524	514.8872	467.4864	386.8384	296.9245	198.9851	134.5751	140.4896	216.4195	329.7038	436.4934	523.2639 (97a)
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	120.3276	81.7563	57.2521	24.8688	8.5592	0.0000	0.0000	0.0000	0.0000	23.8024	70.2708	125.3362 (98)
Space heating												512.1734 (98)
Space heating per m2												9.5608 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.09r14

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	512.1734	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	133.1651	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	532.6603	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1859.8258	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	483.5547	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1934.2189	(310b)
Electricity used for heat distribution	30.8360	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	85.7790	(330a)
Total electricity for the above, kWh/year	85.7790	(331)
Electricity for lighting (calculated in Appendix L)	246.3874	(332)
Total delivered energy for all uses	3415.7653	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	649.1787	0.2160	140.2226 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1419.2920	0.2160	306.5671 (363)
less credit emissions for electricity	-525.5638	0.5190	-272.7676 (364)
Water heating from Combined Heat and Power	5153.7940	0.2160	1113.2195 (365)
less credit emissions for electricity	-1908.4499	0.5190	-990.4855 (366)
Electrical energy for heat distribution	30.8360	0.5190	16.0039 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			312.7599 (373)
Space and water heating			312.7599 (376)
Pumps and fans	85.7790	0.5190	44.5193 (378)
Energy for lighting	246.3874	0.5190	127.8751 (379)
Total CO2, kg/year			485.1543 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0600 (384)

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

DER		9.0600	ZC1
Total Floor Area	TFA	53.5700	
Assumed number of occupants	N	1.7954	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3109	ZC2
CO2 emissions from cooking, equation (L16)		3.0257	ZC3
Total CO2 emissions		29.3966	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		29.3966	ZC8

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

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.5700 (1b)	x 2.5000 (2b)	= 133.9250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.5700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.9250 (5)

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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) =						20.0000 / (5) =	0.1493	(8)
Pressure test							Yes		
Measured/design AP50							5.0000		
Infiltration rate								0.3993	(18)
Number of sides sheltered								3	(19)
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3095	(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												
	0.3946	0.3869	0.3791	0.3404	0.3327	0.2940	0.2940	0.2863	0.3095	0.3327	0.3482	0.3636 (22b)
Effective ac	0.5779	0.5748	0.5719	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661 (25)

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 Opening Type (Uw = 1.40)			13.4000	1.3258	17.7652			(27)					
External Wall 1	21.6370	13.4000	8.2370	0.1800	1.4827			(29a)					
Total net area of external elements Aum(A, m2)			21.6370					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	19.2478			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								1.0819 (36)					
Total fabric heat loss						(33) + (36) =	20.3297	(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	25.5383	25.4047	25.2738	24.6587	24.5436	24.0078	24.0078	23.9086	24.2142	24.5436	24.7764	25.0198	(38)
Heat transfer coeff	45.8680	45.7344	45.6034	44.9883	44.8732	44.3375	44.3375	44.2383	44.5438	44.8732	45.1060	45.3495	(39)
Average = Sum(39)m / 12 =												44.9878	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8562	0.8537	0.8513	0.8398	0.8377	0.8277	0.8277	0.8258	0.8315	0.8377	0.8420	0.8465	(40)
HLP (average)												0.8398	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

Assumed occupancy												1.7954 (42)
Average daily hot water use (litres/day)												76.8396 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	84.5236	81.4500	78.3764	75.3028	72.2292	69.1556	69.1556	72.2292	75.3028	78.3764	81.4500	84.5236 (44)
Energy content (annual)	125.3460	109.6284	113.1267	98.6266	94.6346	81.6624	75.6723	86.8350	87.8721	102.4065	111.7847	121.3909 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1208.9861 (45)
	18.8019	16.4443	16.9690	14.7940	14.1952	12.2494	11.3508	13.0253	13.1808	15.3610	16.7677	18.2086 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858 (64)
	78.9535	70.1200	74.8905	68.8668	68.7419	63.2262	62.4369	66.1486	65.2909	71.3261	73.2419	77.6384 (65)
								Total per year (kWh/year) =	Sum (64)m =			1757.6035 (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	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9515	12.3916	10.0775	7.6293	5.7030	4.8147	5.2025	6.7624	9.0764	11.5246	13.4509	14.3392	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.4931	158.1170	154.0248	145.3130	134.3159	123.9802	117.0753	115.4514	119.5436	128.2554	139.2525	149.5882	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	(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)	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	(71)
Water heating gains (Table 5)	106.1202	104.3453	100.6593	95.6484	92.3950	87.8142	83.9206	88.9094	90.6819	95.8684	101.7248	104.3527	(72)
Total internal gains	329.4951	327.7841	317.6919	301.5210	285.3442	269.5394	259.1287	264.0534	272.2322	288.5787	307.3585	321.2104	(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

Southwest				13.4000	36.7938	0.6300	0.7000			0.7700			150.6786 (79)

Solar gains	150.6786	256.6614	351.1754	435.1233	487.3744	483.8500	466.4830	427.5014	380.2487	283.6656	180.4783	128.9495	(83)
Total gains	480.1737	584.4456	668.8673	736.6443	772.7186	753.3894	725.6117	691.5548	652.4809	572.2443	487.8368	450.1599	(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	81.1053	81.3423	81.5758	82.6912	82.9033	83.9051	83.9051	84.0932	83.5164	82.9033	82.4754	82.0327	
alpha	6.4070	6.4228	6.4384	6.5127	6.5269	6.5937	6.5937	6.6062	6.5678	6.5269	6.4984	6.4688	
util living area	0.9807	0.9430	0.8606	0.7090	0.5356	0.3763	0.2688	0.2942	0.4693	0.7649	0.9487	0.9861	(86)
MIT	20.4534	20.6568	20.8412	20.9590	20.9935	20.9995	21.0000	20.9999	20.9978	20.9461	20.6951	20.4100	(87)
Th 2	20.2049	20.2070	20.2091	20.2190	20.2208	20.2294	20.2294	20.2310	20.2261	20.2208	20.2171	20.2132	(88)
util rest of house	0.9755	0.9298	0.8346	0.6707	0.4923	0.3311	0.2218	0.2451	0.4174	0.7210	0.9345	0.9823	(89)
MIT 2	19.4964	19.7819	20.0274	20.1778	20.2155	20.2291	20.2294	20.2310	20.2247	20.1687	19.8477	19.4412	(90)
Living area fraction									fLA = Living area / (4) =			0.5865	(91)
MIT	20.0577	20.2950	20.5047	20.6359	20.6718	20.6809	20.6814	20.6820	20.6782	20.6247	20.3447	20.0094	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0577	20.2950	20.5047	20.6359	20.6718	20.6809	20.6814	20.6820	20.6782	20.6247	20.3447	20.0094	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9743	0.9314	0.8448	0.6915	0.5174	0.3576	0.2494	0.2739	0.4478	0.7443	0.9371	0.9811	(94)
Useful gains	467.8455	544.3568	565.0262	509.3631	399.8384	269.4162	180.9425	189.4011	292.1741	425.9310	457.1389	441.6446	(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	722.7746	704.0817	638.6621	527.9805	402.5945	269.6139	180.9569	189.4276	293.0165	449.8388	597.4181	716.9484	(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	189.6672	107.3351	54.7851	13.4046	2.0506	0.0000	0.0000	0.0000	0.0000	17.7874	101.0011	204.8260	(98)
Space heating												690.8570	(98)
Space heating per m2												12.8963	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												738.8845	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	189.6672	107.3351	54.7851	13.4046	2.0506	0.0000	0.0000	0.0000	0.0000	17.7874	101.0011	204.8260	(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)	202.8526	114.7969	58.5937	14.3364	2.1931	0.0000	0.0000	0.0000	0.0000	19.0239	108.0225	219.0653	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858	(64)
Efficiency of water heater	85.0759	83.9107	82.2847	80.6131	79.9353	79.8000	79.8000	79.8000	79.8000	80.8190	83.6747	85.3437	(216)
(217)m	85.0759	83.9107	82.2847	80.6131	79.9353	79.8000	79.8000	79.8000	79.8000	80.8190	83.6747	85.3437	(217)
Fuel for water heating, kWh/month	202.1030	180.8043	194.1085	178.2817	176.6798	158.8399	153.2170	167.2054	166.6215	184.3642	187.4837	196.8344	(219)
Water heating fuel used												2146.5434	(219)
Annual totals kWh/year													
Space heating fuel - main system												738.8845	(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)												246.3874	(232)
Total delivered energy for all uses												3206.8153	(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	738.8845	0.2160	159.5991 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2146.5434	0.2160	463.6534 (264)
Space and water heating			623.2524 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	246.3874	0.5190	127.8751 (268)
Total CO2, kg/m2/year			790.0525 (272)
Emissions per m2 for space and water heating			11.6344 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3871 (272b)
Emissions per m2 for pumps and fans			0.7266 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.6344 * 1.00) + 2.3871 + 0.7266, rounded to 2 d.p.			14.7500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000770_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.11_1B		
Property					
SAP Rating	85 B	DER	8.33	TER	14.75
Environmental	94 A	% DER<TER	43.52		
CO ₂ Emissions (t/year)	0.43	DFEE	21.41	TFEE	22.97
General Requirements Compliance	Fail	% DFEE<TFEE	6.82		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 54 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.75 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.33 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)23.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)21.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South West:	13.51 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	53.5700 (1b)	x 2.5000 (2b)	= 133.9250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.5700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.9250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			13.5100	0.9615	12.9904		(27)					
External Wall 1	21.6370	13.5120	8.1250	0.1600	1.3000		(29a)					
Total net area of external elements Aum(A, m2)			21.6350				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.2904		(33)					
Party Floor 1			53.5700				(32d)					
Party Ceilings 1			53.5700				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												
Thermal bridges (Default value 0.150 * total exposed area)							100.0000 (35)					
Total fabric heat loss							(33) + (36) = 17.5356 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.5557	Feb 11.4272	Mar 11.2988	Apr 10.6566	May 10.5281	Jun 9.8859	Jul 9.8859	Aug 9.7575	Sep 10.1428	Oct 10.5281	Nov 10.7850	Dec 11.0419 (38)
Heat transfer coeff	29.0913	28.9629	28.8344	28.1922	28.0638	27.4216	27.4216	27.2931	27.6784	28.0638	28.3207	28.5775 (39)
Average = Sum(39)m / 12 =	28.1601 (39)											
HLP	Jan 0.5431	Feb 0.5407	Mar 0.5383	Apr 0.5263	May 0.5239	Jun 0.5119	Jul 0.5119	Aug 0.5095	Sep 0.5167	Oct 0.5239	Nov 0.5287	Dec 0.5335 (40)
HLP (average)	0.5257 (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												1.7954 (42)
Average daily hot water use (litres/day)												76.8396 (43)
Daily hot water use	84.5236	81.4500	78.3764	75.3028	72.2292	69.1556	69.1556	72.2292	75.3028	78.3764	81.4500	84.5236 (44)
Energy conte	125.3460	109.6284	113.1267	98.6266	94.6346	81.6624	75.6723	86.8350	87.8721	102.4065	111.7847	121.3909 (45)
Energy content (annual)												Total = Sum(45)m = 1208.9861 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.8019	16.4443	16.9690	14.7940	14.1952	12.2494	11.3508	13.0253	13.1808	15.3610	16.7677	18.2086 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	180.6228	159.5558	168.4035	152.1203	149.9114	135.1561	130.9491	142.1118	141.3658	157.6833	165.2783	176.6677	(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	180.6228	159.5558	168.4035	152.1203	149.9114	135.1561	130.9491	142.1118	141.3658	157.6833	165.2783	176.6677	(64)
Total per year (kWh/year) = Sum(64)m =												1859.8258 (64)	
Heat gains from water heating, kWh/month													
	85.8990	76.3934	81.8361	75.5883	75.6874	69.9477	69.3825	73.0941	72.0124	78.2716	79.9633	84.5839	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9515	12.3916	10.0775	7.6293	5.7030	4.8147	5.2025	6.7624	9.0764	11.5246	13.4509	14.3392 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.4931	158.1170	154.0248	145.3130	134.3159	123.9802	117.0753	115.4514	119.5436	128.2554	139.2525	149.5882 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768 (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)	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141 (71)
Water heating gains (Table 5)	115.4556	113.6806	109.9947	104.9837	101.7304	97.1496	93.2560	98.2447	100.0172	105.2038	111.0602	113.6881 (72)
Total internal gains	335.8305	334.1195	324.0273	307.8563	291.6796	275.8748	265.4641	270.3888	278.5676	294.9141	313.6939	327.5458 (73)

[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	
-----					-----	-----	-----	-----			-----	-----	
Southwest					13.5120	36.7938	0.5000	0.8000			0.7700	137.8123 (79)	
-----					-----	-----	-----	-----			-----	-----	
Solar gains	137.8123	234.7453	321.1887	397.9684	445.7578	442.5343	426.6503	390.9973	347.7795	259.4435	165.0673	117.9386	(83)
Total gains	473.6427	568.8648	645.2160	705.8247	737.4374	718.4091	692.1144	661.3861	626.3470	554.3576	478.7613	445.4844	(84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nll,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.1512	51.3780	51.6069	52.7885	53.0241	54.2659	54.2659	54.5213	53.7623	53.0241	52.5431	52.0708
alpha	4.4101	4.4252	4.4405	4.5188	4.5349	4.6177	4.6177	4.6348	4.5842	4.5349	4.5029	4.4714
util living area												
	0.8254	0.7268	0.6113	0.4738	0.3519	0.2440	0.1743	0.1898	0.3040	0.5125	0.7304	0.8464 (86)
MIT	20.5992	20.7766	20.8998	20.9714	20.9935	20.9992	20.9999	20.9998	20.9975	20.9670	20.8132	20.5630 (87)
Th 2	20.4815	20.4837	20.4859	20.4968	20.4990	20.5100	20.5100	20.5121	20.5056	20.4990	20.4946	20.4903 (88)
util rest of house												
	0.8126	0.7111	0.5935	0.4554	0.3333	0.2254	0.1549	0.1697	0.2824	0.4900	0.7125	0.8348 (89)
MIT 2	19.9506	20.1937	20.3598	20.4626	20.4918	20.5091	20.5098	20.5120	20.5031	20.4605	20.2566	19.9084 (90)
Living area fraction										fIA = Living area / (4) =		0.5865 (91)
MIT	20.3310	20.5356	20.6765	20.7610	20.7861	20.7965	20.7973	20.7981	20.7931	20.7575	20.5830	20.2924 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3310	20.5356	20.6765	20.7610	20.7861	20.7965	20.7973	20.7981	20.7931	20.7575	20.5830	20.2924 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8088	0.7127	0.6002	0.4651	0.3439	0.2363	0.1663	0.1814	0.2950	0.5017	0.7157	0.8300 (94)
Useful gains	383.0786	405.4318	387.2369	328.2731	253.6344	169.7522	115.0711	120.0018	184.7644	278.1005	342.6386	369.7444 (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	466.3635	452.8508	408.7725	334.3884	254.9894	169.9189	115.0953	120.0379	185.2550	285.0590	381.8483	459.8805 (97a)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97b)
Space heating kWh	61.9640	31.8655	16.0225	4.4030	1.0081	0.0000	0.0000	0.0000	0.0000	5.1772	28.2310	67.0613 (98)
Space heating												215.7325 (98)
Space heating per m2											(98) / (4) =	4.0271 (99)

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.09r14

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	215.7325	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	56.0905	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	224.3618	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1859.8258	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	483.5547	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1934.2189	(310b)
Electricity used for heat distribution	26.9823	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	85.7790	(330a)
Total electricity for the above, kWh/year	85.7790	(331)
Electricity for lighting (calculated in Appendix L)	246.3874	(332)
Total delivered energy for all uses	3030.3922	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	568.0476	0.2160	122.6983 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	597.8200	0.2160	129.1291 (363)
less credit emissions for electricity	-221.3727	0.5190	-114.8924 (364)
Water heating from Combined Heat and Power	5153.7940	0.2160	1113.2195 (365)
less credit emissions for electricity	-1908.4499	0.5190	-990.4855 (366)
Electrical energy for heat distribution	26.9823	0.5190	14.0038 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			273.6727 (373)
Space and water heating			273.6727 (376)
Pumps and fans	85.7790	0.5190	44.5193 (378)
Energy for lighting	246.3874	0.5190	127.8751 (379)
Total CO2, kg/year			446.0671 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3300 (384)

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

DER	8.3300	ZC1
Total Floor Area	53.5700	TFA
Assumed number of occupants	1.7954	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	17.3109	ZC2
CO2 emissions from cooking, equation (L16)	3.0257	ZC3
Total CO2 emissions	28.6666	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	28.6666	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	53.5700 (1b)	x 2.5000 (2b)	= 133.9250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.5700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.9250 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1493 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3993 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3095 (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	0.3946	0.3869	0.3791	0.3404	0.3327	0.2940	0.2940	0.2863	0.3095	0.3327	0.3482	0.3636 (22b)
Effective ac	0.5779	0.5748	0.5719	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661 (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 Opening Type (Uw = 1.40)			13.4000	1.3258	17.7652		(27)
External Wall 1	21.6370	13.4000	8.2370	0.1800	1.4827		(29a)
Total net area of external elements Aum(A, m ²)			21.6370				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2478		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							1.0819 (36)
Total fabric heat loss						(33) + (36) =	20.3297 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	25.5383	25.4047	25.2738	24.6587	24.5436	24.0078	24.0078
Heat transfer coeff	45.8680	45.7344	45.6034	44.9883	44.8732	44.3375	44.3375
Average = Sum(39)m / 12 =							
HLP	0.8562	0.8537	0.8513	0.8398	0.8377	0.8277	0.8277
HLP (average)							0.8258
Days in month	31	28	31	30	31	30	31
							31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7954 (42)
Average daily hot water use (litres/day)												76.8396 (43)
Daily hot water use	84.5236	81.4500	78.3764	75.3028	72.2292	69.1556	69.1556	72.2292	75.3028	78.3764	81.4500	84.5236 (44)
Energy conte	125.3460	109.6284	113.1267	98.6266	94.6346	81.6624	75.6723	86.8350	87.8721	102.4065	111.7847	121.3909 (45)
Energy content (annual)										Total = Sum(45)m =		1208.9861 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8019	16.4443	16.9690	14.7940	14.1952	12.2494	11.3508	13.0253	13.1808	15.3610	16.7677	18.2086 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858 (64)
	78.9535	70.1200	74.8905	68.8668	68.7419	63.2262	62.4369	66.1486	65.2909	71.3261	73.2419	77.6384 (65)
								Total per year (kWh/year) =	Sum (64)m =			1757.6035 (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	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	89.7676	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9515	12.3916	10.0775	7.6293	5.7030	4.8147	5.2025	6.7624	9.0764	11.5246	13.4509	14.3392	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.4931	158.1170	154.0248	145.3130	134.3159	123.9802	117.0753	115.4514	119.5436	128.2554	139.2525	149.5882	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	31.9768	(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)	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	-71.8141	(71)
Water heating gains (Table 5)	106.1202	104.3453	100.6593	95.6484	92.3950	87.8142	83.9206	88.9094	90.6819	95.8684	101.7248	104.3527	(72)
Total internal gains	329.4951	327.7841	317.6919	301.5210	285.3442	269.5394	259.1287	264.0534	272.2322	288.5787	307.3585	321.2104	(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

Southwest				13.4000	36.7938	0.6300	0.7000			0.7700			150.6786 (79)

Solar gains	150.6786	256.6614	351.1754	435.1233	487.3744	483.8500	466.4830	427.5014	380.2487	283.6656	180.4783	128.9495	(83)
Total gains	480.1737	584.4456	668.8673	736.6443	772.7186	753.3894	725.6117	691.5548	652.4809	572.2443	487.8368	450.1599	(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	81.1053	81.3423	81.5758	82.6912	82.9033	83.9051	83.9051	84.0932	83.5164	82.9033	82.4754	82.0327	
alpha	6.4070	6.4228	6.4384	6.5127	6.5269	6.5937	6.5937	6.6062	6.5678	6.5269	6.4984	6.4688	
util living area	0.9807	0.9430	0.8606	0.7090	0.5356	0.3763	0.2688	0.2942	0.4693	0.7649	0.9487	0.9861	(86)
MIT	20.4534	20.6568	20.8412	20.9590	20.9935	20.9995	21.0000	20.9999	20.9978	20.9461	20.6951	20.4100	(87)
Th 2	20.2049	20.2070	20.2091	20.2190	20.2208	20.2294	20.2294	20.2310	20.2261	20.2208	20.2171	20.2132	(88)
util rest of house	0.9755	0.9298	0.8346	0.6707	0.4923	0.3311	0.2218	0.2451	0.4174	0.7210	0.9345	0.9823	(89)
MIT 2	19.4964	19.7819	20.0274	20.1778	20.2155	20.2291	20.2294	20.2310	20.2247	20.1687	19.8477	19.4412	(90)
Living area fraction									fLA = Living area / (4) =			0.5865	(91)
MIT	20.0577	20.2950	20.5047	20.6359	20.6718	20.6809	20.6814	20.6820	20.6782	20.6247	20.3447	20.0094	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0577	20.2950	20.5047	20.6359	20.6718	20.6809	20.6814	20.6820	20.6782	20.6247	20.3447	20.0094	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9743	0.9314	0.8448	0.6915	0.5174	0.3576	0.2494	0.2739	0.4478	0.7443	0.9371	0.9811	(94)
Useful gains	467.8455	544.3568	565.0262	509.3631	399.8384	269.4162	180.9425	189.4011	292.1741	425.9310	457.1389	441.6446	(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	722.7746	704.0817	638.6621	527.9805	402.5945	269.6139	180.9569	189.4276	293.0165	449.8388	597.4181	716.9484	(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	189.6672	107.3351	54.7851	13.4046	2.0506	0.0000	0.0000	0.0000	0.0000	17.7874	101.0011	204.8260	(98)
Space heating												690.8570	(98)
Space heating per m2												12.8963	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												738.8845	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	189.6672	107.3351	54.7851	13.4046	2.0506	0.0000	0.0000	0.0000	0.0000	17.7874	101.0011	204.8260	(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)	202.8526	114.7969	58.5937	14.3364	2.1931	0.0000	0.0000	0.0000	0.0000	19.0239	108.0225	219.0653	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	171.9409	151.7141	159.7216	143.7184	141.2295	126.7543	122.2672	133.4299	132.9639	149.0014	156.8765	167.9858	(64)
Efficiency of water heater	85.0759	83.9107	82.2847	80.6131	79.9353	79.8000	79.8000	79.8000	79.8000	80.8190	83.6747	85.3437	(216)
(217)m	85.0759	83.9107	82.2847	80.6131	79.9353	79.8000	79.8000	79.8000	79.8000	80.8190	83.6747	85.3437	(217)
Fuel for water heating, kWh/month	202.1030	180.8043	194.1085	178.2817	176.6798	158.8399	153.2170	167.2054	166.6215	184.3642	187.4837	196.8344	(219)
Water heating fuel used												2146.5434	(219)
Annual totals kWh/year													
Space heating fuel - main system												738.8845	(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)												246.3874	(232)
Total delivered energy for all uses												3206.8153	(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	738.8845	0.2160	159.5991 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2146.5434	0.2160	463.6534 (264)
Space and water heating			623.2524 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	246.3874	0.5190	127.8751 (268)
Total CO2, kg/m2/year			790.0525 (272)
Emissions per m2 for space and water heating			11.6344 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3871 (272b)
Emissions per m2 for pumps and fans			0.7266 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.6344 * 1.00) + 2.3871 + 0.7266, rounded to 2 d.p.			14.7500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000798_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.12_2B		
Property					
SAP Rating	85 B	DER	9.38	TER	13.82
Environmental	93 A	% DER<TER	32.13		
CO ₂ Emissions (t/year)	0.63	DFEE	38.33	TFEE	29.80
General Requirements Compliance	Fail	% DFEE<TFEE	-28.60		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 75 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.82 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.38 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)29.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.3 kWh/m²/yrFail
Excess energy =8.5 kWh/m²/yr (28.5%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.44
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail
Based on:		
Overshading:	Average	
Windows facing South East:	14.40 m ² , No overhang	
Windows facing South West:	14.40 m ² , No overhang	
Air change rate:	2.00 ach	
Blinds/curtains:	None	

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	74.6000 (1b)	x 2.5000 (2b)	= 186.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.5000 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							3.0000					
Infiltration rate							0.1500	(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) =	0.1275 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			28.8000	1.3258	38.1818		(27)					
External Wall 1	50.1023	28.8000	21.3023	0.1600	3.4084		(29a)					
Total net area of external elements Aum(A, m2)			50.1023				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.5902		(33)					
Party Floor 1			74.6000				(32d)					
Party Ceilings 1			74.6000				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							7.5153 (36)					
Total fabric heat loss	(33) + (36) =						49.1055 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	16.9749	16.7787	16.5825	15.6017	15.4055	14.4246	14.4246	14.2284	14.8170	15.4055	15.7978	16.1902 (38)
	66.0804	65.8842	65.6881	64.7072	64.5110	63.5301	63.5301	63.3340	63.9225	64.5110	64.9034	65.2957 (39)
Average = Sum(39)m / 12 =												64.6581 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8858	0.8832	0.8805	0.8674	0.8648	0.8516	0.8516	0.8490	0.8569	0.8648	0.8700	0.8753 (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												2.3524 (42)
Average daily hot water use (litres/day)												90.0704 (43)
Daily hot water use	Jan 99.0774	Feb 95.4746	Mar 91.8718	Apr 88.2690	May 84.6661	Jun 81.0633	Jul 81.0633	Aug 84.6661	Sep 88.2690	Oct 91.8718	Nov 95.4746	Dec 99.0774 (44)
Energy conte	146.9289	128.5050	132.6056	115.6088	110.9294	95.7236	88.7020	101.7869	103.0025	120.0395	131.0325	142.2928 (45)
Energy content (annual)												Total = Sum(45)m = 1417.1577 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.0393	19.2757	19.8908	17.3413	16.6394	14.3585	13.3053	15.2680	15.4504	18.0059	19.6549	21.3439 (46)
Water storage loss:												
Store volume												110.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	202.2057	178.4324	187.8824	169.1025	166.2062	149.2173	143.9788	157.0637	156.4962	175.3163	184.5262	197.5696 (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	202.2057	178.4324	187.8824	169.1025	166.2062	149.2173	143.9788	157.0637	156.4962	175.3163	184.5262	197.5696 (64)	
								Total per year (kWh/year) = Sum(64)m =					2067.9974 (64)
Heat gains from water heating, kWh/month													
	93.0753	82.6699	88.3128	81.2349	81.1055	74.6231	73.7149	78.0656	77.0433	84.1346	86.3633	91.5338 (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	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5244	16.4532	13.3806	10.1300	7.5723	6.3928	6.9077	8.9789	12.0514	15.3021	17.8598	19.0392 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (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)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)	125.1012	123.0206	118.7000	112.8262	109.0127	103.6431	99.0791	104.9268	107.0046	113.0841	119.9490	123.0293 (72)
Total internal gains	409.6990	407.7034	394.8767	374.1850	353.2122	332.9397	319.7225	325.4852	336.0690	356.9664	380.9906	398.9738 (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
Southeast					14.4000	36.7938	0.3000		0.8000		0.7700	88.1215
Southwest					14.4000	36.7938	0.3000		0.8000		0.7700	88.1215 (79)
Solar gains	176.2430	300.2071	410.7565	508.9472	570.0632	565.9409	545.6274	500.0320	444.7624	331.7928	211.0986	150.8273 (83)
Total gains	585.9420	707.9105	805.6332	883.1322	923.2755	898.8806	865.3498	825.5173	780.8314	688.7592	592.0891	549.8012 (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	31.3591	31.4525	31.5464	32.0246	32.1220	32.6179	32.6179	32.7190	32.4177	32.1220	31.9278	31.7360
alpha	3.0906	3.0968	3.1031	3.1350	3.1415	3.1745	3.1745	3.1813	3.1612	3.1415	3.1285	3.1157
util living area	0.9283	0.8825	0.8155	0.7107	0.5792	0.4316	0.3169	0.3445	0.5203	0.7485	0.8883	0.9384 (86)
MIT	19.5248	19.8495	20.2194	20.5878	20.8268	20.9503	20.9859	20.9814	20.9073	20.5871	20.0023	19.4622 (87)
Th 2	20.1796	20.1818	20.1841	20.1953	20.1976	20.2088	20.2088	20.2111	20.2043	20.1976	20.1931	20.1886 (88)
util rest of house												
	0.9197	0.8694	0.7960	0.6823	0.5407	0.3835	0.2621	0.2882	0.4702	0.7167	0.8737	0.9309 (89)
MIT 2	18.2086	18.6692	19.1874	19.6965	20.0070	20.1633	20.1991	20.1976	20.1142	19.7091	18.9015	18.1254 (90)
Living area fraction												
MIT	18.6832	19.0948	19.5596	20.0179	20.3026	20.4471	20.4828	20.4803	20.4002	20.0257	19.2984	18.6075 (92)
Temperature adjustment												
adjusted MIT	18.6832	19.0948	19.5596	20.0179	20.3026	20.4471	20.4828	20.4803	20.4002	20.0257	19.2984	18.6075 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9002	0.8492	0.7795	0.6757	0.5459	0.3982	0.2812	0.3077	0.4829	0.7094	0.8546	0.9124 (94)
Useful gains	527.4639	601.1580	627.9797	596.7345	504.0408	357.9425	243.3749	253.9722	377.0442	488.5909	505.9892	501.6636 (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												
	950.4496	935.2151	857.8569	719.4056	554.9644	371.4639	246.6738	258.4186	402.7251	608.0592	791.7182	940.7448 (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												
	314.7014	224.4863	171.0287	88.3232	37.8872	0.0000	0.0000	0.0000	0.0000	88.8844	205.7249	326.6764 (98)
Space heating												1457.7125 (98)
Space heating per m2											(98) / (4) =	19.5404 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	1457.7125 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	379.0053 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1516.0210 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2067.9974 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	537.6793 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2150.7173 (310b)
Electricity used for heat distribution	45.8342 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	125.1415 (330a)
Total electricity for the above, kWh/year	125.1415 (331)
Electricity for lighting (calculated in Appendix L)	327.1458 (332)
Total delivered energy for all uses	5035.7103 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	964.9311	0.2160	208.4251 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	4039.4911	0.2160	872.5301 (363)
less credit emissions for electricity	-1495.8236	0.5190	-776.3324 (364)
Water heating from Combined Heat and Power	5730.6617	0.2160	1237.8229 (365)
less credit emissions for electricity	-2122.0640	0.5190	-1101.3512 (366)
Electrical energy for heat distribution	45.8342	0.5190	23.7880 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			464.8824 (373)
Space and water heating			464.8824 (376)
Pumps and fans	125.1415	0.5190	64.9484 (378)
Energy for lighting	327.1458	0.5190	169.7887 (379)
Total CO2, kg/year			699.6196 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.3800 (384)

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

DER	9.3800 ZC1
Total Floor Area	TFA 74.6000
Assumed number of occupants	N 2.3524
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	16.5054 ZC2
CO2 emissions from cooking, equation (L16)	2.3520 ZC3
Total CO2 emissions	28.2374 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	28.2374 ZC8

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

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6000 (1b)	x 2.5000 (2b)	= 186.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.5000 (5)

	main heating		secondary heating		other		total	m3 per hour
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans							3 * 10 =	30.0000 (7a)
Number of passive vents							0 * 10 =	0.0000 (7b)
Number of flueless gas fires							0 * 40 =	0.0000 (7c)
								Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1609 (8)
Pressure test							Yes	
Measured/design AP50							5.0000	
Infiltration rate								0.4109 (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) =	0.3492 (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												
	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (25)

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 Opening Type (Uw = 1.40)			18.6500	1.3258	24.7254		(27)					
External Wall 1	50.1023	18.6500	31.4523	0.1800	5.6614		(29a)					
Total net area of external elements Aum(A, m2)			50.1023				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.3868		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal Bridges (User defined value 0.050 * total exposed area)							2.5051 (36)					
Total fabric heat loss						(33) + (36) =	32.8919 (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	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596	33.9837	34.5255	35.1096	35.5224	35.9540 (38)
Heat transfer coeff	69.7655	69.5285	69.2963	68.2056	68.0015	67.0515	67.0515	66.8756	67.4175	68.0015	68.4144	68.8460 (39)
Average = Sum(39)m / 12 =												68.2046 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988	0.8965	0.9037	0.9115	0.9171	0.9229 (40)
HLP (average)												0.9143 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

Assumed occupancy												2.3524 (42)
Average daily hot water use (litres/day)												90.0704 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	99.0774	95.4746	91.8718	88.2690	84.6661	81.0633	81.0633	84.6661	88.2690	91.8718	95.4746	99.0774 (44)
Energy content (annual)	146.9289	128.5050	132.6056	115.6088	110.9294	95.7236	88.7020	101.7869	103.0025	120.0395	131.0325	142.2928 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1417.1577 (45)
	22.0393	19.2757	19.8908	17.3413	16.6394	14.3585	13.3053	15.2680	15.4504	18.0059	19.6549	21.3439 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877 (64)
	86.1298	76.3965	81.3673	74.5134	74.1599	67.9016	66.7693	71.1201	70.3218	77.1891	79.6418	84.5883 (65)
								Total per year (kWh/year) =	Sum (64)m =			1965.7751 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	18.5244	16.4532	13.3806	10.1300	7.5723	6.3928	6.9077	8.9789	12.0514	15.3021	17.8598	19.0392 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Pumps, fans	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Total internal gains	115.7659	113.6852	109.3646	103.4908	99.6773	94.3078	89.7437	95.5915	97.6692	103.7487	110.6136	113.6939 (72)
	403.3636	401.3680	388.5414	367.8496	346.8769	326.6044	313.3871	319.1498	329.7336	350.6311	374.6552	392.6385 (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	
Southeast					9.3300	36.7938	0.6300	0.7000	0.7700		104.9128	
Southwest					9.3200	36.7938	0.6300	0.7000	0.7700		104.8004 (79)	
Solar gains	209.7132	357.2191	488.7627	605.6007	678.3233	673.4180	649.2468	594.9926	529.2267	394.8032	251.1880	179.4708 (83)
Total gains	613.0768	758.5871	877.3041	973.4504	1025.2002	1000.0224	962.6339	914.1424	858.9603	745.4343	625.8432	572.1092 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	74.2567	74.5098	74.7595	75.9550	76.1829	77.2623	77.2623	77.4655	76.8429	76.1829	75.7232	75.2485
util living area	5.9504	5.9673	5.9840	6.0637	6.0789	6.1508	6.1508	6.1644	6.1229	6.0789	6.0482	6.0166
	0.9895	0.9661	0.9080	0.7789	0.6039	0.4278	0.3063	0.3362	0.5357	0.8352	0.9713	0.9926 (86)
MIT	20.2683	20.4933	20.7269	20.9118	20.9825	20.9982	20.9998	20.9997	20.9933	20.8886	20.5489	20.2269 (87)
Th 2	20.1377	20.1404	20.1430	20.1554	20.1577	20.1685	20.1685	20.1705	20.1643	20.1577	20.1530	20.1481 (88)
util rest of house	0.9864	0.9572	0.8868	0.7400	0.5535	0.3728	0.2485	0.2758	0.4733	0.7937	0.9621	0.9904 (89)
MIT 2	19.1779	19.4999	19.8213	20.0643	20.1430	20.1675	20.1684	20.1704	20.1599	20.0454	19.5928	19.1261 (90)
Living area fraction									fLA = Living area / (4) =			0.3606 (91)
MIT	19.5711	19.8581	20.1479	20.3699	20.4457	20.4670	20.4682	20.4694	20.4604	20.3494	19.9376	19.5230 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5711	19.8581	20.1479	20.3699	20.4457	20.4670	20.4682	20.4694	20.4604	20.3494	19.9376	19.5230 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9838	0.9537	0.8869	0.7503	0.5710	0.3926	0.2694	0.2976	0.4956	0.8038	0.9592	0.9883 (94)
Ext temp.	603.1503	723.4559	778.0910	730.4224	585.4065	392.6233	259.3110	272.0359	425.7315	599.2014	600.3337	565.4235 (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	1065.3929	1040.0159	945.7462	782.3109	594.7202	393.3925	259.3705	272.1449	428.8052	662.9766	878.2753	1054.9284 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	343.9085	212.7283	124.7355	37.3597	6.9295	0.0000	0.0000	0.0000	0.0000	47.4488	200.1179	364.1917 (98)
												1337.4199 (98)
										(98) / (4) =		17.9279 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1430.3956 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	343.9085	212.7283	124.7355	37.3597	6.9295	0.0000	0.0000	0.0000	0.0000	47.4488	200.1179	364.1917	(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)	367.8166	227.5169	133.4069	39.9569	7.4112	0.0000	0.0000	0.0000	0.0000	50.7474	214.0299	389.5098	(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	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877	(64)
Efficiency of water heater	86.3317	85.4037	83.8696	81.6203	80.1995	79.8000	79.8000	79.8000	79.8000	81.9474	85.1551	86.5372	(217)
Fuel for water heating, kWh/month	224.1632	199.7462	213.6658	196.8881	196.4155	176.4605	169.5450	185.9421	185.5819	203.3431	206.8278	218.2734	(219)
Water heating fuel used												2376.8526	(219)
Annual totals kWh/year													
Space heating fuel - main system												1430.3956	(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)												327.1458	(232)
Total delivered energy for all uses												4209.3940	(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	1430.3956	0.2160	308.9654 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2376.8526	0.2160	513.4002 (264)
Space and water heating			822.3656 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	327.1458	0.5190	169.7887 (268)
Total CO2, kg/m2/year			1031.0793 (272)
Emissions per m2 for space and water heating			11.0237 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2760 (272b)
Emissions per m2 for pumps and fans			0.5218 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.0237 * 1.00) + 2.2760 + 0.5218, rounded to 2 d.p.			13.8200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000842_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.12_2B		
Property					
SAP Rating	86 B	DER	8.06	TER	13.82
Environmental	94 A	% DER<TER	41.68		
CO ₂ Emissions (t/year)	0.56	DFEE	28.54	TFEE	29.80
General Requirements Compliance	Fail	% DFEE<TFEE	4.23		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 75 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 (c)
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.82 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.06 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 29.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 28.5 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room stats	OK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.44	
Maximum	1.5	OK
MVHR efficiency:	91%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South East:	14.40 m ² , No overhang
Windows facing South West:	14.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	74.6000 (1b)	x 2.5000 (2b)	= 186.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.5000 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							3.0000					
Infiltration rate							0.1500	(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) =	0.1275 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Opening Type 1 (Uw = 1.00)			28.8000	0.9615	27.6923		(27)						
External Wall 1	50.1023	28.8000	21.3023	0.1600	3.4084		(29a)						
Total net area of external elements Aum(A, m2)			50.1023				(31)						
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.1007		(33)						
Party Floor 1			74.6000				(32d)						
Party Ceilings 1			74.6000				(32b)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)						
Thermal bridges (Default value 0.150 * total exposed area)							7.5153 (36)						
Total fabric heat loss						(33) + (36) =	38.6160 (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	16.9749	16.7787	16.5825	15.6017	15.4055	14.4246	14.4246	14.2284	14.8170	15.4055	15.7978	16.1902	(38)
Heat transfer coeff	55.5909	55.3947	55.1986	54.2177	54.0215	53.0406	53.0406	52.8445	53.4330	54.0215	54.4139	54.8062	(39)
Average = Sum(39)m / 12 =												54.1686	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7452	0.7426	0.7399	0.7268	0.7241	0.7110	0.7110	0.7084	0.7163	0.7241	0.7294	0.7347	(40)
HLP (average)												0.7261	(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												2.3524 (42)
Average daily hot water use (litres/day)												90.0704 (43)
Daily hot water use	Jan 99.0774	Feb 95.4746	Mar 91.8718	Apr 88.2690	May 84.6661	Jun 81.0633	Jul 81.0633	Aug 84.6661	Sep 88.2690	Oct 91.8718	Nov 95.4746	Dec 99.0774 (44)
Energy conte	146.9289	128.5050	132.6056	115.6088	110.9294	95.7236	88.7020	101.7869	103.0025	120.0395	131.0325	142.2928 (45)
Energy content (annual)												Total = Sum(45)m = 1417.1577 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.0393	19.2757	19.8908	17.3413	16.6394	14.3585	13.3053	15.2680	15.4504	18.0059	19.6549	21.3439 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	202.2057	178.4324	187.8824	169.1025	166.2062	149.2173	143.9788	157.0637	156.4962	175.3163	184.5262	197.5696 (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	202.2057	178.4324	187.8824	169.1025	166.2062	149.2173	143.9788	157.0637	156.4962	175.3163	184.5262	197.5696 (64)	
												Total per year (kWh/year) = Sum (64)m =	2067.9974 (64)
Heat gains from water heating, kWh/month													
	93.0753	82.6699	88.3128	81.2349	81.1055	74.6231	73.7149	78.0656	77.0433	84.1346	86.3633	91.5338 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5244	16.4532	13.3806	10.1300	7.5723	6.3928	6.9077	8.9789	12.0514	15.3021	17.8598	19.0392 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622 (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)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975 (71)
Water heating gains (Table 5)	125.1012	123.0206	118.7000	112.8262	109.0127	103.6431	99.0791	104.9268	107.0046	113.0841	119.9490	123.0293 (72)
Total internal gains	409.6990	407.7034	394.8767	374.1850	353.2122	332.9397	319.7225	325.4852	336.0690	356.9664	380.9906	398.9738 (73)

[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

Southeast	14.4000	36.7938	0.5000	0.8000	0.7700	146.8692 (77)
Southwest	14.4000	36.7938	0.5000	0.8000	0.7700	146.8692 (79)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	713.7752 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	185.5816 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	742.3262 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2067.9974 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	537.6793 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2150.7173 (310b)
Electricity used for heat distribution	36.1630 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	125.1415 (330a)
Total electricity for the above, kWh/year	125.1415 (331)
Electricity for lighting (calculated in Appendix L)	327.1458 (332)
Total delivered energy for all uses	4068.5918 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	761.3272	0.2160	164.4467 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1977.9542	0.2160	427.2381 (363)
less credit emissions for electricity	-732.4364	0.5190	-380.1345 (364)
Water heating from Combined Heat and Power	5730.6617	0.2160	1237.8229 (365)
less credit emissions for electricity	-2122.0640	0.5190	-1101.3512 (366)
Electrical energy for heat distribution	36.1630	0.5190	18.7686 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			366.7906 (373)
Space and water heating			366.7906 (376)
Pumps and fans	125.1415	0.5190	64.9484 (378)
Energy for lighting	327.1458	0.5190	169.7887 (379)
Total CO2, kg/year			601.5277 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.0600 (384)

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

DER	8.0600 ZC1
Total Floor Area	TFA 74.6000
Assumed number of occupants	N 2.3524
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	16.5054 ZC2
CO2 emissions from cooking, equation (L16)	2.3520 ZC3
Total CO2 emissions	26.9174 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	26.9174 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	74.6000 (1b)	x 2.5000 (2b)	= 186.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.5000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1609 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4109 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3492 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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 Opening Type (Uw = 1.40)			18.6500	1.3258	24.7254		(27)
External Wall 1	50.1023	18.6500	31.4523	0.1800	5.6614		(29a)
Total net area of external elements Aum(A, m ²)			50.1023				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.3868		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							2.5051 (36)
Total fabric heat loss						(33) + (36) =	32.8919 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
Jan	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Feb	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Mar	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Apr	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
May	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Jun	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Jul	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Aug	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Sep	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Oct	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Nov	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Dec	36.8735	36.6366	36.4044	35.3137	35.1096	34.1596	34.1596
Heat transfer coeff	69.7655	69.5285	69.2963	68.2056	68.0015	67.0515	67.0515
Average = Sum(39)m / 12 =							
Jan	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Feb	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Mar	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Apr	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
May	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Jun	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Jul	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Aug	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Sep	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Oct	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Nov	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
Dec	0.9352	0.9320	0.9289	0.9143	0.9115	0.8988	0.8988
HLP (average)							0.9229 (40)
Days in month	31	28	31	30	31	30	31
							31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3524 (42)
Average daily hot water use (litres/day)												90.0704 (43)
Jan	99.0774	95.4746	91.8718	88.2690	84.6661	81.0633	81.0633	84.6661	88.2690	91.8718	95.4746	99.0774 (44)
Energy conte	146.9289	128.5050	132.6056	115.6088	110.9294	95.7236	88.7020	101.7869	103.0025	120.0395	131.0325	142.2928 (45)
Energy content (annual)										Total = Sum(45)m =		1417.1577 (45)
Distribution loss (46)m = 0.15 x (45)m												
22.0393	19.2757	19.8908	17.3413	16.6394	14.3585	13.3053	15.2680	15.4504	18.0059	19.6549	21.3439 (46)	
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)	
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877 (64)
	86.1298	76.3965	81.3673	74.5134	74.1599	67.9016	66.7693	71.1201	70.3218	77.1891	79.6418	84.5883 (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	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5244	16.4532	13.3806	10.1300	7.5723	6.3928	6.9077	8.9789	12.0514	15.3021	17.8598	19.0392	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	(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)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	(71)
Water heating gains (Table 5)	115.7659	113.6852	109.3646	103.4908	99.6773	94.3078	89.7437	95.5915	97.6692	103.7487	110.6136	113.6939	(72)
Total internal gains	403.3636	401.3680	388.5414	367.8496	346.8769	326.6044	313.3871	319.1498	329.7336	350.6311	374.6552	392.6385	(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	
Southeast					9.3300	36.7938	0.6300	0.7000	0.7700		104.9128	
Southwest					9.3200	36.7938	0.6300	0.7000	0.7700		104.8004 (79)	
Solar gains	209.7132	357.2191	488.7627	605.6007	678.3233	673.4180	649.2468	594.9926	529.2267	394.8032	251.1880	179.4708 (83)
Total gains	613.0768	758.5871	877.3041	973.4504	1025.2002	1000.0224	962.6339	914.1424	858.9603	745.4343	625.8432	572.1092 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.2567	74.5098	74.7595	75.9550	76.1829	77.2623	77.2623	77.4655	76.8429	76.1829	75.7232	75.2485	
alpha	5.9504	5.9673	5.9840	6.0637	6.0789	6.1508	6.1508	6.1644	6.1229	6.0789	6.0482	6.0166	
util living area	0.9895	0.9661	0.9080	0.7789	0.6039	0.4278	0.3063	0.3362	0.5357	0.8352	0.9713	0.9926	(86)
MIT	20.2683	20.4933	20.7269	20.9118	20.9825	20.9982	20.9998	20.9997	20.9933	20.8886	20.5489	20.2269	(87)
Th 2	20.1377	20.1404	20.1430	20.1554	20.1577	20.1685	20.1685	20.1705	20.1643	20.1577	20.1530	20.1481	(88)
util rest of house	0.9864	0.9572	0.8868	0.7400	0.5535	0.3728	0.2485	0.2758	0.4733	0.7937	0.9621	0.9904	(89)
MIT 2	19.1779	19.4999	19.8213	20.0643	20.1430	20.1675	20.1684	20.1704	20.1599	20.0454	19.5928	19.1261	(90)
Living area fraction	19.5711	19.8581	20.1479	20.3699	20.4457	20.4670	20.4682	20.4694	20.4604	20.3494	19.9376	19.5230	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5711	19.8581	20.1479	20.3699	20.4457	20.4670	20.4682	20.4694	20.4604	20.3494	19.9376	19.5230	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	603.1503	723.4559	778.0910	730.4224	585.4065	392.6233	259.3110	272.0359	425.7315	599.2014	600.3337	565.4235	(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	1065.3929	1040.0159	945.7462	782.3109	594.7202	393.3925	259.3705	272.1449	428.8052	662.9766	878.2753	1054.9284	(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	343.9085	212.7283	124.7355	37.3597	6.9295	0.0000	0.0000	0.0000	0.0000	47.4488	200.1179	364.1917	(98)
Space heating												1337.4199	(98)
Space heating per m2												17.9279	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1430.3956 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	343.9085	212.7283	124.7355	37.3597	6.9295	0.0000	0.0000	0.0000	0.0000	47.4488	200.1179	364.1917	(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)	367.8166	227.5169	133.4069	39.9569	7.4112	0.0000	0.0000	0.0000	0.0000	50.7474	214.0299	389.5098	(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	193.5238	170.5907	179.2005	160.7006	157.5243	140.8155	135.2969	148.3818	148.0944	166.6344	176.1244	188.8877	(64)
Efficiency of water heater	86.3317	85.4037	83.8696	81.6203	80.1995	79.8000	79.8000	79.8000	79.8000	81.9474	85.1551	86.5372	(217)
Fuel for water heating, kWh/month	224.1632	199.7462	213.6658	196.8881	196.4155	176.4605	169.5450	185.9421	185.5819	203.3431	206.8278	218.2734	(219)
Water heating fuel used												2376.8526	(219)
Annual totals kWh/year													
Space heating fuel - main system												1430.3956	(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)												327.1458	(232)
Total delivered energy for all uses												4209.3940	(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	1430.3956	0.2160	308.9654 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2376.8526	0.2160	513.4002 (264)
Space and water heating			822.3656 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	327.1458	0.5190	169.7887 (268)
Total CO2, kg/m2/year			1031.0793 (272)
Emissions per m2 for space and water heating			11.0237 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2760 (272b)
Emissions per m2 for pumps and fans			0.5218 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.0237 * 1.00) + 2.2760 + 0.5218, rounded to 2 d.p.			13.8200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000870_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.13_1B		
Property					
SAP Rating	83 B	DER	11.08	TER	16.40
Environmental	92 A	% DER<TER	32.44		
CO ₂ Emissions (t/year)	0.53	DFEE	45.04	TFEE	33.83
General Requirements Compliance	Fail	% DFEE<TFEE	-33.14		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 53 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 (c)
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.40 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.08 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 33.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 45.0 kWh/m²/yr Fail
Excess energy = 11.2 kWh/m²/yr (33.1%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room stats	OK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.42	
Maximum	1.5	OK
MVHR efficiency:	91%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail
Based on:		
Overshading:	Average	
Windows facing South West:	13.20 m ² , No overhang	
Windows facing North West:	12.00 m ² , No overhang	
Air change rate:	2.00 ach	
Blinds/curtains:	None	

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	53.4400 (1b)	x 2.5000 (2b)	= 133.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6000 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour		
					heating		heating						
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test											Yes		
Measured/design AP50											3.0000		
Infiltration rate											0.1500 (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) =		0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation:												0.5000 (23a)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)	
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			25.2000	1.3258	33.4091		(27)					
External Wall 1	40.0425	25.2000	14.8425	0.1600	2.3748		(29a)					
Total net area of external elements Aum(A, m2)			40.0425				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7839		(33)					
Party Floor 1			53.4400				(32d)					
Party Ceilings 1			53.4400				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							6.0064 (36)					
Total fabric heat loss	(33) + (36) =						41.7903 (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	12.1600	12.0195	11.8790	11.1763	11.0358	10.3331	10.3331	10.1926	10.6142	11.0358	11.3168	11.5979 (38)
Heat transfer coeff	53.9503	53.8098	53.6692	52.9666	52.8260	52.1234	52.1234	51.9829	52.4045	52.8260	53.1071	53.3882 (39)
Average = Sum(39)m / 12 =												52.9314 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0095	1.0069	1.0043	0.9911	0.9885	0.9754	0.9754	0.9727	0.9806	0.9885	0.9938	0.9990 (40)
HLP (average)												0.9905 (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												1.7915 (42)
Average daily hot water use (litres/day)												76.7487 (43)
Daily hot water use	Jan 84.4236	Feb 81.3536	Mar 78.2837	Apr 75.2137	May 72.1438	Jun 69.0738	Jul 69.0738	Aug 72.1438	Sep 75.2137	Oct 78.2837	Nov 81.3536	Dec 84.4236 (44)
Energy conte	125.1977	109.4987	112.9929	98.5099	94.5226	81.5658	75.5827	86.7323	87.7681	102.2853	111.6524	121.2473 (45)
Energy content (annual)												Total = Sum(45)m = 1207.5558 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7797	16.4248	16.9489	14.7765	14.1784	12.2349	11.3374	13.0098	13.1652	15.3428	16.7479	18.1871 (46)
Water storage loss:												110.0000 (47)
Store volume												

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	180.4745	159.4261	168.2697	152.0036	149.7994	135.0595	130.8595	142.0091	141.2618	157.5621	165.1461	176.5241	(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	180.4745	159.4261	168.2697	152.0036	149.7994	135.0595	130.8595	142.0091	141.2618	157.5621	165.1461	176.5241	(64)
								Total per year (kWh/year) =	Sum (64)m =			1858.3955	(64)
Heat gains from water heating, kWh/month													
	85.8497	76.3503	81.7916	75.5495	75.6502	69.9156	69.3527	73.0599	71.9779	78.2313	79.9194	84.5362	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8995	0.8577	0.7919	0.6840	0.5463	0.3977	0.2852	0.3207	0.5109	0.7325	0.8598	0.9100 (94)
Useful gains	394.5555	443.4791	470.7067	462.5997	401.4631	289.9874	198.7912	206.6056	297.6861	368.1555	376.8955	377.2761 (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	763.2635	749.4867	689.3174	582.6881	452.3743	304.5936	202.8410	212.3560	328.3103	490.2229	636.5129	756.9510 (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	274.3187	205.6371	162.6463	86.4637	37.8779	0.0000	0.0000	0.0000	0.0000	90.8181	186.9246	282.4781 (98)
Space heating												1327.1646 (98)
Space heating per m2												24.8347 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	1327.1646 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	345.0628 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1380.2511 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1858.3955 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	483.1828 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1932.7314 (310b)
Electricity used for heat distribution	41.4123 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	85.5708 (330a)
Total electricity for the above, kWh/year	85.5708 (331)
Electricity for lighting (calculated in Appendix L)	245.8579 (332)
Total delivered energy for all uses	4472.6568 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	871.8375	0.2160	188.3169 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	3677.7275	0.2160	794.3891 (363)
less credit emissions for electricity	-1361.8625	0.5190	-706.8066 (364)
Water heating from Combined Heat and Power	5149.8304	0.2160	1112.3634 (365)
less credit emissions for electricity	-1906.9822	0.5190	-989.7238 (366)
Electrical energy for heat distribution	41.4123	0.5190	21.4930 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			420.0320 (373)
Space and water heating			420.0320 (376)
Pumps and fans	85.5708	0.5190	44.4112 (378)
Energy for lighting	245.8579	0.5190	127.6002 (379)
Total CO2, kg/year			592.0435 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			11.0800 (384)

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

DER		11.0800 ZC1
Total Floor Area	TFA	53.4400
Assumed number of occupants	N	1.7915
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.3157 ZC2
CO2 emissions from cooking, equation (L16)		3.0314 ZC3
Total CO2 emissions		31.4271 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		31.4271 ZC8

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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	53.4400 (1b)	x 2.5000 (2b)	= 133.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6000 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.1497 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3997 (18)
					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3397 (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	0.4332	0.4247	0.4162	0.3737	0.3652	0.3228	0.3228	0.3143	0.3397	0.3652	0.3822	0.3992 (22b)
Effective ac	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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 Opening Type (Uw = 1.40)			13.3600	1.3258	17.7121		(27)
External Wall 1	40.0425	13.3600	26.6825	0.1800	4.8029		(29a)
Total net area of external elements Aum(A, m ²)			40.0425				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.5150		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							2.0021 (36)
Total fabric heat loss						(33) + (36) =	24.5171 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	26.1804	26.0197	25.8623	25.1228	24.9845	24.3404	24.3404
Heat transfer coeff	50.6975	50.5368	50.3794	49.6399	49.5016	48.8575	48.8575
Average = Sum(39)m / 12 =						48.7382	49.1056
						49.5016	49.5016
						49.7814	50.0741 (39)
							49.6392 (39)
HLP	0.9487	0.9457	0.9427	0.9289	0.9263	0.9142	0.9142
HLP (average)						0.9120	0.9189
Days in month	31	28	31	30	31	30	31
						30	31
						31	30
							31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7915 (42)
Average daily hot water use (litres/day)												76.7487 (43)
Daily hot water use	84.4236	81.3536	78.2837	75.2137	72.1438	69.0738	69.0738	72.1438	75.2137	78.2837	81.3536	84.4236 (44)
Energy conte	125.1977	109.4987	112.9929	98.5099	94.5226	81.5658	75.5827	86.7323	87.7681	102.2853	111.6524	121.2473 (45)
Energy content (annual)										Total = Sum(45)m =		1207.5558 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7797	16.4248	16.9489	14.7765	14.1784	12.2349	11.3374	13.0098	13.1652	15.3428	16.7479	18.1871 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	171.7926	151.5844	159.5878	143.6018	141.1175	126.6577	122.1776	133.3272	132.8600	148.8802	156.7443	167.8422 (62)
	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								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	171.7926	151.5844	159.5878	143.6018	141.1175	126.6577	122.1776	133.3272	132.8600	148.8802	156.7443	167.8422 (64)
	78.9042	70.0769	74.8460	68.8280	68.7047	63.1941	62.4072	66.1144	65.2564	71.2858	73.1979	77.5906 (65)
								Total per year (kWh/year) = Sum (64)m =				1756.1732 (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	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9215	12.3649	10.0558	7.6129	5.6907	4.8044	5.1913	6.7478	9.0569	11.4999	13.4220	14.3084	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.1568	157.7772	153.6938	145.0007	134.0273	123.7138	116.8237	115.2033	119.2867	127.9798	138.9532	149.2667	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	(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)	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	(71)
Water heating gains (Table 5)	106.0540	104.2811	100.5995	95.5945	92.3450	87.7696	83.8806	88.8634	90.6339	95.8142	101.6637	104.2885	(72)
Total internal gains	329.0051	327.2961	317.2220	301.0810	284.9359	269.1606	258.7685	263.6874	271.8503	288.1667	306.9119	320.7365	(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
Southwest					7.0000	36.7938	0.6300	0.7000				0.7700	78.7127 (79)
Northwest					6.3600	11.2829	0.6300	0.7000				0.7700	21.9306 (81)
Solar gains	100.6434	178.7173	263.8777	359.3889	432.1477	442.0436	420.7584	364.4865	296.6400	202.7377	121.8741	85.2713	(83)
Total gains	429.6485	506.0134	581.0997	660.4699	717.0835	711.2042	679.5269	628.1739	568.4904	490.9044	428.7860	406.0078	(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	73.2011	73.4338	73.6633	74.7606	74.9696	75.9579	75.9579	76.1438	75.5741	74.9696	74.5481	74.1124	
alpha	5.8801	5.8956	5.9109	5.9840	5.9980	6.0639	6.0639	6.0763	6.0383	5.9980	5.9699	5.9408	
util living area	0.9908	0.9761	0.9334	0.8131	0.6251	0.4380	0.3162	0.3565	0.5851	0.8767	0.9773	0.9931	(86)
MIT	20.2320	20.4164	20.6565	20.8836	20.9778	20.9978	20.9997	20.9995	20.9887	20.8453	20.5005	20.1991	(87)
Th 2	20.1263	20.1289	20.1313	20.1430	20.1452	20.1554	20.1554	20.1573	20.1515	20.1452	20.1408	20.1362	(88)
util rest of house	0.9880	0.9694	0.9163	0.7759	0.5732	0.3810	0.2556	0.2914	0.5177	0.8402	0.9698	0.9910	(89)
MIT 2	19.1167	19.3827	19.7186	20.0206	20.1264	20.1541	20.1553	20.1571	20.1438	19.9841	19.5152	19.0767	(90)
Living area fraction	19.6216	19.8506	20.1432	20.4112	20.5118	20.5360	20.5376	20.5384	20.5262	20.3739	19.9612	19.5848	(91)
MIT	19.6216	19.8506	20.1432	20.4112	20.5118	20.5360	20.5376	20.5384	20.5262	20.3739	19.9612	19.5848	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6216	19.8506	20.1432	20.4112	20.5118	20.5360	20.5376	20.5384	20.5262	20.3739	19.9612	19.5848	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	423.6432	489.2309	532.6123	520.5215	427.2572	289.2708	192.3135	201.5614	311.4837	417.6618	415.0099	401.6834	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	776.7653	755.5568	687.3341	571.4150	436.1980	290.0179	192.3790	201.6990	315.5642	483.8240	640.2508	770.3798	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	262.7229	178.9710	115.1130	36.6433	6.6519	0.0000	0.0000	0.0000	0.0000	49.2247	162.1735	274.3102	(98)
Space heating												1085.8103	(98)
Space heating per m2												20.3183	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1161.2944 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	262.7229	178.9710	115.1130	36.6433	6.6519	0.0000	0.0000	0.0000	0.0000	49.2247	162.1735	274.3102	(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)	280.9870	191.4128	123.1155	39.1907	7.1143	0.0000	0.0000	0.0000	0.0000	52.6467	173.4476	293.3798	(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	171.7926	151.5844	159.5878	143.6018	141.1175	126.6577	122.1776	133.3272	132.8600	148.8802	156.7443	167.8422	(64)
Efficiency of water heater (217)m	85.9439	85.2577	83.9598	81.7653	80.2270	79.8000	79.8000	79.8000	79.8000	82.2153	84.9047	86.1167	(217)
Fuel for water heating, kWh/month	199.8893	177.7957	190.0764	175.6267	175.8978	158.7189	153.1048	167.0767	166.4912	181.0857	184.6120	194.9008	(219)
Water heating fuel used												2125.2760	(219)
Annual totals kWh/year													
Space heating fuel - main system												1161.2944	(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)												245.8579	(232)
Total delivered energy for all uses												3607.4283	(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	1161.2944	0.2160	250.8396 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2125.2760	0.2160	459.0596 (264)
Space and water heating			709.8992 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	245.8579	0.5190	127.6002 (268)
Total CO2, kg/m2/year			876.4244 (272)
Emissions per m2 for space and water heating			13.2840 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3877 (272b)
Emissions per m2 for pumps and fans			0.7284 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.2840 * 1.00) + 2.3877 + 0.7284, rounded to 2 d.p.			16.4000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000914_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.13_1B			
Property						
SAP Rating	84 B	DER	9.56	TER	16.40	
Environmental	93 A	% DER<TER	41.71			
CO ₂ Emissions (t/year)	0.47	DFEE	34.30	TFEE	33.83	
General Requirements Compliance	Fail	% DFEE<TFEE	-1.40			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
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

Mid-floor flat, total floor area 53 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.40 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.56 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)33.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)34.3 kWh/m²/yrFail
Excess energy =0.5 kWh/m²/yr (1.5%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail
Based on:		
Overshading:	Average	
Windows facing South West:	13.20 m ² , No overhang	
Windows facing North West:	12.00 m ² , No overhang	
Air change rate:	2.00 ach	
Blinds/curtains:	None	

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	53.4400 (1b)	x 2.5000 (2b)	= 133.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6000 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour		
					heating		heating						
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test											Yes		
Measured/design AP50											3.0000		
Infiltration rate											0.1500 (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) =		0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation:												0.5000 (23a)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)	
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			25.2000	0.9615	24.2308		(27)					
External Wall 1	40.0425	25.2000	14.8425	0.1600	2.3748		(29a)					
Total net area of external elements Aum(A, m2)			40.0425				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.6056		(33)					
Party Floor 1			53.4400				(32d)					
Party Ceilings 1			53.4400				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							6.0064 (36)					
Total fabric heat loss	(33) + (36) =						32.6119 (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	12.1600	12.0195	11.8790	11.1763	11.0358	10.3331	10.3331	10.1926	10.6142	11.0358	11.3168	11.5979 (38)
Heat transfer coeff	44.7720	44.6314	44.4909	43.7883	43.6477	42.9451	42.9451	42.8045	43.2261	43.6477	43.9288	44.2098 (39)
Average = Sum(39)m / 12 =												43.7531 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8378	0.8352	0.8325	0.8194	0.8168	0.8036	0.8036	0.8010	0.8089	0.8168	0.8220	0.8273 (40)
HLP (average)												0.8187 (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												1.7915 (42)
Average daily hot water use (litres/day)												76.7487 (43)
Daily hot water use	Jan 84.4236	Feb 81.3536	Mar 78.2837	Apr 75.2137	May 72.1438	Jun 69.0738	Jul 69.0738	Aug 72.1438	Sep 75.2137	Oct 78.2837	Nov 81.3536	Dec 84.4236 (44)
Energy conte	125.1977	109.4987	112.9929	98.5099	94.5226	81.5658	75.5827	86.7323	87.7681	102.2853	111.6524	121.2473 (45)
Energy content (annual)												Total = Sum(45)m = 1207.5558 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7797	16.4248	16.9489	14.7765	14.1784	12.2349	11.3374	13.0098	13.1652	15.3428	16.7479	18.1871 (46)
Water storage loss:												110.0000 (47)
Store volume												

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	180.4745	159.4261	168.2697	152.0036	149.7994	135.0595	130.8595	142.0091	141.2618	157.5621	165.1461	176.5241	(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	180.4745	159.4261	168.2697	152.0036	149.7994	135.0595	130.8595	142.0091	141.2618	157.5621	165.1461	176.5241	(64)
								Total per year (kWh/year) =	Sum (64)m =			1858.3955	(64)
Heat gains from water heating, kWh/month													
	85.8497	76.3503	81.7916	75.5495	75.6502	69.9156	69.3527	73.0599	71.9779	78.2313	79.9194	84.5362	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8556	0.7748	0.6620	0.5092	0.3647	0.2470	0.1734	0.1998	0.3476	0.5931	0.7895	0.8734 (94)
Useful gains	434.2355	495.3951	513.0252	469.5949	375.8212	254.8781	170.8091	178.5453	273.1204	380.3549	411.9228	413.0786 (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	669.5997	659.9589	605.1768	504.1389	385.6985	256.8315	171.2459	179.2467	279.1775	425.8145	557.4598	661.8895 (97)
Month fracti	1.0000	1.0000		1.0000	1.0000	0.8315	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	175.1110	110.5869	68.5608	24.8717	7.3487	0.0000	0.0000	0.0000	0.0000	33.8219	104.7867	185.1153 (98)
Space heating												710.2030 (99)
Space heating per m2												13.2897 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	710.2030 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	184.6528 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	738.6111 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1858.3955 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	483.1828 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1932.7314 (310b)
Electricity used for heat distribution	33.3918 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	85.5708 (330a)
Total electricity for the above, kWh/year	85.5708 (331)
Electricity for lighting (calculated in Appendix L)	245.8579 (332)
Total delivered energy for all uses	3670.6068 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	702.9849	0.2160	151.8447 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1968.0552	0.2160	425.0999 (363)
less credit emissions for electricity	-728.7708	0.5190	-378.2321 (364)
Water heating from Combined Heat and Power	5149.8304	0.2160	1112.3634 (365)
less credit emissions for electricity	-1906.9822	0.5190	-989.7238 (366)
Electrical energy for heat distribution	33.3918	0.5190	17.3303 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			338.6825 (373)
Space and water heating			338.6825 (376)
Pumps and fans	85.5708	0.5190	44.4112 (378)
Energy for lighting	245.8579	0.5190	127.6002 (379)
Total CO2, kg/year			510.6940 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.5600 (384)

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

DER		9.5600 ZC1
Total Floor Area	TFA	53.4400
Assumed number of occupants	N	1.7915
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.3157 ZC2
CO2 emissions from cooking, equation (L16)		3.0314 ZC3
Total CO2 emissions		29.9071 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		29.9071 ZC8

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

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.4400 (1b)	x 2.5000 (2b)	= 133.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6000 (5)

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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) =						20.0000 / (5) =	0.1497	(8)
Pressure test							Yes		
Measured/design AP50								5.0000	
Infiltration rate								0.3997	(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) =	0.3397	(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												
	0.4332	0.4247	0.4162	0.3737	0.3652	0.3228	0.3228	0.3143	0.3397	0.3652	0.3822	0.3992 (22b)
Effective ac	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (25)

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 Opening Type (Uw = 1.40)			13.3600	1.3258	17.7121		(27)					
External Wall 1	40.0425	13.3600	26.6825	0.1800	4.8029		(29a)					
Total net area of external elements Aum(A, m2)			40.0425				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			22.5150	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal Bridges (User defined value 0.050 * total exposed area)							2.0021 (36)					
Total fabric heat loss						(33) + (36) =	24.5171 (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	26.1804	26.0197	25.8623	25.1228	24.9845	24.3404	24.3404	24.2211	24.5885	24.9845	25.2643	25.5570 (38)
Heat transfer coeff	50.6975	50.5368	50.3794	49.6399	49.5016	48.8575	48.8575	48.7382	49.1056	49.5016	49.7814	50.0741 (39)
Average = Sum(39)m / 12 =												49.6392 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9487	0.9457	0.9427	0.9289	0.9263	0.9142	0.9142	0.9120	0.9189	0.9263	0.9315	0.9370 (40)
HLP (average)												0.9289 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

Assumed occupancy												1.7915 (42)
Average daily hot water use (litres/day)												76.7487 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	84.4236	81.3536	78.2837	75.2137	72.1438	69.0738	69.0738	72.1438	75.2137	78.2837	81.3536	84.4236 (44)
Energy content (annual)	125.1977	109.4987	112.9929	98.5099	94.5226	81.5658	75.5827	86.7323	87.7681	102.2853	111.6524	121.2473 (45)
Distribution loss (46)m = 0.15 x (45)m											Total = Sum(45)m =	1207.5558 (45)
	18.7797	16.4248	16.9489	14.7765	14.1784	12.2349	11.3374	13.0098	13.1652	15.3428	16.7479	18.1871 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	171.7926	151.5844	159.5878	143.6018	141.1175	126.6577	122.1776	133.3272	132.8600	148.8802	156.7443	167.8422 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	171.7926	151.5844	159.5878	143.6018	141.1175	126.6577	122.1776	133.3272	132.8600	148.8802	156.7443	167.8422 (64)
	78.9042	70.0769	74.8460	68.8280	68.7047	63.1941	62.4072	66.1144	65.2564	71.2858	73.1979	77.5906 (65)
								Total per year (kWh/year) =	Sum (64)m =			1756.1732 (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	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	89.5762	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9215	12.3649	10.0558	7.6129	5.6907	4.8044	5.1913	6.7478	9.0569	11.4999	13.4220	14.3084	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.1568	157.7772	153.6938	145.0007	134.0273	123.7138	116.8237	115.2033	119.2867	127.9798	138.9532	149.2667	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	31.9576	(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)	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	-71.6610	(71)
Water heating gains (Table 5)	106.0540	104.2811	100.5995	95.5945	92.3450	87.7696	83.8806	88.8634	90.6339	95.8142	101.6637	104.2885	(72)
Total internal gains	329.0051	327.2961	317.2220	301.0810	284.9359	269.1606	258.7685	263.6874	271.8503	288.1667	306.9119	320.7365	(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
Southwest					7.0000	36.7938	0.6300	0.7000				0.7700			78.7127 (79)
Northwest					6.3600	11.2829	0.6300	0.7000				0.7700			21.9306 (81)
Solar gains	100.6434	178.7173	263.8777	359.3889	432.1477	442.0436	420.7584	364.4865	296.6400	202.7377	121.8741			85.2713 (83)	
Total gains	429.6485	506.0134	581.0997	660.4699	717.0835	711.2042	679.5269	628.1739	568.4904	490.9044	428.7860			406.0078 (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	73.2011	73.4338	73.6633	74.7606	74.9696	75.9579	75.9579	76.1438	75.5741	74.9696	74.5481	74.1124	
alpha	5.8801	5.8956	5.9109	5.9840	5.9980	6.0639	6.0639	6.0763	6.0383	5.9980	5.9699	5.9408	
util living area	0.9908	0.9761	0.9334	0.8131	0.6251	0.4380	0.3162	0.3565	0.5851	0.8767	0.9773	0.9931	(86)
MIT	20.2320	20.4164	20.6565	20.8836	20.9778	20.9978	20.9997	20.9995	20.9887	20.8453	20.5005	20.1991	(87)
Th 2	20.1263	20.1289	20.1313	20.1430	20.1452	20.1554	20.1554	20.1573	20.1515	20.1452	20.1408	20.1362	(88)
util rest of house	0.9880	0.9694	0.9163	0.7759	0.5732	0.3810	0.2556	0.2914	0.5177	0.8402	0.9698	0.9910	(89)
MIT 2	19.1167	19.3827	19.7186	20.0206	20.1264	20.1541	20.1553	20.1571	20.1438	19.9841	19.5152	19.0767	(90)
Living area fraction	19.6216	19.8506	20.1432	20.4112	20.5118	20.5360	20.5376	20.5384	20.5262	20.3739	19.9612	19.5848	(91)
MIT	19.6216	19.8506	20.1432	20.4112	20.5118	20.5360	20.5376	20.5384	20.5262	20.3739	19.9612	19.5848	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6216	19.8506	20.1432	20.4112	20.5118	20.5360	20.5376	20.5384	20.5262	20.3739	19.9612	19.5848	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	423.6432	489.2309	532.6123	520.5215	427.2572	289.2708	192.3135	201.5614	311.4837	417.6618	415.0099	401.6834	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	776.7653	755.5568	687.3341	571.4150	436.1980	290.0179	192.3790	201.6990	315.5642	483.8240	640.2508	770.3798	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	262.7229	178.9710	115.1130	36.6433	6.6519	0.0000	0.0000	0.0000	0.0000	49.2247	162.1735	274.3102	(98)
Space heating												1085.8103	(98)
Space heating per m2												20.3183	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1161.2944 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	262.7229	178.9710	115.1130	36.6433	6.6519	0.0000	0.0000	0.0000	0.0000	49.2247	162.1735	274.3102	(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)	280.9870	191.4128	123.1155	39.1907	7.1143	0.0000	0.0000	0.0000	0.0000	52.6467	173.4476	293.3798	(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	171.7926	151.5844	159.5878	143.6018	141.1175	126.6577	122.1776	133.3272	132.8600	148.8802	156.7443	167.8422	(64)
Efficiency of water heater (217)m	85.9439	85.2577	83.9598	81.7653	80.2270	79.8000	79.8000	79.8000	79.8000	82.2153	84.9047	86.1167	(217)
Fuel for water heating, kWh/month	199.8893	177.7957	190.0764	175.6267	175.8978	158.7189	153.1048	167.0767	166.4912	181.0857	184.6120	194.9008	(219)
Water heating fuel used												2125.2760	(219)
Annual totals kWh/year													
Space heating fuel - main system												1161.2944	(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)												245.8579	(232)
Total delivered energy for all uses												3607.4283	(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	1161.2944	0.2160	250.8396 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2125.2760	0.2160	459.0596 (264)
Space and water heating			709.8992 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	245.8579	0.5190	127.6002 (268)
Total CO2, kg/m2/year			876.4244 (272)
Emissions per m2 for space and water heating			13.2840 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3877 (272b)
Emissions per m2 for pumps and fans			0.7284 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.2840 * 1.00) + 2.3877 + 0.7284, rounded to 2 d.p.			16.4000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000942_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.14_2B		
Property					
SAP Rating	85 B	DER	9.24	TER	15.55
Environmental	93 A	% DER<TER	40.58		
CO ₂ Emissions (t/year)	0.56	DFEE	35.32	TFEE	36.55
General Requirements Compliance	Fail	% DFEE<TFEE	3.36		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 69 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.55 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.24 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)36.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)35.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor (no floor)			
Roof (no roof)			
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.44
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	2.40 m ² , No overhang
Windows facing North West:	15.60 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	68.8700 (1b)	x 2.5000 (2b)	= 172.1750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.1750 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											3.0000	
Infiltration rate											0.1500	(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) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			18.0000	1.3258	23.8636		(27)					
External Wall 1	36.8672	18.0000	18.8672	0.1600	3.0188		(29a)					
Total net area of external elements Aum(A, m2)			36.8672				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8824		(33)					
Party Floor 1			68.8700				(32d)					
Party Ceilings 1			68.8700				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							5.5301 (36)					
Total fabric heat loss	(33) + (36) =						32.4125 (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	15.6710	15.4899	15.3088	14.4033	14.2222	13.3167	13.3167	13.1356	13.6789	14.2222	14.5844	14.9466 (38)
Heat transfer coeff	48.0835	47.9024	47.7213	46.8158	46.6347	45.7291	45.7291	45.5480	46.0913	46.6347	46.9969	47.3591 (39)
Average = Sum(39)m / 12 =												46.7705 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6982	0.6955	0.6929	0.6798	0.6771	0.6640	0.6640	0.6614	0.6693	0.6771	0.6824	0.6877 (40)
HLP (average)												0.6791 (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												2.2184 (42)
Average daily hot water use (litres/day)												86.8865 (43)
Daily hot water use	Jan 95.5752	Feb 92.0997	Mar 88.6243	Apr 85.1488	May 81.6734	Jun 78.1979	Jul 78.1979	Aug 81.6734	Sep 85.1488	Oct 88.6243	Nov 92.0997	Dec 95.5752 (44)
Energy conte	141.7353	123.9626	127.9183	111.5222	107.0082	92.3400	85.5666	98.1889	99.3616	115.7963	126.4008	137.2630 (45)
Energy content (annual)												Total = Sum(45)m = 1367.0637 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.2603	18.5944	19.1877	16.7283	16.0512	13.8510	12.8350	14.7283	14.9042	17.3695	18.9601	20.5895 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	197.0121	173.8900	183.1951	165.0159	162.2851	145.8337	140.8434	153.4657	152.8553	171.0731	179.8944	192.5398	(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	197.0121	173.8900	183.1951	165.0159	162.2851	145.8337	140.8434	153.4657	152.8553	171.0731	179.8944	192.5398	(64)
												Total per year (kWh/year) = Sum (64)m =	2017.9035 (64)
Heat gains from water heating, kWh/month													
	91.3484	81.1595	86.7543	79.8761	79.8017	73.4980	72.6723	76.8692	75.8327	82.7237	84.8232	89.8614	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3528	15.4126	12.5344	9.4893	7.0934	5.9885	6.4708	8.4110	11.2892	14.3343	16.7302	17.8351 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.6455	196.6653	191.5754	180.7397	167.0616	154.2061	145.6178	143.5980	148.6878	159.5235	173.2017	186.0572 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919 (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)	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352 (71)
Water heating gains (Table 5)	122.7801	120.7731	116.6052	110.9390	107.2603	102.0805	97.6779	103.3189	105.3231	111.1878	117.8100	120.7815 (72)
Total internal gains	391.0541	389.1266	376.9907	357.4438	337.6910	318.5508	306.0422	311.6036	321.5759	341.3213	364.0176	380.9494 (73)

[Jan					Area	Solar flux	g		FF	Access		Gains
					m ²	Table 6a	Table 6b		Table 6c	factor		W
						W/m ²	or Table 6b		or Table 6c	Table 6d		
Northeast					2.4000	11.2829	0.3000		0.8000	0.7700		4.5038 (75)
Northwest					15.6000	11.2829	0.3000		0.8000	0.7700		29.2746 (81)
Solar gains	33.7784	68.7569	123.8782	203.4435	273.4680	291.5458	272.7351	217.4276	150.9475	84.0264	42.5020	27.5852 (83)
Total gains	424.8325	457.8836	500.8688	560.8873	611.1590	610.0967	578.7773	529.0312	472.5234	425.3478	406.5196	408.5346 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil/m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.7861	39.9365	40.0881	40.8635	41.0222	41.8345	41.8345	42.0008	41.5057	41.0222	40.7060	40.3947
alpha	3.6524	3.6624	3.6725	3.7242	3.7348	3.7890	3.7890	3.8001	3.7670	3.7348	3.7137	3.6930
util living area	0.9515	0.9340	0.8918	0.7922	0.6384	0.4638	0.3435	0.3889	0.6147	0.8372	0.9274	0.9566 (86)
MIT	19.7735	19.9422	20.2440	20.6215	20.8648	20.9697	20.9925	20.9882	20.9142	20.6001	20.1448	19.7495 (87)
Th 2	20.3424	20.3448	20.3471	20.3587	20.3611	20.3727	20.3727	20.3751	20.3681	20.3611	20.3564	20.3517 (88)
util rest of house	0.9458	0.9264	0.8795	0.7704	0.6054	0.4222	0.2959	0.3384	0.5702	0.8147	0.9178	0.9515 (89)
MIT 2	18.6776	18.9213	19.3527	19.8852	20.2069	20.3436	20.3671	20.3658	20.2794	19.8672	19.2234	18.6497 (90)
Living area fraction									fLA = Living area / (4) =			0.4703 (91)
MIT	19.1930	19.4014	19.7719	20.2315	20.5163	20.6381	20.6612	20.6585	20.5779	20.2119	19.6567	19.1669 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1930	19.4014	19.7719	20.2315	20.5163	20.6381	20.6612	20.6585	20.5779	20.2119	19.6567	19.1669 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9338	0.9136	0.8673	0.7658	0.6136	0.4400	0.3179	0.3615	0.5854	0.8090	0.9058	0.9401 (94)
Useful gains	396.6890	418.3012	434.4228	429.5450	374.9991	268.4474	184.0089	191.2303	276.6149	344.0935	368.2206	384.0731 (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	716.1072	694.6529	633.3510	530.4922	411.1458	276.1158	185.7158	193.9656	298.5760	448.2487	590.1262	708.8195 (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	237.6472	185.7083	148.0026	72.6820	26.8931	0.0000	0.0000	0.0000	0.0000	77.4915	159.7720	241.6113 (98)
Space heating												1149.8080 (98)
Space heating per m2												16.6953 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	1149.8080 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	298.9501 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1195.8003 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2017.9035 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	524.6549 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2098.6196 (310b)
Electricity used for heat distribution	41.1802 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	115.5294 (330a)
Total electricity for the above, kWh/year	115.5294 (331)
Electricity for lighting (calculated in Appendix L)	306.4556 (332)
Total delivered energy for all uses	4540.0100 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	866.9526	0.2160	187.2618 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	3186.2518	0.2160	688.2304 (363)
less credit emissions for electricity	-1179.8691	0.5190	-612.3520 (364)
Water heating from Combined Heat and Power	5591.8456	0.2160	1207.8386 (365)
less credit emissions for electricity	-2070.6604	0.5190	-1074.6728 (366)
Electrical energy for heat distribution	41.1802	0.5190	21.3725 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			417.6786 (373)
Space and water heating			417.6786 (376)
Pumps and fans	115.5294	0.5190	59.9598 (378)
Energy for lighting	306.4556	0.5190	159.0505 (379)
Total CO2, kg/year			636.6888 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.2400 (384)

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

DER		9.2400 ZC1
Total Floor Area	TFA	68.8700
Assumed number of occupants	N	2.2184
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.7479 ZC2
CO2 emissions from cooking, equation (L16)		2.5010 ZC3
Total CO2 emissions		28.4889 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		28.4889 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	68.8700 (1b)	x 2.5000 (2b)	= 172.1750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.1750 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1162 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3662 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3112 (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												
	0.3968	0.3890	0.3813	0.3424	0.3346	0.2957	0.2957	0.2879	0.3112	0.3346	0.3501	0.3657 (22b)
Effective ac	0.5787	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5414	0.5484	0.5560	0.5613	0.5669 (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 Opening Type (Uw = 1.40)			17.2200	1.3258	22.8295		(27)						
External Wall 1	36.8672	17.2200	19.6472	0.1800	3.5365		(29a)						
Total net area of external elements Aum(A, m2)			36.8672				(31)						
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.3660		(33)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)						
Thermal bridges (User defined value 0.050 * total exposed area)							1.8434 (36)						
Total fabric heat loss						(33) + (36) =	28.2094 (37)						
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 32.8825	Feb 32.7087	Mar 32.5385	Apr 31.7387	May 31.5891	Jun 30.8925	Jul 30.8925	Aug 30.7635	Sep 31.1608	Oct 31.5891	Nov 31.8918	Dec 32.2082	(38)
Heat transfer coeff	61.0919	60.9182	60.7479	59.9481	59.7985	59.1019	59.1019	58.9729	59.3702	59.7985	60.1012	60.4176	(39)
Average = Sum(39)m / 12 =												59.9474	(39)
HLP	Jan 0.8871	Feb 0.8845	Mar 0.8821	Apr 0.8705	May 0.8683	Jun 0.8582	Jul 0.8582	Aug 0.8563	Sep 0.8621	Oct 0.8683	Nov 0.8727	Dec 0.8773	(40)
HLP (average)												0.8704	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	Solar input (sum of months) = Sum (63)m =											0.0000 (63)
	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579 (64)
	Total per year (kWh/year) = Sum (64)m =											1915.6811 (64)
	84.4029	74.8861	79.8087	73.1546	72.8562	66.7765	65.7268	69.9237	69.1112	75.7782	78.1017	82.9159 (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	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3528	15.4126	12.5344	9.4893	7.0934	5.9885	6.4708	8.4110	11.2892	14.3343	16.7302	17.8351	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.6455	196.6653	191.5754	180.7397	167.0616	154.2061	145.6178	143.5980	148.6878	159.5235	173.2017	186.0572	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	(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)	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	(71)
Water heating gains (Table 5)	113.4448	111.4377	107.2698	101.6036	97.9250	92.7452	88.3425	93.9835	95.9878	101.8524	108.4746	111.4461	(72)
Total internal gains	384.7187	382.7913	370.6553	351.1084	331.3556	312.2155	299.7068	305.2682	315.2406	334.9860	357.6822	374.6141	(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
Northeast					2.3000	11.2829	0.6300	0.7000			0.7700			7.9309 (75)
Northwest					14.9200	11.2829	0.6300	0.7000			0.7700			51.4473 (81)
Solar gains	59.3782	120.8661	217.7623	357.6283	480.7226	512.5011	479.4343	382.2106	265.3468	147.7080	74.7132			48.4913 (83)
Total gains	444.0970	503.6574	588.4176	708.7366	812.0782	824.7166	779.1411	687.4788	580.5873	482.6939	432.3954			423.1053 (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	78.2860	78.5093	78.7293	79.7797	79.9793	80.9219	80.9219	81.0989	80.5562	79.9793	79.5765	79.1596
alpha	6.2191	6.2340	6.2486	6.3186	6.3320	6.3948	6.3948	6.4066	6.3704	6.3320	6.3051	6.2773
util living area	0.9968	0.9923	0.9718	0.8732	0.6639	0.4569	0.3336	0.3940	0.6812	0.9467	0.9924	0.9976 (86)
MIT	20.1728	20.3107	20.5570	20.8469	20.9756	20.9980	20.9998	20.9994	20.9796	20.7629	20.4164	20.1492 (87)
Th 2	20.1785	20.1807	20.1828	20.1927	20.1945	20.2032	20.2032	20.2048	20.1999	20.1945	20.1908	20.1869 (88)
util rest of house	0.9958	0.9899	0.9633	0.8428	0.6131	0.4008	0.2733	0.3262	0.6118	0.9260	0.9895	0.9968 (89)
MIT 2	19.0713	19.2734	19.6276	20.0250	20.1733	20.2020	20.2031	20.2046	20.1852	19.9277	19.4358	19.0433 (90)
Living area fraction	fLA = Living area / (4) =											0.4703 (91)
MIT	19.5893	19.7613	20.0647	20.4116	20.5506	20.5763	20.5778	20.5784	20.5588	20.3205	19.8970	19.5634 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5893	19.7613	20.0647	20.4116	20.5506	20.5763	20.5778	20.5784	20.5588	20.3205	19.8970	19.5634 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9948	0.9884	0.9618	0.8516	0.6360	0.4272	0.3016	0.3581	0.6437	0.9297	0.9882	0.9961	(94)
Ext temp.	441.7998	497.7973	565.9476	603.5537	516.4455	352.3197	235.0179	246.1899	373.7363	448.7727	427.3056	421.4389	(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	934.0525	905.3203	824.0260	690.0980	529.2539	353.2131	235.0951	246.4109	383.4618	581.2710	769.1153	928.2199	(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	366.2361	273.8554	192.0103	62.3119	9.5295	0.0000	0.0000	0.0000	0.0000	98.5788	246.1030	377.0451	(98)
Space heating per m2	(98) / (4) =											23.6049	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1738.6844 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	366.2361	273.8554	192.0103	62.3119	9.5295	0.0000	0.0000	0.0000	0.0000	98.5788	246.1030	377.0451	(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)	391.6963	292.8935	205.3586	66.6437	10.1919	0.0000	0.0000	0.0000	0.0000	105.4318	263.2117	403.2568	(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	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579	(64)
Efficiency of water heater (217)m	86.5585	86.1402	85.0690	82.5789	80.3550	79.8000	79.8000	79.8000	79.8000	83.5306	85.7768	86.6898	(216)
Fuel for water heating, kWh/month	217.5755	192.7651	205.1430	189.6538	191.1557	172.2203	165.6159	181.4333	181.0193	194.4094	199.9290	212.0871	(219)
Water heating fuel used												2303.0075	(219)
Annual totals kWh/year													
Space heating fuel - main system												1738.6844	(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)												306.4556	(232)
Total delivered energy for all uses												4423.1475	(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	1738.6844	0.2160	375.5558 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2303.0075	0.2160	497.4496 (264)
Space and water heating			873.0054 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	306.4556	0.5190	159.0505 (268)
Total CO2, kg/m2/year			1070.9809 (272)
Emissions per m2 for space and water heating			12.6761 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3094 (272b)
Emissions per m2 for pumps and fans			0.5652 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.6761 * 1.00) + 2.3094 + 0.5652, rounded to 2 d.p.			15.5500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_000986_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	A_1_14.14_2B		
Property					
SAP Rating	86 B	DER	8.41	TER	15.55
Environmental	94 A	% DER<TER	45.92		
CO ₂ Emissions (t/year)	0.53	DFEE	29.02	TFEE	36.55
General Requirements Compliance	Fail	% DFEE<TFEE	20.59		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 69 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 (c)
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.55 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.41 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 36.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 29.0 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor (no floor)			
Roof (no roof)			
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room stats	OK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.44	
Maximum	1.5	OK
MVHR efficiency:	91%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	2.40 m ² , No overhang
Windows facing North West:	15.60 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	68.8700 (1b)	x 2.5000 (2b)	= 172.1750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.1750 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							3.0000					
Infiltration rate							0.1500	(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) =	0.1275 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			18.0000	0.9615	17.3077		(27)					
External Wall 1	36.8672	18.0000	18.8672	0.1600	3.0188		(29a)					
Total net area of external elements Aum(A, m2)			36.8672				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.3264		(33)					
Party Floor 1			68.8700				(32d)					
Party Ceilings 1			68.8700				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							5.5301 (36)					
Total fabric heat loss	(33) + (36) =						25.8565 (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	15.6710	15.4899	15.3088	14.4033	14.2222	13.3167	13.3167	13.1356	13.6789	14.2222	14.5844	14.9466 (38)
Heat transfer coeff	41.5276	41.3465	41.1654	40.2598	40.0787	39.1732	39.1732	38.9921	39.5354	40.0787	40.4409	40.8031 (39)
Average = Sum(39)m / 12 =												40.2145 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6030	0.6004	0.5977	0.5846	0.5819	0.5688	0.5688	0.5662	0.5741	0.5819	0.5872	0.5925 (40)
HLP (average)												0.5839 (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												2.2184 (42)
Average daily hot water use (litres/day)												86.8865 (43)
Daily hot water use	Jan 95.5752	Feb 92.0997	Mar 88.6243	Apr 85.1488	May 81.6734	Jun 78.1979	Jul 78.1979	Aug 81.6734	Sep 85.1488	Oct 88.6243	Nov 92.0997	Dec 95.5752 (44)
Energy conte	141.7353	123.9626	127.9183	111.5222	107.0082	92.3400	85.5666	98.1889	99.3616	115.7963	126.4008	137.2630 (45)
Energy content (annual)												Total = Sum(45)m = 1367.0637 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.2603	18.5944	19.1877	16.7283	16.0512	13.8510	12.8350	14.7283	14.9042	17.3695	18.9601	20.5895 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	197.0121	173.8900	183.1951	165.0159	162.2851	145.8337	140.8434	153.4657	152.8553	171.0731	179.8944	192.5398 (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	197.0121	173.8900	183.1951	165.0159	162.2851	145.8337	140.8434	153.4657	152.8553	171.0731	179.8944	192.5398 (64)	
								Total per year (kWh/year) = Sum(64)m =					2017.9035 (64)
Heat gains from water heating, kWh/month													
	91.3484	81.1595	86.7543	79.8761	79.8017	73.4980	72.6723	76.8692	75.8327	82.7237	84.8232	89.8614 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3528	15.4126	12.5344	9.4893	7.0934	5.9885	6.4708	8.4110	11.2892	14.3343	16.7302	17.8351 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.6455	196.6653	191.5754	180.7397	167.0616	154.2061	145.6178	143.5980	148.6878	159.5235	173.2017	186.0572 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919 (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)	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352 (71)
Water heating gains (Table 5)	122.7801	120.7731	116.6052	110.9390	107.2603	102.0805	97.6779	103.3189	105.3231	111.1878	117.8100	120.7815 (72)
Total internal gains	391.0541	389.1266	376.9907	357.4438	337.6910	318.5508	306.0422	311.6036	321.5759	341.3213	364.0176	380.9494 (73)

[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
Northeast	2.4000	11.2829	0.5000	0.8000	0.7700	7.5063 (75)
Northwest	15.6000	11.2829	0.5000	0.8000	0.7700	48.7910 (81)

MIT	20.1165	20.3151	20.6067	20.8736	20.9724	20.9961	20.9992	20.9985	20.9795	20.8120	20.4410	20.0881 (87)
Th 2	20.4273	20.4297	20.4320	20.4439	20.4463	20.4582	20.4582	20.4605	20.4534	20.4463	20.4415	20.4368 (88)
util rest of house												
	0.9262	0.8872	0.7969	0.6203	0.4336	0.2843	0.1985	0.2345	0.4306	0.7197	0.8820	0.9352 (89)
MIT 2	19.2301	19.5136	19.9219	20.2895	20.4154	20.4544	20.4576	20.4594	20.4326	20.2183	19.7051	19.1970 (90)
Living area fraction										fIA = Living area / (4) =		0.4703 (91)
MIT	19.6470	19.8905	20.2440	20.5642	20.6774	20.7092	20.7123	20.7129	20.6898	20.4975	20.0512	19.6161 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6470	19.8905	20.2440	20.5642	20.6774	20.7092	20.7123	20.7129	20.6898	20.4975	20.0512	19.6161 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9154	0.8768	0.7913	0.6254	0.4442	0.2963	0.2116	0.2490	0.4456	0.7221	0.8729	0.9247 (94)
Useful gains	409.4972	441.6579	461.6824	435.5748	352.4812	238.3476	160.9204	167.8335	255.3698	347.6074	379.5746	394.7950 (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	637.3224	619.8047	565.7751	469.5988	359.8013	239.3150	161.0923	168.1696	260.5307	396.6799	523.7589	629.0256 (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	169.5020	119.7147	77.4449	24.4973	5.4462	0.0000	0.0000	0.0000	0.0000	36.5100	103.8127	174.2676 (98)
Space heating												711.1953 (98)
Space heating per m2												10.3266 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	711.1953 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	184.9108 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	739.6431 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2017.9035 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	524.6549 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2098.6196 (310b)
Electricity used for heat distribution	35.4783 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	115.5294 (330a)
Total electricity for the above, kWh/year	115.5294 (331)
Electricity for lighting (calculated in Appendix L)	306.4556 (332)
Total delivered energy for all uses	3969.8135 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	746.9112	0.2160	161.3328 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1970.8050	0.2160	425.6939 (363)
less credit emissions for electricity	-729.7891	0.5190	-378.7605 (364)
Water heating from Combined Heat and Power	5591.8456	0.2160	1207.8386 (365)
less credit emissions for electricity	-2070.6604	0.5190	-1074.6728 (366)
Electrical energy for heat distribution	35.4783	0.5190	18.4132 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			359.8453 (373)
Space and water heating			359.8453 (376)
Pumps and fans	115.5294	0.5190	59.9598 (378)
Energy for lighting	306.4556	0.5190	159.0505 (379)
Total CO2, kg/year			578.8555 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.4100 (384)

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

DER	8.4100 ZC1
Total Floor Area	68.8700
Assumed number of occupants	2.2184
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190
CO2 emissions from appliances, equation (L14)	16.7479 ZC2
CO2 emissions from cooking, equation (L16)	2.5010 ZC3
Total CO2 emissions	27.6589 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	27.6589 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	68.8700 (1b)	x 2.5000 (2b)	= 172.1750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.1750 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1162 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3662 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3112 (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												
	0.3968	0.3890	0.3813	0.3424	0.3346	0.2957	0.2957	0.2879	0.3112	0.3346	0.3501	0.3657 (22b)
Effective ac	0.5787	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5414	0.5484	0.5560	0.5613	0.5669 (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 Opening Type (Uw = 1.40)			17.2200	1.3258	22.8295		(27)
External Wall 1	36.8672	17.2200	19.6472	0.1800	3.5365		(29a)
Total net area of external elements Aum(A, m ²)			36.8672				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.3660		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							1.8434 (36)
Total fabric heat loss						(33) + (36) =	28.2094 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	32.8825	32.7087	32.5385	31.7387	31.5891	30.8925	30.8925
Heat transfer coeff	61.0919	60.9182	60.7479	59.9481	59.7985	59.1019	59.1019
Average = Sum(39)m / 12 =						58.9729	59.3702
						59.7985	59.7985
						60.1012	60.1012
						60.4176	60.4176 (39)
						59.9474	59.9474 (39)
HLP	0.8871	0.8845	0.8821	0.8705	0.8683	0.8582	0.8582
HLP (average)						0.8563	0.8621
Days in month	31	28	31	30	31	30	31
						30	31
						31	30
						31	30
						31	31
						31	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2184 (42)
Average daily hot water use (litres/day)												86.8865 (43)
Daily hot water use	95.5752	92.0997	88.6243	85.1488	81.6734	78.1979	78.1979	81.6734	85.1488	88.6243	92.0997	95.5752 (44)
Energy conte	141.7353	123.9626	127.9183	111.5222	107.0082	92.3400	85.5666	98.1889	99.3616	115.7963	126.4008	137.2630 (45)
Energy content (annual)										Total = Sum(45)m =		1367.0637 (45)
Distribution loss (46)m = 0.15 x (45)m	21.2603	18.5944	19.1877	16.7283	16.0512	13.8510	12.8350	14.7283	14.9042	17.3695	18.9601	20.5895 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1915.6811 (64)
	84.4029	74.8861	79.8087	73.1546	72.8562	66.7765	65.7268	69.9237	69.1112	75.7782	78.1017	82.9159 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190	110.9190 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	17.3528	15.4126	12.5344	9.4893	7.0934	5.9885	6.4708	8.4110	11.2892	14.3343	16.7302	17.8351 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	194.6455	196.6653	191.5754	180.7397	167.0616	154.2061	145.6178	143.5980	148.6878	159.5235	173.2017	186.0572 (68)
Pumps, fans	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919	34.0919 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352	-88.7352 (71)
Total internal gains	113.4448	111.4377	107.2698	101.6036	97.9250	92.7452	88.3425	93.9835	95.9878	101.8524	108.4746	111.4461 (72)
	384.7187	382.7913	370.6553	351.1084	331.3556	312.2155	299.7068	305.2682	315.2406	334.9860	357.6822	374.6141 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast	2.3000	11.2829	0.6300	0.7000	0.7700	7.9309 (75)
Northwest	14.9200	11.2829	0.6300	0.7000	0.7700	51.4473 (81)
Solar gains	59.3782	120.8661	217.7623	357.6283	480.7226	512.5011
Total gains	444.0970	503.6574	588.4176	708.7366	812.0782	824.7166

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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	78.2860	78.5093	78.7293	79.7797	79.9793	80.9219	80.9219	81.0989	80.5562	79.9793	79.5765	79.1596
util living area	6.2191	6.2340	6.2486	6.3186	6.3320	6.3948	6.3948	6.4066	6.3704	6.3320	6.3051	6.2773
	0.9968	0.9923	0.9718	0.8732	0.6639	0.4569	0.3336	0.3940	0.6812	0.9467	0.9924	0.9976 (86)
MIT	20.1728	20.3107	20.5570	20.8469	20.9756	20.9980	20.9998	20.9994	20.9796	20.7629	20.4164	20.1492 (87)
Th 2	20.1785	20.1807	20.1828	20.1927	20.1945	20.2032	20.2032	20.2048	20.1999	20.1945	20.1908	20.1869 (88)
util rest of house	0.9958	0.9899	0.9633	0.8428	0.6131	0.4008	0.2733	0.3262	0.6118	0.9260	0.9895	0.9968 (89)
MIT 2	19.0713	19.2734	19.6276	20.0250	20.1733	20.2020	20.2031	20.2046	20.1852	19.9277	19.4358	19.0433 (90)
Living area fraction									fLA = Living area / (4) =			0.4703 (91)
MIT	19.5893	19.7613	20.0647	20.4116	20.5506	20.5763	20.5778	20.5784	20.5588	20.3205	19.8970	19.5634 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5893	19.7613	20.0647	20.4116	20.5506	20.5763	20.5778	20.5784	20.5588	20.3205	19.8970	19.5634 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9948	0.9884	0.9618	0.8516	0.6360	0.4272	0.3016	0.3581	0.6437	0.9297	0.9882	0.9961 (94)
Ext temp.	441.7998	497.7973	565.9476	603.5537	516.4455	352.3197	235.0179	246.1899	373.7363	448.7727	427.3056	421.4389 (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	934.0525	905.3203	824.0260	690.0980	529.2539	353.2131	235.0951	246.4109	383.4618	581.2710	769.1153	928.2199 (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	366.2361	273.8554	192.0103	62.3119	9.5295	0.0000	0.0000	0.0000	0.0000	98.5788	246.1030	377.0451 (98)
Space heating per m2												1625.6699 (98)
										(98) / (4) =		23.6049 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1738.6844 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	366.2361	273.8554	192.0103	62.3119	9.5295	0.0000	0.0000	0.0000	0.0000	98.5788	246.1030	377.0451	(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)	391.6963	292.8935	205.3586	66.6437	10.1919	0.0000	0.0000	0.0000	0.0000	105.4318	263.2117	403.2568	(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	188.3302	166.0483	174.5132	156.6141	153.6032	137.4318	132.1615	144.7838	144.4534	162.3912	171.4926	183.8579	(64)
Efficiency of water heater	86.5585	86.1402	85.0690	82.5789	80.3550	79.8000	79.8000	79.8000	79.8000	83.5306	85.7768	86.6898	(216)
Fuel for water heating, kWh/month	217.5755	192.7651	205.1430	189.6538	191.1557	172.2203	165.6159	181.4333	181.0193	194.4094	199.9290	212.0871	(219)
Water heating fuel used												2303.0075	(219)
Annual totals kWh/year													
Space heating fuel - main system												1738.6844	(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)												306.4556	(232)
Total delivered energy for all uses												4423.1475	(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	1738.6844	0.2160	375.5558 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2303.0075	0.2160	497.4496 (264)
Space and water heating			873.0054 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	306.4556	0.5190	159.0505 (268)
Total CO2, kg/m2/year			1070.9809 (272)
Emissions per m2 for space and water heating			12.6761 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3094 (272b)
Emissions per m2 for pumps and fans			0.5652 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.6761 * 1.00) + 2.3094 + 0.5652, rounded to 2 d.p.			15.5500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001014_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.09_1B		
Property					
SAP Rating	85 B	DER	9.18	TER	15.85
Environmental	93 A	% DER<TER	42.10		
CO ₂ Emissions (t/year)	0.51	DFEE	33.30	TFEE	34.82
General Requirements Compliance	Fail	% DFEE<TFEE	4.35		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 62 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.85 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.18 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)34.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	14.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	61.5300 (1b)	x 2.5000 (2b)	= 153.8250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.8250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			14.4000	1.3258	19.0909		(27)					
External Wall 1	30.3761	14.4000	15.9761	0.1600	2.5562		(29a)					
Total net area of external elements Aum(A, m2)			30.3761				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.6471		(33)					
Party Floor 1			61.5300				(32d)					
Party Ceilings 1			61.4400				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							4.5564 (36)					
Total fabric heat loss							(33) + (36) = 26.2035 (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	13.2727	13.1252	12.9777	12.2400	12.0925	11.3549	11.3549	11.2074	11.6499	12.0925	12.3876	12.6826 (38)
Heat transfer coeff	39.4762	39.3287	39.1812	38.4435	38.2960	37.5584	37.5584	37.4109	37.8534	38.2960	38.5911	38.8861 (39)
Average = Sum(39)m / 12 =												38.4067 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6416	0.6392	0.6368	0.6248	0.6224	0.6104	0.6104	0.6080	0.6152	0.6224	0.6272	0.6320 (40)
HLP (average)												0.6242 (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												2.0245 (42)
Average daily hot water use (litres/day)												82.2830 (43)
Daily hot water use	90.5113	87.2200	83.9286	80.6373	77.3460	74.0547	74.0547	77.3460	80.6373	83.9286	87.2200	90.5113 (44)
Energy conte	134.2256	117.3946	121.1407	105.6134	101.3386	87.4475	81.0329	92.9865	94.0970	109.6610	119.7036	129.9903 (45)
Energy content (annual)												Total = Sum(45)m = 1294.6317 (45)
Distribution loss (46)m = 0.15 x (45)m												19.4986 (46)
Water storage loss:	20.1338	17.6092	18.1711	15.8420	15.2008	13.1171	12.1549	13.9480	14.1146	16.4492	17.9555	19.4986 (46)
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	189.5024	167.3220	176.4175	159.1071	156.6154	140.9412	136.3097	148.2633	147.5907	164.9378	173.1973	185.2671	(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													
	189.5024	167.3220	176.4175	159.1071	156.6154	140.9412	136.3097	148.2633	147.5907	164.9378	173.1973	185.2671	(64)
Total per year (kWh/year) = Sum(64)m =												1945.4715 (64)	
Heat gains from water heating, kWh/month													
	88.8515	78.9756	84.5007	77.9114	77.9165	71.8712	71.1649	75.1394	74.0822	80.6837	82.5964	87.4432	(65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	855.8066	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	222.5097	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	890.0389	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1945.4715	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	505.8226	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2023.2903	(310b)
Electricity used for heat distribution	36.4166	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	98.5249	(330a)
Total electricity for the above, kWh/year	98.5249	(331)
Electricity for lighting (calculated in Appendix L)	278.3410	(332)
Total delivered energy for all uses	4018.5275	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	766.6656	0.2160	165.5998 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	2371.5398	0.2160	512.2526 (363)
less credit emissions for electricity	-878.1812	0.5190	-455.7760 (364)
Water heating from Combined Heat and Power	5391.1280	0.2160	1164.4837 (365)
less credit emissions for electricity	-1996.3347	0.5190	-1036.0977 (366)
Electrical energy for heat distribution	36.4166	0.5190	18.9002 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			369.3625 (373)
Space and water heating			369.3625 (376)
Pumps and fans	98.5249	0.5190	51.1344 (378)
Energy for lighting	278.3410	0.5190	144.4590 (379)
Total CO2, kg/year			564.9559 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.1800 (384)

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

DER		9.1800	ZC1
Total Floor Area	TFA	61.5300	
Assumed number of occupants	N	2.0245	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0260	ZC2
CO2 emissions from cooking, equation (L16)		2.7237	ZC3
Total CO2 emissions		28.9297	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		28.9297	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	61.5300 (1b)	x 2.5000 (2b)	= 153.8250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.8250 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1300 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3800 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2945 (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	0.3755	0.3681	0.3608	0.3240	0.3166	0.2798	0.2798	0.2724	0.2945	0.3166	0.3313	0.3461 (22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5391	0.5391	0.5371	0.5434	0.5501	0.5549	0.5599 (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 Opening Type (Uw = 1.40)			14.4000	1.3258	19.0909			(27)				
External Wall 1	30.3761	14.4000	15.9761	0.1800	2.8757			(29a)				
Total net area of external elements Aum(A, m2)			30.3761					(31)				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 21.9666			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (User defined value 0.050 * total exposed area)								1.5188 (36)				
Total fabric heat loss						(33) + (36) =		23.4854 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.9600	28.8210	28.6848	28.0450	27.9253	27.3680	27.3680	27.2648	27.5826	27.9253	28.1674	28.4206 (38)
Heat transfer coeff	52.4454	52.3064	52.1702	51.5304	51.4107	50.8534	50.8534	50.7502	51.0681	51.4107	51.6528	51.9060 (39)
Average = Sum(39)m / 12 =												51.5298 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8524	0.8501	0.8479	0.8375	0.8355	0.8265	0.8265	0.8248	0.8300	0.8355	0.8395	0.8436 (40)
HLP (average)												0.8375 (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												2.0245 (42)
Average daily hot water use (litres/day)												82.2830 (43)
Daily hot water use	90.5113	87.2200	83.9286	80.6373	77.3460	74.0547	74.0547	77.3460	80.6373	83.9286	87.2200	90.5113 (44)
Energy conte	134.2256	117.3946	121.1407	105.6134	101.3386	87.4475	81.0329	92.9865	94.0970	109.6610	119.7036	129.9903 (45)
Energy content (annual)										Total = Sum(45)m =		1294.6317 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1338	17.6092	18.1711	15.8420	15.2008	13.1171	12.1549	13.9480	14.1146	16.4492	17.9555	19.4986 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	180.8205	159.4803	167.7356	150.7052	147.9335	132.5393	127.6278	139.5814	139.1889	156.2559	164.7954	176.5852 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	180.8205	159.4803	167.7356	150.7052	147.9335	132.5393	127.6278	139.5814	139.1889	156.2559	164.7954	176.5852 (64)
	81.9059	72.7023	77.5552	71.1899	70.9710	65.1498	64.2194	68.1939	67.3607	73.7382	75.8749	80.4977 (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	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7608	13.9986	11.3844	8.6188	6.4426	5.4391	5.8772	7.6394	10.2536	13.0192	15.1954	16.1989 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	176.7885	178.6230	174.0001	164.1585	151.7352	140.0590	132.2587	130.4241	135.0471	144.8887	157.3120	168.9881 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227 (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)	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819 (71)
Water heating gains (Table 5)	110.0886	108.1879	104.2409	98.8749	95.3911	90.4858	86.3164	91.6585	93.5566	99.1105	105.3818	108.1958 (72)
Total internal gains	359.0061	357.1777	345.9936	328.0203	309.9371	292.3521	280.8204	286.0902	295.2254	313.3866	334.2574	349.7510 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast	14.4000	11.2829	0.6300	0.7000	0.7700	49.6543 (75)
Solar gains	49.6543	101.0727	182.1009	299.0620	401.9980	428.5724
Total gains	408.6604	458.2504	528.0945	627.0823	711.9351	720.9245

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	81.4737	81.6901	81.9034	82.9203	83.1134	84.0242	84.0242	84.1951	83.6710	83.1134	82.7238	82.3203	
alpha	6.4316	6.4460	6.4602	6.5280	6.5409	6.6016	6.6016	6.6130	6.5781	6.5409	6.5149	6.4880	
util living area	0.9960	0.9909	0.9682	0.8647	0.6544	0.4501	0.3281	0.3850	0.6630	0.9376	0.9905	0.9970 (86)	
MIT	20.2434	20.3735	20.6040	20.8684	20.9802	20.9985	20.9998	20.9996	20.9846	20.7976	20.4742	20.2194 (87)	
Th 2	20.2082	20.2101	20.2120	20.2210	20.2226	20.2304	20.2304	20.2319	20.2274	20.2226	20.2193	20.2157 (88)	
util rest of house	0.9948	0.9881	0.9589	0.8339	0.6053	0.3966	0.2708	0.3209	0.5961	0.9148	0.9871	0.9961 (89)	
MIT 2	19.1971	19.3872	19.7176	20.0776	20.2055	20.2295	20.2304	20.2317	20.2164	19.9973	19.5415	19.1679 (90)	
Living area fraction													fLA = Living area / (4) = 0.6691 (91)
MIT	19.8972	20.0471	20.3107	20.6067	20.7239	20.7440	20.7452	20.7455	20.7304	20.5327	20.1656	19.8714 (92)	
Temperature adjustment													0.0000
adjusted MIT	19.8972	20.0471	20.3107	20.6067	20.7239	20.7440	20.7452	20.7455	20.7304	20.5327	20.1656	19.8714 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9942	0.9874	0.9602	0.8498	0.6373	0.4324	0.3091	0.3638	0.6403	0.9247	0.9868	0.9955 (94)
Useful gains	406.2902	452.4867	507.0721	532.8826	453.7030	311.7343	210.7364	220.3588	331.0853	404.0103	391.5053	388.5628 (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	818.0005	792.2902	720.5073	603.2531	463.9228	312.4449	210.7992	220.5347	338.6010	510.6489	674.8732	813.4420 (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	306.3124	228.3480	158.7958	50.6668	7.6036	0.0000	0.0000	0.0000	0.0000	79.3391	204.0249	316.1101 (98)
Space heating												1351.2007 (98)
Space heating per m2												21.9600 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	1445.1344	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	306.3124 228.3480 158.7958 50.6668 7.6036 0.0000 0.0000 0.0000 0.0000 79.3391 204.0249 316.1101	(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)	327.6069 244.2224 169.8351 54.1891 8.1321 0.0000 0.0000 0.0000 0.0000 84.8547 218.2084 338.0856	(211)
Water heating requirement	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(215)
Water heating		
Water heating requirement	180.8205 159.4803 167.7356 150.7052 147.9335 132.5393 127.6278 139.5814 139.1889 156.2559 164.7954 176.5852	(64)
Efficiency of water heater	86.2092 85.7708 84.6682 82.2467 80.2639 79.8000 79.8000 79.8000 79.8000 83.1091 85.3845 86.3503	(216)
Fuel for water heating, kWh/month	209.7461 185.9378 198.1093 183.2356 184.3088 166.0894 159.9346 174.9140 174.4222 188.0131 193.0040 204.4988	(219)
Water heating fuel used		2222.2136 (219)
Annual totals kWh/year		
Space heating fuel - main system		1445.1344 (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)		278.3410 (232)
Total delivered energy for all uses		4020.6891 (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	1445.1344	0.2160	312.1490 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2222.2136	0.2160	479.9981 (264)
Space and water heating			792.1472 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	278.3410	0.5190	144.4590 (268)
Total CO2, kg/m2/year			975.5312 (272)
Emissions per m2 for space and water heating			12.8742 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3478 (272b)
Emissions per m2 for pumps and fans			0.6326 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.8742 * 1.00) + 2.3478 + 0.6326, rounded to 2 d.p.			15.8500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001030_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.09_1B		
Property					
SAP Rating	85 B	DER	9.25	TER	15.85
Environmental	93 A	% DER<TER	41.66		
CO ₂ Emissions (t/year)	0.51	DFEE	33.87	TFEE	34.82
General Requirements Compliance	Fail	% DFEE<TFEE	2.72		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 62 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.85 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.25 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)34.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor (no floor)			
Roof (no roof)			
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	14.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	61.5300 (1b)	x 2.5000 (2b)	= 153.8250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.8250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			14.4000	1.3258	19.0909			(27)				
External Wall 1	30.3761	14.4000	15.9761	0.2000	3.1952			(29a)				
Total net area of external elements Aum(A, m2)			30.3761					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.2861			(33)				
Party Floor 1			61.5300					(32d)				
Party Ceilings 1			61.4400					(32b)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)				
Thermal bridges (Default value 0.150 * total exposed area)								4.5564 (36)				
Total fabric heat loss	(33) + (36) =							26.8425 (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	13.2727	13.1252	12.9777	12.2400	12.0925	11.3549	11.3549	11.2074	11.6499	12.0925	12.3876	12.6826 (38)
Heat transfer coeff	40.1153	39.9678	39.8202	39.0826	38.9351	38.1974	38.1974	38.0499	38.4925	38.9351	39.2301	39.5252 (39)
Average = Sum(39)m / 12 =												39.0457 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6520	0.6496	0.6472	0.6352	0.6328	0.6208	0.6208	0.6184	0.6256	0.6328	0.6376	0.6424 (40)
HLP (average)												0.6346 (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												2.0245 (42)
Average daily hot water use (litres/day)												82.2830 (43)
Daily hot water use	90.5113	87.2200	83.9286	80.6373	77.3460	74.0547	74.0547	77.3460	80.6373	83.9286	87.2200	90.5113 (44)
Energy conte	134.2256	117.3946	121.1407	105.6134	101.3386	87.4475	81.0329	92.9865	94.0970	109.6610	119.7036	129.9903 (45)
Energy content (annual)												Total = Sum(45)m = 1294.6317 (45)
Distribution loss (46)m = 0.15 x (45)m												19.4986 (46)
Water storage loss:	20.1338	17.6092	18.1711	15.8420	15.2008	13.1171	12.1549	13.9480	14.1146	16.4492	17.9555	19.4986 (46)
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	189.5024	167.3220	176.4175	159.1071	156.6154	140.9412	136.3097	148.2633	147.5907	164.9378	173.1973	185.2671	(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													
	189.5024	167.3220	176.4175	159.1071	156.6154	140.9412	136.3097	148.2633	147.5907	164.9378	173.1973	185.2671	(64)
Total per year (kWh/year) = Sum(64)m = 1945.4715 (64)													
Heat gains from water heating, kWh/month													
	88.8515	78.9756	84.5007	77.9114	77.9165	71.8712	71.1649	75.1394	74.0822	80.6837	82.5964	87.4432	(65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	889.5704	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	231.2883	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	925.1532	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1945.4715	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	505.8226	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2023.2903	(310b)
Electricity used for heat distribution	36.8555	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	98.5249	(330a)
Total electricity for the above, kWh/year	98.5249	(331)
Electricity for lighting (calculated in Appendix L)	278.3410	(332)
Total delivered energy for all uses	4062.4204	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	775.9062	0.2160	167.5957 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	2465.1032	0.2160	532.4623 (363)
less credit emissions for electricity	-912.8277	0.5190	-473.7576 (364)
Water heating from Combined Heat and Power	5391.1280	0.2160	1164.4837 (365)
less credit emissions for electricity	-1996.3347	0.5190	-1036.0977 (366)
Electrical energy for heat distribution	36.8555	0.5190	19.1280 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			373.8144 (373)
Space and water heating			373.8144 (376)
Pumps and fans	98.5249	0.5190	51.1344 (378)
Energy for lighting	278.3410	0.5190	144.4590 (379)
Total CO2, kg/year			569.4078 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.2500 (384)

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

DER		9.2500	ZC1
Total Floor Area		61.5300	
Assumed number of occupants		2.0245	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		17.0260	ZC2
CO2 emissions from cooking, equation (L16)		2.7237	ZC3
Total CO2 emissions		28.9997	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		28.9997	ZC8

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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	61.5300 (1b)	x 2.5000 (2b)	= 153.8250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.8250 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1300 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3800 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2945 (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	0.3755	0.3681	0.3608	0.3240	0.3166	0.2798	0.2798	0.2724	0.2945	0.3166	0.3313	0.3461 (22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5391	0.5391	0.5371	0.5434	0.5501	0.5549	0.5599 (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 Opening Type (Uw = 1.40)			14.4000	1.3258	19.0909			(27)				
External Wall 1	30.3761	14.4000	15.9761	0.1800	2.8757			(29a)				
Total net area of external elements Aum(A, m2)			30.3761					(31)				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	21.9666		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (User defined value 0.050 * total exposed area)								1.5188 (36)				
Total fabric heat loss						(33) + (36) =	23.4854	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.9600	28.8210	28.6848	28.0450	27.9253	27.3680	27.3680	27.2648	27.5826	27.9253	28.1674	28.4206 (38)
Heat transfer coeff	52.4454	52.3064	52.1702	51.5304	51.4107	50.8534	50.8534	50.7502	51.0681	51.4107	51.6528	51.9060 (39)
Average = Sum(39)m / 12 =												51.5298 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8524	0.8501	0.8479	0.8375	0.8355	0.8265	0.8265	0.8248	0.8300	0.8355	0.8395	0.8436 (40)
HLP (average)												0.8375 (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												2.0245 (42)
Average daily hot water use (litres/day)												82.2830 (43)
Daily hot water use	90.5113	87.2200	83.9286	80.6373	77.3460	74.0547	74.0547	77.3460	80.6373	83.9286	87.2200	90.5113 (44)
Energy conte	134.2256	117.3946	121.1407	105.6134	101.3386	87.4475	81.0329	92.9865	94.0970	109.6610	119.7036	129.9903 (45)
Energy content (annual)										Total = Sum(45)m =		1294.6317 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1338	17.6092	18.1711	15.8420	15.2008	13.1171	12.1549	13.9480	14.1146	16.4492	17.9555	19.4986 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	180.8205	159.4803	167.7356	150.7052	147.9335	132.5393	127.6278	139.5814	139.1889	156.2559	164.7954	176.5852 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	180.8205	159.4803	167.7356	150.7052	147.9335	132.5393	127.6278	139.5814	139.1889	156.2559	164.7954	176.5852 (64)
	81.9059	72.7023	77.5552	71.1899	70.9710	65.1498	64.2194	68.1939	67.3607	73.7382	75.8749	80.4977 (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	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7608	13.9986	11.3844	8.6188	6.4426	5.4391	5.8772	7.6394	10.2536	13.0192	15.1954	16.1989	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	176.7885	178.6230	174.0001	164.1585	151.7352	140.0590	132.2587	130.4241	135.0471	144.8887	157.3120	168.9881	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	(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)	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	(71)
Water heating gains (Table 5)	110.0886	108.1879	104.2409	98.8749	95.3911	90.4858	86.3164	91.6585	93.5566	99.1105	105.3818	108.1958	(72)
Total internal gains	359.0061	357.1777	345.9936	328.0203	309.9371	292.3521	280.8204	286.0902	295.2254	313.3866	334.2574	349.7510	(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				

Northeast					14.4000	11.2829	0.6300	0.7000			0.7700	49.6543 (75)				

Solar gains					49.6543	101.0727	182.1009	299.0620	401.9980	428.5724	400.9207	319.6186	221.8928	123.5189	62.4779	40.5502 (83)
Total gains					408.6604	458.2504	528.0945	627.0823	711.9351	720.9245	681.7411	605.7088	517.1182	436.9055	396.7353	390.3012 (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	81.4737	81.6901	81.9034	82.9203	83.1134	84.0242	84.0242	84.1951	83.6710	83.1134	82.7238	82.3203	
alpha	6.4316	6.4460	6.4602	6.5280	6.5409	6.6016	6.6016	6.6130	6.5781	6.5409	6.5149	6.4880	
util living area	0.9960	0.9909	0.9682	0.8647	0.6544	0.4501	0.3281	0.3850	0.6630	0.9376	0.9905	0.9970	(86)
MIT	20.2434	20.3735	20.6040	20.8684	20.9802	20.9985	20.9998	20.9996	20.9846	20.7976	20.4742	20.2194	(87)
Th 2	20.2082	20.2101	20.2120	20.2210	20.2226	20.2304	20.2304	20.2319	20.2274	20.2226	20.2193	20.2157	(88)
util rest of house	0.9948	0.9881	0.9589	0.8339	0.6053	0.3966	0.2708	0.3209	0.5961	0.9148	0.9871	0.9961	(89)
MIT 2	19.1971	19.3872	19.7176	20.0776	20.2055	20.2295	20.2304	20.2317	20.2164	19.9973	19.5415	19.1679	(90)
Living area fraction													(91)
MIT	19.8972	20.0471	20.3107	20.6067	20.7239	20.7440	20.7452	20.7455	20.7304	20.5327	20.1656	19.8714	(92)
Temperature adjustment													(93)
adjusted MIT	19.8972	20.0471	20.3107	20.6067	20.7239	20.7440	20.7452	20.7455	20.7304	20.5327	20.1656	19.8714	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9942	0.9874	0.9602	0.8498	0.6373	0.4324	0.3091	0.3638	0.6403	0.9247	0.9868	0.9955	(94)
Ext temp.	406.2902	452.4867	507.0721	532.8826	453.7030	311.7343	210.7364	220.3588	331.0853	404.0103	391.5053	388.5628	(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	818.0005	792.2902	720.5073	603.2531	463.9228	312.4449	210.7992	220.5347	338.6010	510.6489	674.8732	813.4420	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	306.3124	228.3480	158.7958	50.6668	7.6036	0.0000	0.0000	0.0000	0.0000	79.3391	204.0249	316.1101	(98)
												1351.2007	(98)
												21.9600	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1445.1344 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	306.3124	228.3480	158.7958	50.6668	7.6036	0.0000	0.0000	0.0000	0.0000	79.3391	204.0249	316.1101	(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)	327.6069	244.2224	169.8351	54.1891	8.1321	0.0000	0.0000	0.0000	0.0000	84.8547	218.2084	338.0856	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	180.8205	159.4803	167.7356	150.7052	147.9335	132.5393	127.6278	139.5814	139.1889	156.2559	164.7954	176.5852	(64)
Efficiency of water heater	86.2092	85.7708	84.6682	82.2467	80.2639	79.8000	79.8000	79.8000	79.8000	83.1091	85.3845	86.3503	(216)
(217)m	86.2092	85.7708	84.6682	82.2467	80.2639	79.8000	79.8000	79.8000	79.8000	83.1091	85.3845	86.3503	(217)
Fuel for water heating, kWh/month	209.7461	185.9378	198.1093	183.2356	184.3088	166.0894	159.9346	174.9140	174.4222	188.0131	193.0040	204.4988	(219)
Water heating fuel used												2222.2136	(219)
Annual totals kWh/year													
Space heating fuel - main system												1445.1344	(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)												278.3410	(232)
Total delivered energy for all uses												4020.6891	(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	1445.1344	0.2160	312.1490 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2222.2136	0.2160	479.9981 (264)
Space and water heating			792.1472 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	278.3410	0.5190	144.4590 (268)
Total CO2, kg/m2/year			975.5312 (272)
Emissions per m2 for space and water heating			12.8742 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3478 (272b)
Emissions per m2 for pumps and fans			0.6326 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.8742 * 1.00) + 2.3478 + 0.6326, rounded to 2 d.p.			15.8500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001058_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.09_1B			
Property						
SAP Rating	86 B	DER	8.44	TER	15.85	
Environmental	94 A	% DER<TER	46.77			
CO ₂ Emissions (t/year)	0.48	DFEE	27.48	TFEE	34.82	
General Requirements Compliance	Fail	% DFEE<TFEE	21.08			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
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

Mid-floor flat, total floor area 62 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.85 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.44 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)34.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)27.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor (no floor)			
Roof (no roof)			
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	14.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	61.5300 (1b)	x 2.5000 (2b)	= 153.8250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.8250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Opening Type 1 (Uw = 1.00)			14.4000	0.9615	13.8462		(27)						
External Wall 1	30.3761	14.4000	15.9761	0.1600	2.5562		(29a)						
Total net area of external elements Aum(A, m2)			30.3761				(31)						
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.4023		(33)						
Party Floor 1			61.5300				(32d)						
Party Ceilings 1			61.4400				(32b)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)						
Thermal bridges (Default value 0.150 * total exposed area)							4.5564 (36)						
Total fabric heat loss						(33) + (36) =	20.9587 (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	13.2727	13.1252	12.9777	12.2400	12.0925	11.3549	11.3549	11.2074	11.6499	12.0925	12.3876	12.6826	(38)
Heat transfer coeff	34.2315	34.0840	33.9364	33.1988	33.0513	32.3136	32.3136	32.1661	32.6087	33.0513	33.3463	33.6414	(39)
Average = Sum(39)m / 12 =												33.1619	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5563	0.5539	0.5515	0.5396	0.5372	0.5252	0.5252	0.5228	0.5300	0.5372	0.5420	0.5467	(40)
HLP (average)												0.5390	(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												2.0245 (42)
Average daily hot water use (litres/day)												82.2830 (43)
Daily hot water use	90.5113	87.2200	83.9286	80.6373	77.3460	74.0547	74.0547	77.3460	80.6373	83.9286	87.2200	90.5113 (44)
Energy conte	134.2256	117.3946	121.1407	105.6134	101.3386	87.4475	81.0329	92.9865	94.0970	109.6610	119.7036	129.9903 (45)
Energy content (annual)												Total = Sum(45)m = 1294.6317 (45)
Distribution loss (46)m = 0.15 x (45)m												19.4986 (46)
Water storage loss:	20.1338	17.6092	18.1711	15.8420	15.2008	13.1171	12.1549	13.9480	14.1146	16.4492	17.9555	19.4986 (46)
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144 (56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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 (58)	
Total heat required for water heating calculated for each month													
	189.5024	167.3220	176.4175	159.1071	156.6154	140.9412	136.3097	148.2633	147.5907	164.9378	173.1973	185.2671 (59)	
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													
	189.5024	167.3220	176.4175	159.1071	156.6154	140.9412	136.3097	148.2633	147.5907	164.9378	173.1973	185.2671 (64)	
								Total per year (kWh/year) = Sum (64)m =			1945.4715 (64)		
Heat gains from water heating, kWh/month													
	88.8515	78.9756	84.5007	77.9114	77.9165	71.8712	71.1649	75.1394	74.0822	80.6837	82.5964	87.4432 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7608	13.9986	11.3844	8.6188	6.4426	5.4391	5.8772	7.6394	10.2536	13.0192	15.1954	16.1989 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	176.7885	178.6230	174.0001	164.1585	151.7352	140.0590	132.2587	130.4241	135.0471	144.8887	157.3120	168.9881 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	(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)	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	(71)
Water heating gains (Table 5)	119.4240	117.5233	113.5762	108.2103	104.7265	99.8212	95.6517	100.9939	102.8920	108.4459	114.7172	117.5312 (72)
Total internal gains	365.3415	363.5131	352.3290	334.3557	316.2725	298.6875	287.1558	292.4256	301.5608	319.7220	340.5927	356.0864 (73)

[Jan				Area	Solar flux	g		FF			Access	Gains
				m2	Table 6a	Specific data		Specific data			factor	W
					W/m2	or Table 6b		or Table 6c			Table 6d	
Northeast				14.4000	11.2829	0.5000		0.8000			0.7700	45.0379 (75)
Solar gains	45.0379	91.6759	165.1709	271.2580	364.6240	388.7278	363.6469	289.9035	201.2633	112.0353	56.6693	36.7802 (83)
Total gains	410.3794	455.1890	517.4998	605.6137	680.8965	687.4153	650.8026	582.3291	502.8240	431.7573	397.2621	392.8666 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.9297	50.1458	50.3638	51.4828	51.7126	52.8931	52.8931	53.1357	52.4145	51.7126	51.2550	50.8055
alpha	4.3286	4.3431	4.3576	4.4322	4.4475	4.5262	4.5262	4.5424	4.4943	4.4475	4.4170	4.3870
util living area												
	0.9190	0.8801	0.7923	0.6227	0.4441	0.2999	0.2183	0.2537	0.4407	0.7133	0.8723	0.9280 (86)
MIT	20.2888	20.4580	20.6994	20.9095	20.9817	20.9977	20.9996	20.9992	20.9875	20.8682	20.5697	20.2637 (87)
Th 2	20.4695	20.4716	20.4738	20.4847	20.4869	20.4978	20.4978	20.5000	20.4934	20.4869	20.4825	20.4782 (88)
util rest of house												
	0.9111	0.8695	0.7762	0.6012	0.4209	0.2766	0.1934	0.2263	0.4099	0.6886	0.8595	0.9210 (89)
MIT 2	19.5079	19.7483	20.0846	20.3741	20.4664	20.4956	20.4975	20.4994	20.4807	20.3277	19.9177	19.4792 (90)
Living area fraction												
MIT	20.0304	20.2231	20.4960	20.7324	20.8112	20.8315	20.8334	20.8338	20.8198	20.6894	20.3540	20.0041 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0304	20.2231	20.4960	20.7324	20.8112	20.8315	20.8334	20.8338	20.8198	20.6894	20.3540	20.0041 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9040	0.8641	0.7769	0.6117	0.4356	0.2921	0.2101	0.2446	0.4298	0.6985	0.8561	0.9139 (94)
Useful gains	370.9993	393.3346	402.0478	370.4252	296.6222	200.8130	136.7049	142.4371	216.1345	301.6010	340.0864	359.0385 (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	538.4760	522.2732	474.9735	392.8205	301.1354	201.3630	136.7978	142.6179	219.1230	333.4669	441.9707	531.6712 (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	124.6026	86.6468	54.2567	16.1246	3.3578	0.0000	0.0000	0.0000	0.0000	23.7082	73.3567	128.4387 (98)
Space heating												510.4923 (99)
Space heating per m2												8.2966 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	510.4923	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	132.7280	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	530.9119	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1945.4715	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	505.8226	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2023.2903	(310b)
Electricity used for heat distribution	31.9275	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	98.5249	(330a)
Total electricity for the above, kWh/year	98.5249	(331)
Electricity for lighting (calculated in Appendix L)	278.3410	(332)
Total delivered energy for all uses	3569.6188	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	672.1585	0.2160	145.1862 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1414.6335	0.2160	305.5608 (363)
less credit emissions for electricity	-523.8388	0.5190	-271.8723 (364)
Water heating from Combined Heat and Power	5391.1280	0.2160	1164.4837 (365)
less credit emissions for electricity	-1996.3347	0.5190	-1036.0977 (366)
Electrical energy for heat distribution	31.9275	0.5190	16.5704 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			323.8311 (373)
Space and water heating			323.8311 (376)
Pumps and fans	98.5249	0.5190	51.1344 (378)
Energy for lighting	278.3410	0.5190	144.4590 (379)
Total CO2, kg/year			519.4245 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.4400 (384)

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

DER	8.4400	ZC1
Total Floor Area	61.5300	TFA
Assumed number of occupants	2.0245	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	17.0260	ZC2
CO2 emissions from cooking, equation (L16)	2.7237	ZC3
Total CO2 emissions	28.1897	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	28.1897	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	61.5300 (1b)	x 2.5000 (2b)	= 153.8250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.8250 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1300 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3800 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2945 (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	0.3755	0.3681	0.3608	0.3240	0.3166	0.2798	0.2798	0.2724	0.2945	0.3166	0.3313	0.3461 (22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5391	0.5391	0.5371	0.5434	0.5501	0.5549	0.5599 (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 Opening Type (Uw = 1.40)			14.4000	1.3258	19.0909			(27)				
External Wall 1	30.3761	14.4000	15.9761	0.1800	2.8757			(29a)				
Total net area of external elements Aum(A, m2)			30.3761					(31)				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	21.9666		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (User defined value 0.050 * total exposed area)								1.5188 (36)				
Total fabric heat loss						(33) + (36) =	23.4854	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.9600	28.8210	28.6848	28.0450	27.9253	27.3680	27.3680	27.2648	27.5826	27.9253	28.1674	28.4206 (38)
Heat transfer coeff	52.4454	52.3064	52.1702	51.5304	51.4107	50.8534	50.8534	50.7502	51.0681	51.4107	51.6528	51.9060 (39)
Average = Sum(39)m / 12 =												51.5298 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8524	0.8501	0.8479	0.8375	0.8355	0.8265	0.8265	0.8248	0.8300	0.8355	0.8395	0.8436 (40)
HLP (average)												0.8375 (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												2.0245 (42)
Average daily hot water use (litres/day)												82.2830 (43)
Daily hot water use	90.5113	87.2200	83.9286	80.6373	77.3460	74.0547	74.0547	77.3460	80.6373	83.9286	87.2200	90.5113 (44)
Energy conte	134.2256	117.3946	121.1407	105.6134	101.3386	87.4475	81.0329	92.9865	94.0970	109.6610	119.7036	129.9903 (45)
Energy content (annual)										Total = Sum(45)m =		1294.6317 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1338	17.6092	18.1711	15.8420	15.2008	13.1171	12.1549	13.9480	14.1146	16.4492	17.9555	19.4986 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	180.8205	159.4803	167.7356	150.7052	147.9335	132.5393	127.6278	139.5814	139.1889	156.2559	164.7954	176.5852 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	180.8205	159.4803	167.7356	150.7052	147.9335	132.5393	127.6278	139.5814	139.1889	156.2559	164.7954	176.5852 (64)
	81.9059	72.7023	77.5552	71.1899	70.9710	65.1498	64.2194	68.1939	67.3607	73.7382	75.8749	80.4977 (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	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	101.2273	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7608	13.9986	11.3844	8.6188	6.4426	5.4391	5.8772	7.6394	10.2536	13.0192	15.1954	16.1989	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	176.7885	178.6230	174.0001	164.1585	151.7352	140.0590	132.2587	130.4241	135.0471	144.8887	157.3120	168.9881	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	33.1227	(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)	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	-80.9819	(71)
Water heating gains (Table 5)	110.0886	108.1879	104.2409	98.8749	95.3911	90.4858	86.3164	91.6585	93.5566	99.1105	105.3818	108.1958	(72)
Total internal gains	359.0061	357.1777	345.9936	328.0203	309.9371	292.3521	280.8204	286.0902	295.2254	313.3866	334.2574	349.7510	(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	

Northeast					14.4000	11.2829	0.6300	0.7000			0.7700	49.6543 (75)	

Solar gains	49.6543	101.0727	182.1009	299.0620	401.9980	428.5724	400.9207	319.6186	221.8928	123.5189	62.4779	40.5502 (83)	
Total gains	408.6604	458.2504	528.0945	627.0823	711.9351	720.9245	681.7411	605.7088	517.1182	436.9055	396.7353	390.3012 (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	81.4737	81.6901	81.9034	82.9203	83.1134	84.0242	84.0242	84.1951	83.6710	83.1134	82.7238	82.3203	
alpha	6.4316	6.4460	6.4602	6.5280	6.5409	6.6016	6.6016	6.6130	6.5781	6.5409	6.5149	6.4880	
util living area	0.9960	0.9909	0.9682	0.8647	0.6544	0.4501	0.3281	0.3850	0.6630	0.9376	0.9905	0.9970	(86)
MIT	20.2434	20.3735	20.6040	20.8684	20.9802	20.9985	20.9998	20.9996	20.9846	20.7976	20.4742	20.2194	(87)
Th 2	20.2082	20.2101	20.2120	20.2210	20.2226	20.2304	20.2304	20.2319	20.2274	20.2226	20.2193	20.2157	(88)
util rest of house	0.9948	0.9881	0.9589	0.8339	0.6053	0.3966	0.2708	0.3209	0.5961	0.9148	0.9871	0.9961	(89)
MIT 2	19.1971	19.3872	19.7176	20.0776	20.2055	20.2295	20.2304	20.2317	20.2164	19.9973	19.5415	19.1679	(90)
Living area fraction													(91)
MIT	19.8972	20.0471	20.3107	20.6067	20.7239	20.7440	20.7452	20.7455	20.7304	20.5327	20.1656	19.8714	(92)
Temperature adjustment													(93)
adjusted MIT	19.8972	20.0471	20.3107	20.6067	20.7239	20.7440	20.7452	20.7455	20.7304	20.5327	20.1656	19.8714	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9942	0.9874	0.9602	0.8498	0.6373	0.4324	0.3091	0.3638	0.6403	0.9247	0.9868	0.9955	(94)
Ext temp.	406.2902	452.4867	507.0721	532.8826	453.7030	311.7343	210.7364	220.3588	331.0853	404.0103	391.5053	388.5628	(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	818.0005	792.2902	720.5073	603.2531	463.9228	312.4449	210.7992	220.5347	338.6010	510.6489	674.8732	813.4420	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	306.3124	228.3480	158.7958	50.6668	7.6036	0.0000	0.0000	0.0000	0.0000	79.3391	204.0249	316.1101	(98)
												1351.2007	(98)
												21.9600	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1445.1344 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	306.3124	228.3480	158.7958	50.6668	7.6036	0.0000	0.0000	0.0000	0.0000	79.3391	204.0249	316.1101	(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)	327.6069	244.2224	169.8351	54.1891	8.1321	0.0000	0.0000	0.0000	0.0000	84.8547	218.2084	338.0856	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	180.8205	159.4803	167.7356	150.7052	147.9335	132.5393	127.6278	139.5814	139.1889	156.2559	164.7954	176.5852	(64)
Efficiency of water heater	86.2092	85.7708	84.6682	82.2467	80.2639	79.8000	79.8000	79.8000	79.8000	83.1091	85.3845	86.3503	(216)
(217)m	86.2092	85.7708	84.6682	82.2467	80.2639	79.8000	79.8000	79.8000	79.8000	83.1091	85.3845	86.3503	(217)
Fuel for water heating, kWh/month	209.7461	185.9378	198.1093	183.2356	184.3088	166.0894	159.9346	174.9140	174.4222	188.0131	193.0040	204.4988	(219)
Water heating fuel used												2222.2136	(219)
Annual totals kWh/year													
Space heating fuel - main system												1445.1344	(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)												278.3410	(232)
Total delivered energy for all uses												4020.6891	(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	1445.1344	0.2160	312.1490 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2222.2136	0.2160	479.9981 (264)
Space and water heating			792.1472 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	278.3410	0.5190	144.4590 (268)
Total CO2, kg/m2/year			975.5312 (272)
Emissions per m2 for space and water heating			12.8742 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3478 (272b)
Emissions per m2 for pumps and fans			0.6326 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.8742 * 1.00) + 2.3478 + 0.6326, rounded to 2 d.p.			15.8500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001086_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.10_2B		
Property					
SAP Rating	86 B	DER	7.98	TER	13.65
Environmental	93 A	% DER<TER	41.52		
CO ₂ Emissions (t/year)	0.65	DFEE	32.14	TFEE	34.26
General Requirements Compliance	Fail	% DFEE<TFEE	6.19		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 92 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.65 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.98 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)34.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)32.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.44
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	21.60 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	92.4500 (1b)	x 2.5000 (2b)	= 231.1250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.1250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.40)			21.6000	1.3258	28.6364		(27)
External Wall 1	35.6308	21.6000	14.0308	0.1600	2.2449		(29a)
Total net area of external elements Aum(A, m ²)			35.6308				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8813		(33)
Party Floor 1			92.4500				(32d)
Party Ceilings 1			92.4500				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							5.3446 (36)
Total fabric heat loss							(33) + (36) = 36.2259 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	19.9425	19.7209	19.4992	18.3909	18.1692	17.0609	17.0609	16.8393	17.5043	18.1692	18.6126	19.0559 (38)
Average = Sum(39)m / 12 =	56.1685	55.9468	55.7251	54.6168	54.3952	53.2868	53.2868	53.0652	53.7302	54.3952	54.8385	55.2818 (39)
												54.5614 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6076	0.6052	0.6028	0.5908	0.5884	0.5764	0.5764	0.5740	0.5812	0.5884	0.5932	0.5980 (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												2.6578 (42)
Average daily hot water use (litres/day)												97.3226 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.0548	103.1619	99.2690	95.3761	91.4832	87.5903	87.5903	91.4832	95.3761	99.2690	103.1619	107.0548 (44)
Energy content (annual)	158.7592	138.8518	143.2826	124.9173	119.8611	103.4310	95.8440	109.9824	111.2960	129.7047	141.5828	153.7498 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1531.2627 (45)
Water storage loss:	23.8139	20.8278	21.4924	18.7376	17.9792	15.5147	14.3766	16.4974	16.6944	19.4557	21.2374	23.0625 (46)
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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 (58)	
Total heat required for water heating calculated for each month													
	214.0360	188.7792	198.5594	178.4109	175.1379	156.9247	151.1208	165.2592	164.7896	184.9815	195.0765	209.0266 (59)	
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	214.0360	188.7792	198.5594	178.4109	175.1379	156.9247	151.1208	165.2592	164.7896	184.9815	195.0765	209.0266 (64)	
								Total per year (kWh/year) = Sum(64)m =					2182.1025 (64)
Heat gains from water heating, kWh/month													
	97.0089	86.1102	91.8629	84.3299	84.0753	77.1858	76.0896	80.7906	79.8009	87.3483	89.8712	95.3432 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7094	19.2821	15.6813	11.8717	8.8743	7.4920	8.0954	10.5227	14.1235	17.9331	20.9305	22.3128 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.5136	246.0405	239.6727	226.1166	209.0044	192.9214	182.1769	179.6500	186.0177	199.5739	216.6861	232.7691 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890 (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)	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117 (71)
Water heating gains (Table 5)	130.3883	128.1401	123.4717	117.1249	113.0044	107.2024	102.2709	108.5895	110.8345	117.4036	124.8212	128.1495 (72)
Total internal gains	458.4781	456.3296	441.6925	417.9801	393.7499	370.4827	355.4101	361.6291	373.8427	397.7774	425.3046	446.0983 (73)

[Jan]				Area	Solar flux		g		FF		Access		Gains
				m2	Table 6a		Table 6b		Specific data or Table 6c		factor Table 6d		W
Northeast				21.6000	11.2829		0.3000		0.8000		0.7700		40.5341 (75)
Solar gains	40.5341	82.5083	148.6538	244.1322	328.1616	349.8550	327.2822	260.9131	181.1370	100.8317	51.0024	33.1022 (83)	
Total gains	499.0122	538.8379	590.3463	662.1123	721.9115	720.3377	682.6923	622.5422	554.9796	498.6091	476.3070	479.2005 (84)	

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.7206	45.9017	46.0843	47.0195	47.2111	48.1931	48.1931	48.3944	47.7954	47.2111	46.8294	46.4539
alpha	4.0480	4.0601	4.0723	4.1346	4.1474	4.2129	4.2129	4.2263	4.1864	4.1474	4.1220	4.0969
util living area	0.9621	0.9461	0.9058	0.8045	0.6436	0.4625	0.3409	0.3875	0.6213	0.8530	0.9407	0.9667 (86)
MIT	19.9102	20.0687	20.3483	20.6927	20.9010	20.9811	20.9959	20.9931	20.9376	20.6631	20.2476	19.8877 (87)
Th 2	20.4232	20.4254	20.4275	20.4383	20.4405	20.4513	20.4513	20.4535	20.4470	20.4405	20.4362	20.4318 (88)
util rest of house	0.9577	0.9400	0.8953	0.7849	0.6136	0.4255	0.2993	0.3430	0.5810	0.8332	0.9330	0.9628 (89)
MIT 2	18.9324	19.1620	19.5628	20.0503	20.3263	20.4327	20.4481	20.4479	20.3814	20.0194	19.4299	18.9061 (90)
Living area fraction									fLA = Living area / (4) =			0.312 (91)
MIT	19.2367	19.4442	19.8073	20.2502	20.5051	20.6034	20.6186	20.6175	20.5545	20.2197	19.6843	19.2116 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2367	19.4442	19.8073	20.2502	20.5051	20.6034	20.6186	20.6175	20.5545	20.2197	19.6843	19.2116 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9467	0.9276	0.8825	0.7779	0.6171	0.4359	0.3120	0.3564	0.5890	0.8247	0.9210	0.9526 (94)
Useful gains	472.3962	499.8501	520.9635	515.0296	445.5111	313.9946	213.0220	221.8959	326.8900	411.1852	438.6672	456.4706 (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	838.9714	813.7005	741.5498	619.9122	478.9561	319.8999	214.1361	223.8045	346.7994	523.2645	690.1063	829.8668 (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	272.7320	210.9075	164.1163	75.5155	24.8831	0.0000	0.0000	0.0000	0.0000	83.3870	181.0362	277.8068 (98)
Space heating												1290.3844 (99)
Space heating per m2										(98) / (4) =		13.9576 (99)

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.09r14

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1290.3844	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	335.4999	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	1341.9998	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2182.1025	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	567.3467	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2269.3866	(310b)
Electricity used for heat distribution	45.1423	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	155.0849	(330a)
Total electricity for the above, kWh/year	155.0849	(331)
Electricity for lighting (calculated in Appendix L)	383.3950	(332)
Total delivered energy for all uses	5052.7129	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	950.3648	0.2160	205.2788 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	3575.8054	0.2160	772.3740 (363)
less credit emissions for electricity	-1324.1208	0.5190	-687.2187 (364)
Water heating from Combined Heat and Power	6046.8601	0.2160	1306.1218 (365)
less credit emissions for electricity	-2239.1523	0.5190	-1162.1200 (366)
Electrical energy for heat distribution	45.1423	0.5190	23.4289 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			457.8647 (373)
Space and water heating			457.8647 (376)
Pumps and fans	155.0849	0.5190	80.4891 (378)
Energy for lighting	383.3950	0.5190	198.9820 (379)
Total CO2, kg/year			737.3358 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.9800 (384)

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

DER		7.9800	ZC1
Total Floor Area	TFA	92.4500	
Assumed number of occupants	N	2.6578	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.6085	ZC2
CO2 emissions from cooking, equation (L16)		1.9771	ZC3
Total CO2 emissions		25.5657	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		25.5657	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	92.4500 (1b)	x 2.5000 (2b)	= 231.1250 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.1250 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				30.0000 / (5) =	0.1298 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3798 (18)
					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2943 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3753	0.3679	0.3606	0.3238	0.3164	0.2796	0.2796	0.2723	0.2943	0.3164	0.3311	0.3459 (22b)
	0.5704	0.5677	0.5650	0.5524	0.5501	0.5391	0.5391	0.5371	0.5433	0.5501	0.5548	0.5598 (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 Opening Type (Uw = 1.40)			21.6000	1.3258	28.6364			(27)					
External Wall 1	35.6308	21.6000	14.0308	0.1800	2.5255			(29a)					
Total net area of external elements Aum(A, m2)			35.6308					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			31.1619		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								1.7815 (36)					
Total fabric heat loss						(33) + (36) =	32.9434	(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	43.5067	43.2982	43.0937	42.1335	41.9538	41.1175	41.1175	40.9626	41.4397	41.9538	42.3173	42.6973	(38)
Heat transfer coeff	76.4502	76.2416	76.0372	75.0769	74.8973	74.0610	74.0610	73.9061	74.3831	74.8973	75.2607	75.6407	(39)
Average = Sum(39)m / 12 =												75.0761	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8269	0.8247	0.8225	0.8121	0.8101	0.8011	0.8011	0.7994	0.8046	0.8101	0.8141	0.8182	(40)
HLP (average)												0.8121	(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												2.6578 (42)
Average daily hot water use (litres/day)												97.3226 (43)
Daily hot water use	107.0548	103.1619	99.2690	95.3761	91.4832	87.5903	87.5903	91.4832	95.3761	99.2690	103.1619	107.0548 (44)
Energy conte	158.7592	138.8518	143.2826	124.9173	119.8611	103.4310	95.8440	109.9824	111.2960	129.7047	141.5828	153.7498 (45)
Energy content (annual)										Total = Sum(45)m =		1531.2627 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8139	20.8278	21.4924	18.7376	17.9792	15.5147	14.3766	16.4974	16.6944	19.4557	21.2374	23.0625 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	205.3541	180.9375	189.8775	170.0091	166.4560	148.5228	142.4389	156.5773	156.3878	176.2996	186.6747	200.3447 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	205.3541	180.9375	189.8775	170.0091	166.4560	148.5228	142.4389	156.5773	156.3878	176.2996	186.6747	200.3447 (64)
	90.0634	79.8368	84.9174	77.6085	77.1297	70.4643	69.1441	73.8451	73.0794	80.4027	83.1498	88.3977 (65)
								Total per year (kWh/year) =	Sum (64)m =			2079.8801 (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	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	132.8896	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7094	19.2821	15.6813	11.8717	8.8743	7.4920	8.0954	10.5227	14.1235	17.9331	20.9305	22.3128	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.5136	246.0405	239.6727	226.1166	209.0044	192.9214	182.1769	179.6500	186.0177	199.5739	216.6861	232.7691	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	36.2890	(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)	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	-106.3117	(71)
Water heating gains (Table 5)	121.0529	118.8048	114.1363	107.7895	103.6690	97.8671	92.9356	99.2541	101.4991	108.0682	115.4858	118.8142	(72)
Total internal gains	452.1428	449.9942	435.3572	411.6447	387.4145	364.1473	349.0747	355.2937	367.5073	391.4420	418.9693	439.7629	(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
-----					21.6000	11.2829	0.6300	0.7000			0.7700			74.4814 (75)

Solar gains	74.4814	151.6091	273.1513	448.5929	602.9969	642.8585	601.3810	479.4279	332.8392	185.2783	93.7169	60.8253	(83)	
Total gains	526.6242	601.6033	708.5085	860.2377	990.4115	1007.0059	950.4557	834.7216	700.3464	576.7203	512.6862	500.5882	(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	83.9781	84.2078	84.4342	85.5141	85.7192	86.6872	86.6872	86.8689	86.3118	85.7192	85.3053	84.8768	
alpha	6.5985	6.6139	6.6289	6.7009	6.7146	6.7791	6.7791	6.7913	6.7541	6.7146	6.6870	6.6585	
util living area	0.9983	0.9954	0.9803	0.8926	0.6823	0.4692	0.3427	0.4067	0.7065	0.9617	0.9957	0.9988 (86)	
MIT	20.1894	20.3212	20.5592	20.8478	20.9774	20.9983	20.9998	20.9995	20.9800	20.7571	20.4204	20.1666 (87)	
Th 2	20.2300	20.2320	20.2339	20.2429	20.2446	20.2524	20.2524	20.2538	20.2494	20.2446	20.2412	20.2376 (88)	
util rest of house	0.9977	0.9940	0.9741	0.8657	0.6335	0.4151	0.2846	0.3411	0.6399	0.9460	0.9940	0.9984 (89)	
MIT 2	19.1354	19.3290	19.6736	20.0734	20.2247	20.2514	20.2523	20.2536	20.2346	19.9642	19.4814	19.1080 (90)	
Living area fraction									fLA = Living area / (4) =			0.3112 (91)	
MIT	19.4634	19.6377	19.9492	20.3144	20.4590	20.4838	20.4849	20.4857	20.4666	20.2110	19.7736	19.4374 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.4634	19.6377	19.9492	20.3144	20.4590	20.4838	20.4849	20.4857	20.4666	20.2110	19.7736	19.4374 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9970	0.9925	0.9713	0.8685	0.6477	0.4319	0.3027	0.3615	0.6598	0.9452	0.9927	0.9978 (94)
Useful gains	525.0451	597.0774	688.1620	747.0980	641.4819	434.9157	287.6621	301.7685	462.1025	545.1228	508.9216	499.4887 (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	1159.2454	1123.6286	1022.6373	856.9596	656.0239	435.7620	287.7229	301.9617	473.5670	719.8358	953.8241	1152.5708 (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	471.8450	353.8424	248.8496	79.1003	10.8192	0.0000	0.0000	0.0000	0.0000	129.9865	320.3298	485.8931 (98)
Space heating												2100.6659 (98)
Space heating per m2												22.7222 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												2246.7015	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	471.8450	353.8424	248.8496	79.1003	10.8192	0.0000	0.0000	0.0000	0.0000	129.9865	320.3298	485.8931	(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)	504.6470	378.4411	266.1493	84.5993	11.5714	0.0000	0.0000	0.0000	0.0000	139.0230	342.5987	519.6717	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	205.3541	180.9375	189.8775	170.0091	166.4560	148.5228	142.4389	156.5773	156.3878	176.2996	186.6747	200.3447	(64)
Efficiency of water heater	86.9640	86.5725	85.5362	82.9128	80.3800	79.8000	79.8000	79.8000	79.8000	84.0157	86.2423	79.8000	(216)
(217)m	86.9640	86.5725	85.5362	82.9128	80.3800	79.8000	79.8000	79.8000	79.8000	84.0157	86.2423	87.0908	(217)
Fuel for water heating, kWh/month	236.1368	209.0011	221.9849	205.0458	207.0863	186.1189	178.4949	196.2122	195.9747	209.8414	216.4537	230.0413	(219)
Water heating fuel used												2492.3919	(219)
Annual totals kWh/year													
Space heating fuel - main system												2246.7015	(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)												383.3950	(232)
Total delivered energy for all uses												5197.4884	(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	2246.7015	0.2160	485.2875 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2492.3919	0.2160	538.3566 (264)
Space and water heating			1023.6442 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	383.3950	0.5190	198.9820 (268)
Total CO2, kg/m2/year			1261.5512 (272)
Emissions per m2 for space and water heating			11.0724 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1523 (272b)
Emissions per m2 for pumps and fans			0.4210 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.0724 * 1.00) + 2.1523 + 0.4210, rounded to 2 d.p.			13.6500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001158_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.11_1B			
Property						
SAP Rating	85 B	DER	9.36	TER	15.87	
Environmental	93 A	% DER<TER	41.02			
CO ₂ Emissions (t/year)	0.51	DFEE	34.35	TFEE	34.45	
General Requirements Compliance	Fail	% DFEE<TFEE	0.29			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
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

Mid-floor flat, total floor area 61 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.87 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.36 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)34.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)34.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	12.72 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	61.0300 (1b)	x 2.5000 (2b)	= 152.5750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 152.5750 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											3.0000	
Infiltration rate											0.1500	(18)
Number of sides sheltered											3	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1163 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			12.7200	1.3258	16.8636		(27)					
External Wall 1	22.5081	12.7200	9.7881	0.1600	1.5661		(29a)					
External Roof 1	18.2400		18.2400	0.1600	2.9184		(30)					
Total net area of external elements Aum(A, m2)			40.7481				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.3481		(33)					
Party Floor 1			61.0300				(32d)					
Party Ceilings 1			42.7900				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)				
Thermal bridges (Default value 0.150 * total exposed area)								6.1122 (36)				
Total fabric heat loss								(33) + (36) = 27.4603 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 13.1649	Feb 13.0186	Mar 12.8722	Apr 12.1406	May 11.9943	Jun 11.2626	Jul 11.2626	Aug 11.1163	Sep 11.5553	Oct 11.9943	Nov 12.2869	Dec 12.5796 (38)
Heat transfer coeff	40.6252	40.4789	40.3326	39.6009	39.4546	38.7230	38.7230	38.5766	39.0156	39.4546	39.7473	40.0399 (39)
Average = Sum(39)m / 12 =	39.5643 (39)											
HLP	Jan 0.6657	Feb 0.6633	Mar 0.6609	Apr 0.6489	May 0.6465	Jun 0.6345	Jul 0.6345	Aug 0.6321	Sep 0.6393	Oct 0.6465	Nov 0.6513	Dec 0.6561 (40)
HLP (average)	0.6483 (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												2.0106 (42)
Average daily hot water use (litres/day)												81.9518 (43)
Daily hot water use	Jan 90.1470	Feb 86.8689	Mar 83.5908	Apr 80.3128	May 77.0347	Jun 73.7566	Jul 73.7566	Aug 77.0347	Sep 80.3128	Oct 83.5908	Nov 86.8689	Dec 90.1470 (44)
Energy conte	133.6854	116.9221	120.6531	105.1883	100.9307	87.0955	80.7068	92.6122	93.7183	109.2196	119.2218	129.4671 (45)
Energy content (annual)												Total = Sum(45)m = 1289.4209 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.0528	17.5383	18.0980	15.7782	15.1396	13.0643	12.1060	13.8918	14.0577	16.3829	17.8833	19.4201 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													110.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)
Total storage loss													
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	(56)
If cylinder contains dedicated solar storage													
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	(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	23.2624	(59)
Total heat required for water heating calculated for each month													
188.9622	166.8495	175.9299	158.6820	156.2075	140.5892	135.9836	147.8890	147.2120	164.4964	172.7155	184.7439	184.7439	(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													
188.9622	166.8495	175.9299	158.6820	156.2075	140.5892	135.9836	147.8890	147.2120	164.4964	172.7155	184.7439	184.7439	(64)
Heat gains from water heating, kWh/month													
88.6718	78.8185	84.3386	77.7701	77.7809	71.7542	71.0564	75.0150	73.9563	80.5370	82.4362	87.2693	87.2693	(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	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
15.6492	13.8995	11.3039	8.5577	6.3970	5.4006	5.8356	7.5853	10.1810	12.9271	15.0878	16.0842	16.0842	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
175.5369	177.3585	172.7683	162.9963	150.6610	139.0675	131.3224	129.5008	134.0910	143.8630	156.1983	167.7918	167.7918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	(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)													
-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	(71)
Water heating gains (Table 5)													
119.1826	117.2895	113.3583	108.0140	104.5442	99.6586	95.5060	100.8266	102.7171	108.2486	114.4947	117.2974	117.2974	(72)
Total internal gains													
363.5278	361.7065	350.5895	332.7271	314.7612	297.2858	285.8229	291.0718	300.1481	318.1977	338.9398	354.3324	354.3324	(73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF		Access		Gains	
				m2	Table 6a		Specific data	Specific data		factor		W	
					W/m2		or Table 6b	or Table 6c		Table 6d			
Northeast				12.7200	11.2829		0.3000	0.8000		0.7700		23.8701 (75)	
Solar gains	23.8701	48.5882	87.5406	143.7667	193.2507	206.0257	192.7328	153.6489	106.6695	59.3787	30.0347	19.4935	(83)
Total gains	387.3979	410.2948	438.1301	476.4938	508.0120	503.3115	478.5558	444.7206	406.8176	377.5764	368.9746	373.8259	(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	41.7297	41.8805	42.0325	42.8090	42.9678	43.7797	43.7797	43.9457	43.4513	42.9678	42.6514	42.3397	
alpha	3.7820	3.7920	3.8022	3.8539	3.8645	3.9186	3.9186	3.9297	3.8968	3.8645	3.8434	3.8226	
util living area													
0.9447	0.9281	0.8885	0.7962	0.6505	0.4763	0.3520	0.3925	0.6101	0.8261	0.9180	0.9500	0.9500	(86)
MIT	19.9008	20.0460	20.3107	20.6465	20.8707	20.9712	20.9931	20.9896	20.9253	20.6510	20.2435	19.8786	(87)
Th 2	20.3713	20.3734	20.3755	20.3862	20.3883	20.3991	20.3991	20.4012	20.3948	20.3883	20.3841	20.3798	(88)
util rest of house													
0.9384	0.9201	0.8762	0.7751	0.6185	0.4355	0.3053	0.3435	0.5671	0.8033	0.9078	0.9444	0.9444	(89)
MIT 2	18.8805	19.0901	19.4682	19.9425	20.2398	20.3711	20.3938	20.3929	20.3173	19.9578	19.3834	18.8548	(90)
Living area fraction													
MIT	19.3897	19.5672	19.8887	20.2939	20.5547	20.6706	20.6929	20.6907	20.6207	20.3038	19.8127	19.3658	(92)
Temperature adjustment													
adjusted MIT	19.3897	19.5672	19.8887	20.2939	20.5547	20.6706	20.6929	20.6907	20.6207	20.3038	19.8127	19.3658	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9270	0.9083	0.8655	0.7718	0.6274	0.4541	0.3283	0.3673	0.5836	0.7999	0.8970	0.9334	0.9334	(94)
Useful gains	359.1143	372.6727	379.2092	367.7559	318.7292	228.5754	157.0890	163.3676	237.4015	302.0282	330.9519	348.9343	(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													
613.0238	593.7132	540.0001	451.2085	349.3573	235.0711	158.4903	165.5217	254.4106	382.8599	505.2941	607.2363	607.2363	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
188.9087	148.5392	119.6284	60.0858	22.7873	0.0000	0.0000	0.0000	0.0000	60.1388	125.5264	192.1767	192.1767	(98)
Space heating													
Space heating per m ²													
													(98) / (4) = 15.0384 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	917.7914 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	238.6258 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	954.5030 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1940.2606 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	504.4678 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2017.8711 (310b)
Electricity used for heat distribution	37.1547 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	97.7243 (330a)
Total electricity for the above, kWh/year	97.7243 (331)
Electricity for lighting (calculated in Appendix L)	276.3706 (332)
Total delivered energy for all uses	4089.5625 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	782.2037	0.2160	168.9560 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	2543.3068	0.2160	549.3543 (363)
less credit emissions for electricity	-941.7865	0.5190	-488.7872 (364)
Water heating from Combined Heat and Power	5376.6882	0.2160	1161.3646 (365)
less credit emissions for electricity	-1990.9876	0.5190	-1033.3226 (366)
Electrical energy for heat distribution	37.1547	0.5190	19.2833 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			376.8484 (373)
Space and water heating			376.8484 (376)
Pumps and fans	97.7243	0.5190	50.7189 (378)
Energy for lighting	276.3706	0.5190	143.4363 (379)
Total CO2, kg/year			571.0037 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.3600 (384)

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

DER		9.3600 ZC1
Total Floor Area	TFA	61.0300
Assumed number of occupants	N	2.0106
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.0440 ZC2
CO2 emissions from cooking, equation (L16)		2.7405 ZC3
Total CO2 emissions		29.1445 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		29.1445 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	61.0300 (1b)	x 2.5000 (2b)	= 152.5750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 152.5750 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.1311 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3811 (18)
Number of sides sheltered					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2953 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3766	0.3692	0.3618	0.3249	0.3175	0.2806	0.2806	0.2732	0.2953	0.3175	0.3323	0.3470 (22b)
	0.5709	0.5681	0.5654	0.5528	0.5504	0.5394	0.5394	0.5373	0.5436	0.5504	0.5552	0.5602 (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 Opening Type (Uw = 1.40)			12.7200	1.3258	16.8636		(27)
External Wall 1	22.5081	12.7200	9.7881	0.1800	1.7619		(29a)
External Roof 1	18.2400		18.2400	0.1300	2.3712		(30)
Total net area of external elements Aum(A, m ²)			40.7481				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.9967		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							2.0374 (36)
Total fabric heat loss						(33) + (36) =	23.0341 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	28.7446	28.6059	28.4701	27.8319	27.7125	27.1567	27.1567
Heat transfer coeff	51.7787	51.6400	51.5042	50.8660	50.7466	50.1908	50.1908
Average = Sum(39)m / 12 =						50.0878	50.0878
	50.4049	50.7466	50.9881	51.2407	51.4077	51.5707	51.7337
HLP	0.8484	0.8461	0.8439	0.8335	0.8315	0.8224	0.8224
HLP (average)						0.8207	0.8207
Days in month	31	28	31	30	31	30	31
						30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0106 (42)
Average daily hot water use (litres/day)												81.9518 (43)
Daily hot water use	90.1470	86.8689	83.5908	80.3128	77.0347	73.7566	73.7566	77.0347	80.3128	83.5908	86.8689	90.1470 (44)
Energy conte	133.6854	116.9221	120.6531	105.1883	100.9307	87.0955	80.7068	92.6122	93.7183	109.2196	119.2218	129.4671 (45)
Energy content (annual)												1289.4209 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.0528	17.5383	18.0980	15.7782	15.1396	13.0643	12.1060	13.8918	14.0577	16.3829	17.8833	19.4201 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

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If cylinder contains dedicated solar storage												
Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	180.2803	159.0078	167.2480	150.2801	147.5256	132.1873	127.3017	139.2071	138.8101	155.8145	164.3136	176.0620 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	Solar input (sum of months) = Sum (63)m = 0.0000 (63)											
	180.2803	159.0078	167.2480	150.2801	147.5256	132.1873	127.3017	139.2071	138.8101	155.8145	164.3136	176.0620 (64)
	Total per year (kWh/year) = Sum (64)m = 1838.0383 (64)											
	81.7263	72.5452	77.3931	71.0486	70.8354	65.0327	64.1109	68.0695	67.2348	73.5915	75.7147	80.3237 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	15.7008	13.9453	11.3411	8.5859	6.4181	5.4184	5.8548	7.6103	10.2145	12.9697	15.1375	16.1372 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	175.5369	177.3585	172.7683	162.9963	150.6610	139.0675	131.3224	129.5008	134.0910	143.8630	156.1983	167.7918 (68)
Pumps, fans	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241 (71)
Total internal gains	109.8472	107.9541	104.0230	98.6786	95.2088	90.3232	86.1706	91.4912	93.3817	98.9132	105.1593	107.9620 (72)
	357.2440	355.4169	344.2914	326.4199	308.4470	290.9682	279.5068	284.7614	293.8462	311.9049	332.6542	348.0500 (73)

6. Solar gains

[Jan]	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
Northeast	12.7200		11.2829		0.6300		0.7000		0.7700		43.8613 (75)	
Solar gains	43.8613	89.2809	160.8558	264.1714	355.0982	378.5723	354.1466	282.3298	196.0053	109.1083	55.1888	35.8193 (83)
Total gains	401.1052	444.6978	505.1472	590.5913	663.5451	669.5405	633.6534	567.0912	489.8515	421.0132	387.8430	383.8694 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	81.8521	82.0719	82.2884	83.3208	83.5168	84.4417	84.4417	84.6153	84.0830	83.5168	83.1212	82.7115
util living area	6.4568	6.4715	6.4859	6.5547	6.5678	6.6294	6.6294	6.6410	6.6055	6.5678	6.5414	6.5141
	0.9962	0.9918	0.9729	0.8848	0.6875	0.4778	0.3483	0.4057	0.6869	0.9440	0.9911	0.9971 (86)
MIT	20.2427	20.3641	20.5839	20.8483	20.9743	20.9979	20.9998	20.9994	20.9815	20.7871	20.4706	20.2202 (87)
Th 2	20.2116	20.2135	20.2154	20.2244	20.2261	20.2340	20.2340	20.2354	20.2309	20.2261	20.2227	20.2191 (88)
util rest of house	0.9951	0.9893	0.9648	0.8566	0.6378	0.4215	0.2878	0.3386	0.6194	0.9230	0.9879	0.9962 (89)
MIT 2	19.1986	19.3764	19.6926	20.0566	20.2035	20.2327	20.2339	20.2352	20.2175	19.9870	19.5391	19.1718 (90)
Living area fraction	fLA = Living area / (4) = 0.4991 (91)											
MIT	19.7197	19.8694	20.1374	20.4518	20.5882	20.6146	20.6161	20.6166	20.5988	20.3864	20.0040	19.6951 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.7197	19.8694	20.1374	20.4518	20.5882	20.6146	20.6161	20.6166	20.5988	20.3864	20.0040	19.6951 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9941	0.9879	0.9638	0.8654	0.6615	0.4496	0.3180	0.3721	0.6524	0.9279	0.9868	0.9954 (94)
Ext temp.	398.7483	439.3368	486.8740	511.1053	438.9497	301.0316	201.5040	211.0137	319.5912	390.6502	382.7304	382.1191 (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	798.4104	773.0196	702.3838	587.5913	451.0463	301.8770	201.5733	211.2016	327.5707	496.6244	657.9501	793.9777 (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	297.3486	224.2348	160.3393	55.0700	8.9999	0.0000	0.0000	0.0000	0.0000	78.8448	198.1582	306.4228 (98)
Space heating per m2	(98) / (4) = 21.7830 (99)											

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1421.8379 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	297.3486	224.2348	160.3393	55.0700	8.9999	0.0000	0.0000	0.0000	0.0000	78.8448	198.1582	306.4228	(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)	318.0199	239.8234	171.4858	58.8984	9.6256	0.0000	0.0000	0.0000	0.0000	84.3260	211.9339	327.7249	(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	180.2803	159.0078	167.2480	150.2801	147.5256	132.1873	127.3017	139.2071	138.8101	155.8145	164.3136	176.0620	(64)
Efficiency of water heater (217)m	86.1404	85.7306	84.7016	82.4131	80.3462	79.8000	79.8000	79.8000	79.8000	83.1012	85.3144	86.2785	(217)
Fuel for water heating, kWh/month	209.2865	185.4737	197.4555	182.3499	183.6124	165.6483	159.5259	174.4450	173.9475	187.4996	192.5978	204.0624	(219)
Water heating fuel used												2215.9047	(219)
Annual totals kWh/year													
Space heating fuel - main system												1421.8379	(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)												277.2812	(232)
Total delivered energy for all uses												3990.0238	(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	1421.8379	0.2160	307.1170 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2215.9047	0.2160	478.6354 (264)
Space and water heating			785.7524 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	277.2812	0.5190	143.9090 (268)
Total CO2, kg/m2/year			968.5864 (272)
Emissions per m2 for space and water heating			12.8749 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3580 (272b)
Emissions per m2 for pumps and fans			0.6378 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.8749 * 1.00) + 2.3580 + 0.6378, rounded to 2 d.p.			15.8700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001202_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.11_1B		
Property					
SAP Rating	85 B	DER	8.68	TER	15.87
Environmental	94 A	% DER<TER	45.31		
CO ₂ Emissions (t/year)	0.48	DFEE	29.07	TFEE	34.45
General Requirements Compliance	Fail	% DFEE<TFEE	15.63		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
Client					

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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

Mid-floor flat, total floor area 61 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.87 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.68 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)34.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)29.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor (no floor)			
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing North East:	12.72 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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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	61.0300 (1b)	x 2.5000 (2b)	= 152.5750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 152.5750 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.00)			12.7200	0.9615	12.2308		(27)
External Wall 1	22.5081	12.7200	9.7881	0.1600	1.5661		(29a)
External Roof 1	18.2400		18.2400	0.1600	2.9184		(30)
Total net area of external elements Aum(A, m ²)			40.7481				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.7153		(33)
Party Floor 1			61.0300				(32d)
Party Ceilings 1			42.7900				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)	6.1122 (36)
Total fabric heat loss	(33) + (36) = 22.8275 (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	13.1649	13.0186	12.8722	12.1406	11.9943	11.2626	11.2626	11.1163	11.5553	11.9943	12.2869	12.5796 (38)
Heat transfer coeff	35.9924	35.8460	35.6997	34.9681	34.8217	34.0901	34.0901	33.9438	34.3827	34.8217	35.1144	35.4071 (39)
Average = Sum(39)m / 12 =												34.9315 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.5897	0.5874	0.5850	0.5730	0.5706	0.5586	0.5586	0.5562	0.5634	0.5706	0.5754	0.5802 (40)
HLP (average)												0.5724 (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	2.0106 (42)
Average daily hot water use (litres/day)	81.9518 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1470	86.8689	83.5908	80.3128	77.0347	73.7566	73.7566	77.0347	80.3128	83.5908	86.8689	90.1470 (44)
Energy conte	133.6854	116.9221	120.6531	105.1883	100.9307	87.0955	80.7068	92.6122	93.7183	109.2196	119.2218	129.4671 (45)
Energy content (annual)	Total = Sum(45)m =											1289.4209 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0528	17.5383	18.0980	15.7782	15.1396	13.0643	12.1060	13.8918	14.0577	16.3829	17.8833	19.4201 (46)
Water storage loss:												

store volume													110.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152	(51)
Volume factor from Table 2a													1.0294	(52)
Temperature factor from Table 2b													0.6000	(53)
Enter (49) or (54) in (55)													1.0327	(55)
Total storage loss														
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144		32.0144	(56)
If cylinder contains dedicated solar storage														
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144		32.0144	(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														
188.9622	166.8495	175.9299	158.6820	156.2075	140.5892	135.9836	147.8890	147.2120	164.4964	172.7155		184.7439	(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														
188.9622	166.8495	175.9299	158.6820	156.2075	140.5892	135.9836	147.8890	147.2120	164.4964	172.7155		184.7439	(64)	
Total per year (kWh/year) = Sum(64)m =													1940.2606	(64)
Heat gains from water heating, kWh/month														
88.6718	78.8185	84.3386	77.7701	77.7809	71.7542	71.0564	75.0150	73.9563	80.5370	82.4362		87.2693	(65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6492	13.8995	11.3039	8.5577	6.3970	5.4006	5.8356	7.5853	10.1810	12.9271	15.0878	16.0842 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5369	177.3585	172.7683	162.9963	150.6610	139.0675	131.3224	129.5008	134.0910	143.8630	156.1983	167.7918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530 (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)	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241 (71)
Water heating gains (Table 5)	119.1826	117.2895	113.3583	108.0140	104.5442	99.6586	95.5060	100.8266	102.7171	108.2486	114.4947	117.2974 (72)
Total internal gains	363.5278	361.7065	350.5895	332.7271	314.7612	297.2858	285.8229	291.0718	300.1481	318.1977	338.9398	354.3324 (73)

[Jan]													Gains
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Specific data		Specific data		factor		
					W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast	12.7200				11.2829		0.5000		0.8000		0.7700		39.7835 (75)
Solar gains	39.7835	80.9804	145.9009	239.6112	322.0845	343.3762	321.2214	256.0814	177.7826	98.9645	50.0579	32.4892	(83)
Total gains	403.3113	442.6869	496.4904	572.3383	636.8458	640.6620	607.0443	547.1532	477.9306	417.1622	388.9977	386.8216	(84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	47.1010	47.2933	47.4872	48.4807	48.6845	49.7293	49.7293	49.9437	49.3061	48.6845	48.2787	47.8797
alpha	4.1401	4.1529	4.1658	4.2320	4.2456	4.3153	4.3153	4.3296	4.2871	4.2456	4.2186	4.1920
util living area	0.9276	0.8961	0.8229	0.6717	0.4939	0.3384	0.2466	0.2845	0.4837	0.7482	0.8877	0.9355 (86)
MIT	20.1756	20.3438	20.6029	20.8585	20.9660	20.9949	20.9990	20.9982	20.9777	20.8168	20.4781	20.1503 (87)
Th 2	20.4392	20.4414	20.4436	20.4544	20.4566	20.4674	20.4674	20.4696	20.4631	20.4566	20.4522	20.4479 (88)
util rest of house	0.9203	0.8861	0.8075	0.6492	0.4676	0.3108	0.2170	0.2520	0.4489	0.7233	0.8756	0.9289 (89)
MIT 2	19.3234	19.5635	19.9270	20.2804	20.4184	20.4625	20.4667	20.4682	20.4403	20.2341	19.7656	19.2941 (90)
Living area fraction	19.7487	19.9530	20.2643	20.5689	20.6917	20.7282	20.7323	20.7327	20.7085	20.5249	20.1212	0.4991 (91)
MIT	19.7487	19.9530	20.2643	20.5689	20.6917	20.7282	20.7323	20.7327	20.7085	20.5249	20.1212	19.7214 (92)
Temperature adjustment	19.7487	19.9530	20.2643	20.5689	20.6917	20.7282	20.7323	20.7327	20.7085	20.5249	20.1212	0.0000
adjusted MIT	19.7487	19.9530	20.2643	20.5689	20.6917	20.7282	20.7323	20.7327	20.7085	20.5249	20.1212	19.7214 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9101	0.8766	0.8022	0.6540	0.4791	0.3243	0.2317	0.2681	0.4649	0.7266	0.8675	0.9190 (94)
Useful gains	367.0357	388.0378	398.2984	374.3225	305.1015	207.7913	140.6741	146.7037	222.2009	303.0979	337.4723	355.4759 (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	556.0364	539.5899	491.3832	408.0393	313.1064	208.9122	140.8722	147.0681	227.2182	345.6021	457.2313	549.5669 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	140.6166	101.8430	69.2551	24.2761	5.9556	0.0000	0.0000	0.0000	0.0000	31.6231	86.2265	144.4037 (98)
Space heating												604.1996 (98)
Space heating per m2												9.9000 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	604.1996 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	157.0919 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	628.3676 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1940.2606 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	504.4678 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2017.8711 (310b)
Electricity used for heat distribution	33.0780 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	97.7243 (330a)
Total electricity for the above, kWh/year	97.7243 (331)
Electricity for lighting (calculated in Appendix L)	276.3706 (332)
Total delivered energy for all uses	3681.8932 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	696.3786	0.2160	150.4178 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1674.3076	0.2160	361.6504 (363)
less credit emissions for electricity	-619.9961	0.5190	-321.7780 (364)
Water heating from Combined Heat and Power	5376.6882	0.2160	1161.3646 (365)
less credit emissions for electricity	-1990.9876	0.5190	-1033.3226 (366)
Electrical energy for heat distribution	33.0780	0.5190	17.1675 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			335.4998 (373)
Space and water heating			335.4998 (376)
Pumps and fans	97.7243	0.5190	50.7189 (378)
Energy for lighting	276.3706	0.5190	143.4363 (379)
Total CO2, kg/year			529.6550 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.6800 (384)

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

DER		8.6800 ZC1
Total Floor Area	TFA	61.0300
Assumed number of occupants	N	2.0106
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.0440 ZC2
CO2 emissions from cooking, equation (L16)		2.7405 ZC3
Total CO2 emissions		28.4645 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		28.4645 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	61.0300 (1b)	x 2.5000 (2b)	= 152.5750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 152.5750 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3811 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2953 (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	0.3766	0.3692	0.3618	0.3249	0.3175	0.2806	0.2806	0.2732	0.2953	0.3175	0.3323	0.3470 (22b)
Effective ac	0.5709	0.5681	0.5654	0.5528	0.5504	0.5394	0.5394	0.5373	0.5436	0.5504	0.5552	0.5602 (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 Opening Type (Uw = 1.40)			12.7200	1.3258	16.8636		(27)
External Wall 1	22.5081	12.7200	9.7881	0.1800	1.7619		(29a)
External Roof 1	18.2400		18.2400	0.1300	2.3712		(30)
Total net area of external elements Aum(A, m ²)			40.7481				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.9967		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)	2.0374 (36)
Total fabric heat loss	(33) + (36) = 23.0341 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.7446	28.6059	28.4701	27.8319	27.7125	27.1567	27.1567	27.0537	27.3708	27.7125	27.9540	28.2066 (38)
Heat transfer coeff	51.7787	51.6400	51.5042	50.8660	50.7466	50.1908	50.1908	50.0878	50.4049	50.7466	50.9881	51.2407 (39)
Average = Sum(39)m / 12 =												50.8654 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8484	0.8461	0.8439	0.8335	0.8315	0.8224	0.8224	0.8207	0.8259	0.8315	0.8355	0.8396 (40)
HLP (average)												0.8334 (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	2.0106 (42)
Average daily hot water use (litres/day)	81.9518 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1470	86.8689	83.5908	80.3128	77.0347	73.7566	73.7566	77.0347	80.3128	83.5908	86.8689	90.1470 (44)
Energy conte	133.6854	116.9221	120.6531	105.1883	100.9307	87.0955	80.7068	92.6122	93.7183	109.2196	119.2218	129.4671 (45)
Energy content (annual)												Total = Sum(45)m = 1289.4209 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0528	17.5383	18.0980	15.7782	15.1396	13.0643	12.1060	13.8918	14.0577	16.3829	17.8833	19.4201 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	180.2803	159.0078	167.2480	150.2801	147.5256	132.1873	127.3017	139.2071	138.8101	155.8145	164.3136	176.0620 (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	180.2803	159.0078	167.2480	150.2801	147.5256	132.1873	127.3017	139.2071	138.8101	155.8145	164.3136	176.0620 (64)
Heat gains from water heating, kWh/month	81.7263	72.5452	77.3931	71.0486	70.8354	65.0327	64.1109	68.0695	67.2348	73.5915	75.7147	80.3237 (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	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301	100.5301 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7008	13.9453	11.3411	8.5859	6.4181	5.4184	5.8548	7.6103	10.2145	12.9697	15.1375	16.1372 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5369	177.3585	172.7683	162.9963	150.6610	139.0675	131.3224	129.5008	134.0910	143.8630	156.1983	167.7918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530	33.0530 (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)	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241	-80.4241 (71)
Water heating gains (Table 5)	109.8472	107.9541	104.0230	98.6786	95.2088	90.3232	86.1706	91.4912	93.3817	98.9132	105.1593	107.9620 (72)
Total internal gains	357.2440	355.4169	344.2914	326.4199	308.4470	290.9682	279.5068	284.7614	293.8462	311.9049	332.6542	348.0500 (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	
Northeast				12.7200	11.2829	0.6300		0.7000	0.7700		43.8613 (75)	
Solar gains	43.8613	89.2809	160.8558	264.1714	355.0982	378.5723	354.1466	282.3298	196.0053	109.1083	55.1888	35.8193 (83)
Total gains	401.1052	444.6978	505.1472	590.5913	663.5451	669.5405	633.6534	567.0912	489.8515	421.0132	387.8430	383.8694 (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	81.8521	82.0719	82.2884	83.3208	83.5168	84.4417	84.4417	84.6153	84.0830	83.5168	83.1212	82.7115
alpha	6.4568	6.4715	6.4859	6.5547	6.5678	6.6294	6.6294	6.6410	6.6055	6.5678	6.5414	6.5141
util living area	0.9962	0.9918	0.9729	0.8848	0.6875	0.4778	0.3483	0.4057	0.6869	0.9440	0.9911	0.9971 (86)
MIT	20.2427	20.3641	20.5839	20.8483	20.9743	20.9979	20.9998	20.9994	20.9815	20.7871	20.4706	20.2202 (87)
Th 2	20.2116	20.2135	20.2154	20.2244	20.2261	20.2340	20.2340	20.2354	20.2309	20.2261	20.2227	20.2191 (88)
util rest of house	0.9951	0.9893	0.9648	0.8566	0.6378	0.4215	0.2878	0.3386	0.6194	0.9230	0.9879	0.9962 (89)
MIT 2	19.1986	19.3764	19.6926	20.0566	20.2035	20.2327	20.2339	20.2352	20.2175	19.9870	19.5391	19.1718 (90)
Living area fraction									fLA = Living area / (4) =			0.4991 (91)
MIT	19.7197	19.8694	20.1374	20.4518	20.5882	20.6146	20.6161	20.6166	20.5988	20.3864	20.0040	19.6951 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7197	19.8694	20.1374	20.4518	20.5882	20.6146	20.6161	20.6166	20.5988	20.3864	20.0040	19.6951 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9941	0.9879	0.9638	0.8654	0.6615	0.4496	0.3180	0.3721	0.6524	0.9279	0.9868	0.9954 (94)
Ext temp.	398.7483	439.3368	486.8740	511.1053	438.9497	301.0316	201.5040	211.0137	319.5912	390.6502	382.7304	382.1191 (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	798.4104	773.0196	702.3838	587.5913	451.0463	301.8770	201.5733	211.2016	327.5707	496.6244	657.9501	793.9777 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	297.3486	224.2348	160.3393	55.0700	8.9999	0.0000	0.0000	0.0000	0.0000	78.8448	198.1582	306.4228 (98)
												1329.4184 (98)
										(98) / (4) =		21.7830 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													1421.8379 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	297.3486	224.2348	160.3393	55.0700	8.9999	0.0000	0.0000	0.0000	0.0000	78.8448	198.1582	306.4228	(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)	318.0199	239.8234	171.4858	58.8984	9.6256	0.0000	0.0000	0.0000	0.0000	84.3260	211.9339	327.7249	(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	180.2803	159.0078	167.2480	150.2801	147.5256	132.1873	127.3017	139.2071	138.8101	155.8145	164.3136	176.0620	(64)
Efficiency of water heater (217)m	86.1404	85.7306	84.7016	82.4131	80.3462	79.8000	79.8000	79.8000	79.8000	83.1012	85.3144	86.2785	(217)
Fuel for water heating, kWh/month	209.2865	185.4737	197.4555	182.3499	183.6124	165.6483	159.5259	174.4450	173.9475	187.4996	192.5978	204.0624	(219)
Water heating fuel used												2215.9047	(219)
Annual totals kWh/year													
Space heating fuel - main system												1421.8379	(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)												277.2812	(232)
Total delivered energy for all uses												3990.0238	(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	1421.8379	0.2160	307.1170 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2215.9047	0.2160	478.6354 (264)
Space and water heating			785.7524 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	277.2812	0.5190	143.9090 (268)
Total CO2, kg/m2/year			968.5864 (272)
Emissions per m2 for space and water heating			12.8749 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3580 (272b)
Emissions per m2 for pumps and fans			0.6378 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.8749 * 1.00) + 2.3580 + 0.6378, rounded to 2 d.p.			15.8700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001230_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.12_2B		
Property					
SAP Rating	84 B	DER	9.83	TER	14.39
Environmental	91 B	% DER<TER	31.70		
CO ₂ Emissions (t/year)	0.94	DFEE	50.06	TFEE	42.54
General Requirements Compliance	Fail	% DFEE<TFEE	-17.66		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 110 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.83 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)42.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.1 kWh/m²/yrFail
Excess energy =7.6 kWh/m²/yr (17.9%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.44
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK

Based on:

Overshading:	Average
Windows facing South East:	12.00 m ² , No overhang
Windows facing South West:	13.20 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	109.8600 (1b)	x 2.5000 (2b)	= 274.6500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.6500 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											3.0000	
Infiltration rate											0.1500	(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) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			25.2000	1.3258	33.4091		(27)					
External Wall 1	83.0636	25.2000	57.8636	0.1600	9.2582		(29a)					
External Roof 1	103.0300		103.0300	0.1600	16.4848		(30)					
Total net area of external elements Aum(A, m2)			186.0936				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		59.1521		(33)					
Party Floor 1			109.8600				(32d)					
Party Ceilings 1			6.8400				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							27.9140 (36)					
Total fabric heat loss						(33) + (36) =	87.0661 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.9981	Feb 24.7092	Mar 24.4203	Apr 22.9758	May 22.6869	Jun 21.2425	Jul 21.2425	Aug 20.9536	Sep 21.8203	Oct 22.6869	Nov 23.2647	Dec 23.8425 (38)
Heat transfer coeff	112.0642	111.7753	111.4864	110.0420	109.7531	108.3086	108.3086	108.0197	108.8864	109.7531	110.3309	110.9086 (39)
Average = Sum(39)m / 12 =												109.9697 (39)
HLP	Jan 1.0201	Feb 1.0174	Mar 1.0148	Apr 1.0017	May 0.9990	Jun 0.9859	Jul 0.9859	Aug 0.9832	Sep 0.9911	Oct 0.9990	Nov 1.0043	Dec 1.0095 (40)
HLP (average)												1.0010 (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												2.8140 (42)
Average daily hot water use (litres/day)												101.0321 (43)
Daily hot water use	Jan 111.1353	Feb 107.0940	Mar 103.0527	Apr 99.0115	May 94.9702	Jun 90.9289	Jul 90.9289	Aug 94.9702	Sep 99.0115	Oct 103.0527	Nov 107.0940	Dec 111.1353 (44)
Energy conte	164.8104	144.1443	148.7440	129.6786	124.4297	107.3734	99.4972	114.1745	115.5381	134.6485	146.9794	159.6101 (45)
Energy content (annual)										Total = Sum(45)m =		1589.6283 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.7216	21.6216	22.3116	19.4518	18.6645	16.1060	14.9246	17.1262	17.3307	20.1973	22.0469	23.9415 (46)
Water storage loss:												

store volume													110.0000	(47)	
b) If manufacturer declared loss factor is not known :															
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152	(51)	
Volume factor from Table 2a													1.0294	(52)	
Temperature factor from Table 2b													0.6000	(53)	
Enter (49) or (54) in (55)													1.0327	(55)	
Total storage loss															
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	30.9817	32.0144	(56)	
If cylinder contains dedicated solar storage															
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	30.9817	32.0144	(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	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month															
220.0872	194.0717	204.0208	183.1723	179.7065	160.8671	154.7740	169.4513	169.0318	189.9253	200.4731	214.8869	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	0.0000	(63)	
Solar input (sum of months) = Sum(63)m =													0.0000	(63)	
Output from w/h															
220.0872	194.0717	204.0208	183.1723	179.7065	160.8671	154.7740	169.4513	169.0318	189.9253	200.4731	214.8869	64			
Total per year (kWh/year) = Sum(64)m =													2240.4680	(64)	
Heat gains from water heating, kWh/month															
99.0209	87.8699	93.6788	85.9131	85.5943	78.4966	77.3043	82.1845	81.2114	88.9921	91.6656	97.2918	65			

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.1915	21.4867	17.4741	13.2290	9.8889	8.3486	9.0209	11.7258	15.7383	19.9834	23.3236	24.8638 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.3547	274.1705	267.0748	251.9688	232.9001	214.9783	203.0054	200.1896	207.2853	222.3914	241.4600	259.3818 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699 (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)	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593 (71)
Water heating gains (Table 5)	133.0926	130.7588	125.9124	119.3237	115.0461	109.0230	103.9036	110.4630	112.7936	119.6130	127.3133	130.7686 (72)
Total internal gains	493.8486	491.6257	475.6710	449.7313	423.0448	397.5596	381.1397	387.5881	401.0269	427.1975	457.3066	480.2240 (73)

[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Southeast					12.0000	36.7938	0.3000	0.8000	0.7700	73.4346		
Southwest					13.2000	36.7938	0.3000	0.8000	0.7700	80.7781 (77)		
Solar gains	154.2127	262.6812	359.4119	445.3288	498.8053	495.1982	477.4240	437.5280	389.1671	290.3187	184.7112	131.9739 (83)
Total gains	648.0612	754.3070	835.0829	895.0600	921.8502	892.7579	858.5636	825.1161	790.1940	717.5162	642.0179	612.1979 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.2314	27.3018	27.3725	27.7318	27.8048	28.1757	28.1757	28.2510	28.0262	27.8048	27.6592	27.5151	
alpha	2.8154	2.8201	2.8248	2.8488	2.8537	2.8784	2.8784	2.8834	2.8684	2.8537	2.8439	2.8343	
util living area													
	0.9664	0.9481	0.9187	0.8650	0.7769	0.6424	0.5045	0.5377	0.7225	0.8815	0.9494	0.9710	(86)
MIT	18.8796	19.1516	19.5508	20.0446	20.4775	20.7937	20.9252	20.9081	20.6896	20.1266	19.4173	18.8310	(87)
Th 2	20.0666	20.0688	20.0710	20.0820	20.0841	20.0951	20.0951	20.0973	20.0907	20.0841	20.0798	20.0754	(88)
util rest of house													
	0.9616	0.9408	0.9068	0.8441	0.7398	0.5794	0.4166	0.4513	0.6668	0.8589	0.9410	0.9668	(89)
MIT 2	17.2140	17.6076	18.1825	18.8894	19.4856	19.8983	20.0423	20.0289	19.7747	19.0169	18.0028	17.1489	(90)
Living area fraction													
									fLA = Living area / (4) =			0.3468	(91)
MIT	17.7917	18.1431	18.6571	19.2900	19.8296	20.2088	20.3485	20.3339	20.0920	19.4018	18.4934	17.7323	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7917	18.1431	18.6571	19.2900	19.8296	20.2088	20.3485	20.3339	20.0920	19.4018	18.4934	17.7323	(93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9452	0.9207	0.8841	0.8228	0.7283	0.5879	0.4423	0.4751	0.6669	0.8386	0.9217	0.9518 (94)
Useful gains	612.5653	694.4920	738.2797	736.4916	671.3852	524.8217	379.7706	392.0170	526.9937	601.7011	591.7440	582.7099 (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	1511.9322	1480.2465	1355.3464	1143.3401	892.2456	607.4858	405.9944	424.9335	652.4437	966.0195	1257.0413	1500.8446 (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	669.1290	528.0270	459.0976	292.9310	164.3201	0.0000	0.0000	0.0000	0.0000	271.0529	479.0141	683.0922 (98)
Space heating												3546.6640 (98)
Space heating per m2												32.2835 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	3546.6640 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	922.1326 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	3688.5305 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2240.4680 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	582.5217 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2330.0868 (310b)
Electricity used for heat distribution	75.2327 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)	
mechanical ventilation fans (SFP = 0.5500)	184.2902 (330a)
Total electricity for the above, kWh/year	184.2902 (331)
Electricity for lighting (calculated in Appendix L)	427.2290 (332)
Total delivered energy for all uses	8134.7907 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1583.8467	0.2160	342.1109 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	9828.2189	0.2160	2122.8953 (363)
less credit emissions for electricity	-3639.3894	0.5190	-1888.8431 (364)
Water heating from Combined Heat and Power	6208.5978	0.2160	1341.0571 (365)
less credit emissions for electricity	-2299.0438	0.5190	-1193.2037 (366)
Electrical energy for heat distribution	75.2327	0.5190	39.0458 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			763.0622 (373)
Space and water heating			763.0622 (376)
Pumps and fans	184.2902	0.5190	95.6466 (378)
Energy for lighting	427.2290	0.5190	221.7318 (379)
Total CO2, kg/year			1080.4406 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.8300 (384)

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

DER		9.8300 ZC1
Total Floor Area	TFA	109.8600
Assumed number of occupants	N	2.8140
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		14.6367 ZC2
CO2 emissions from cooking, equation (L16)		1.6979 ZC3
Total CO2 emissions		26.1647 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		26.1647 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	109.8600 (1b)	x 2.5000 (2b)	= 274.6500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.6500 (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) =	0.1456 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3956 (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) =		0.3363 (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	0.4288	0.4204	0.4120	0.3699	0.3615	0.3195	0.3195	0.3111	0.3363	0.3615	0.3783	0.3951 (22b)
Effective ac	0.5919	0.5884	0.5849	0.5684	0.5653	0.5510	0.5510	0.5484	0.5565	0.5653	0.5716	0.5781 (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 Opening Type (Uw = 1.40)			25.2000	1.3258	33.4091		(27)
External Wall 1	83.0636	25.2000	57.8636	0.1800	10.4154		(29a)
External Roof 1	103.0300		103.0300	0.1300	13.3939		(30)
Total net area of external elements Aum(A, m ²)			186.0936				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.2184		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							9.3047 (36)
Total fabric heat loss						(33) + (36) =	66.5231 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	53.6487	53.3252	53.0081	51.5186	51.2399	49.9426	49.9426
Heat transfer coeff	120.1718	119.8483	119.5312	118.0417	117.7631	116.4658	116.4658
Average = Sum(39)m / 12 =							118.0404 (39)
HLP	1.0939	1.0909	1.0880	1.0745	1.0719	1.0601	1.0601
HLP (average)							1.0745 (40)
Days in month	31	28	31	30	31	30	31
							31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8140 (42)
Average daily hot water use (litres/day)												101.0321 (43)
Daily hot water use	111.1353	107.0940	103.0527	99.0115	94.9702	90.9289	90.9289	94.9702	99.0115	103.0527	107.0940	111.1353 (44)
Energy conte	164.8104	144.1443	148.7440	129.6786	124.4297	107.3734	99.4972	114.1745	115.5381	134.6485	146.9794	159.6101 (45)
Energy content (annual)												1589.6283 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.7216	21.6216	22.3116	19.4518	18.6645	16.1060	14.9246	17.1262	17.3307	20.1973	22.0469	23.9415 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	211.4053	186.2300	195.3389	174.7704	171.0246	152.4652	146.0921	160.7694	160.6300	181.2434	192.0712	206.2050 (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	211.4053	186.2300	195.3389	174.7704	171.0246	152.4652	146.0921	160.7694	160.6300	181.2434	192.0712	206.2050 (64)
Heat gains from water heating, kWh/month	92.0754	81.5965	86.7333	79.1916	78.6488	71.7751	70.3587	75.2389	74.4899	82.0466	84.9441	90.3463 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.1915	21.4867	17.4741	13.2290	9.8889	8.3486	9.0209	11.7258	15.7383	19.9834	23.3236	24.8638	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.3547	274.1705	267.0748	251.9688	232.9001	214.9783	203.0054	200.1896	207.2853	222.3914	241.4600	259.3818	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	(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)	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	(71)
Water heating gains (Table 5)	123.7573	121.4234	116.5770	109.9883	105.7108	99.6877	94.5682	101.1276	103.4582	110.2776	117.9780	121.4332	(72)
Total internal gains	487.5132	485.2904	469.3357	443.3959	416.7095	391.2243	374.8043	381.2527	394.6916	420.8621	450.9713	473.8886	(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	
Southeast					12.0000	36.7938	0.6300	0.7000	0.7700		134.9361 (77)	
Southwest					13.2000	36.7938	0.6300	0.7000	0.7700		148.4297 (79)	
Solar gains	283.3658	482.6768	660.4194	818.2916	916.5548	909.9268	877.2665	803.9578	715.0945	533.4606	339.4069	242.5021 (83)
Total gains	770.8790	967.9671	1129.7550	1261.6875	1333.2643	1301.1510	1252.0708	1185.2105	1109.7861	954.3227	790.3781	716.3906 (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	63.4855	63.6568	63.8257	64.6311	64.7840	65.5057	65.5057	65.6411	65.2258	64.7840	64.4754	64.1558	
alpha	5.2324	5.2438	5.2550	5.3087	5.3189	5.3670	5.3670	5.3761	5.3484	5.3189	5.2984	5.2771	
util living area	0.9959	0.9864	0.9606	0.8887	0.7490	0.5602	0.4073	0.4476	0.6856	0.9262	0.9892	0.9971 (86)	
MIT	19.9297	20.1577	20.4397	20.7339	20.9163	20.9857	20.9978	20.9964	20.9599	20.7044	20.2524	19.8891 (87)	
Th 2	20.0058	20.0083	20.0106	20.0217	20.0238	20.0335	20.0335	20.0353	20.0298	20.0238	20.0196	20.0152 (88)	
util rest of house	0.9945	0.9822	0.9485	0.8577	0.6910	0.4811	0.3189	0.3556	0.6050	0.8979	0.9851	0.9962 (89)	
MIT 2	18.5881	18.9198	19.3226	19.7289	19.9489	20.0248	20.0328	20.0340	20.0016	19.7026	19.0677	18.5358 (90)	
Living area fraction	19.0534	19.3491	19.7100	20.0774	20.2844	20.3580	20.3675	20.3678	20.3339	20.0500	19.4786	19.0051 (92)	
MIT	19.0534	19.3491	19.7100	20.0774	20.2844	20.3580	20.3675	20.3678	20.3339	20.0500	19.4786	19.0051 (93)	
Temperature adjustment												0.0000	
adjusted MIT	19.0534	19.3491	19.7100	20.0774	20.2844	20.3580	20.3675	20.3678	20.3339	20.0500	19.4786	19.0051 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9927	0.9785	0.9441	0.8597	0.7073	0.5082	0.3496	0.3876	0.6314	0.8988	0.9821	0.9948 (94)
Useful gains	765.2682	947.2020	1066.6457	1084.6600	943.0344	661.2089	437.7527	459.3895	700.7284	857.7099	776.2385	712.6830 (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	1772.9397	1731.7008	1579.0072	1319.4050	1010.9228	670.6138	438.7792	461.1554	729.1542	1112.8624	1464.7187	1760.5709 (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	749.7076	527.1832	381.1970	169.0164	50.5089	0.0000	0.0000	0.0000	0.0000	189.8334	495.7058	779.6286 (98)
Space heating												3342.7809 (98)
Space heating per m2												30.4276 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3575.1668 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	749.7076	527.1832	381.1970	169.0164	50.5089	0.0000	0.0000	0.0000	0.0000	189.8334	495.7058	779.6286 (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)	801.8263	563.8323	407.6973	180.7662	54.0203	0.0000	0.0000	0.0000	0.0000	203.0304	530.1666	833.8274 (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	211.4053	186.2300	195.3389	174.7704	171.0246	152.4652	146.0921	160.7694	160.6300	181.2434	192.0712	206.2050 (64)
Efficiency of water heater (217)m	87.9073	87.4395	86.5672	84.7248	82.0107	79.8000	79.8000	79.8000	79.8000	84.9374	87.2335	79.8000 (216)
Fuel for water heating, kWh/month	240.4866	212.9816	225.6499	206.2802	208.5393	191.0592	183.0728	201.4654	201.2907	213.3847	220.1805	234.2412 (219)
Water heating fuel used												2538.6323 (219)
Annual totals kWh/year												
Space heating fuel - main system												3575.1668 (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)												427.2290 (232)
Total delivered energy for all uses												6616.0280 (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	3575.1668	0.2160	772.2360 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2538.6323	0.2160	548.3446 (264)
Space and water heating			1320.5806 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	427.2290	0.5190	221.7318 (268)
Total CO2, kg/m2/year			1581.2374 (272)
Emissions per m2 for space and water heating			12.0206 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0183 (272b)
Emissions per m2 for pumps and fans			0.3543 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.0206 * 1.00) + 2.0183 + 0.3543, rounded to 2 d.p.			14.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001274_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.12_2B			
Property						
SAP Rating	85 B	DER	8.76	TER	14.39	
Environmental	92 A	% DER<TER	39.14			
CO ₂ Emissions (t/year)	0.85	DFEE	42.09	TFEE	42.54	
General Requirements Compliance	Fail	% DFEE<TFEE	1.07			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
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

Mid-floor flat, total floor area 110 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.76 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)42.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor (no floor)			
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.44
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley): High Fail

Based on:

Overshading:	Average
Windows facing South East:	12.00 m ² , No overhang
Windows facing South West:	13.20 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	109.8600 (1b)	x 2.5000 (2b)	= 274.6500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.6500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (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) =		0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.00)			25.2000	0.9615	24.2308		(27)
External Wall 1	83.0636	25.2000	57.8636	0.1600	9.2582		(29a)
External Roof 1	103.0300		103.0300	0.1600	16.4848		(30)
Total net area of external elements Aum(A, m ²)			186.0936				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.9737		(33)
Party Floor 1			109.8600				(32d)
Party Ceilings 1			6.8400				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K												100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)												27.9140 (36)
Total fabric heat loss												(33) + (36) = 77.8878 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.9981	24.7092	24.4203	22.9758	22.6869	21.2425	21.2425	20.9536	21.8203	22.6869	23.2647	23.8425 (38)
Average = Sum(39)m / 12 =	102.8859	102.5970	102.3081	100.8636	100.5747	99.1302	99.1302	98.8413	99.7080	100.5747	101.1525	101.7303 (39)
												100.7914 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9365	0.9339	0.9313	0.9181	0.9155	0.9023	0.9023	0.8997	0.9076	0.9155	0.9207	0.9260 (40)
Days in month												0.9175 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8140 (42)
Average daily hot water use (litres/day)												101.0321 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	111.1353	107.0940	103.0527	99.0115	94.9702	90.9289	90.9289	94.9702	99.0115	103.0527	107.0940	111.1353 (44)
Energy content (annual)	164.8104	144.1443	148.7440	129.6786	124.4297	107.3734	99.4972	114.1745	115.5381	134.6485	146.9794	159.6101 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1589.6283 (45)
Water storage loss:	24.7216	21.6216	22.3116	19.4518	18.6645	16.1060	14.9246	17.1262	17.3307	20.1973	22.0469	23.9415 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													110.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)
Total storage loss													
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	(56)
If cylinder contains dedicated solar storage													
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	(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	23.2624	(59)
Total heat required for water heating calculated for each month													
220.0872	194.0717	204.0208	183.1723	179.7065	160.8671	154.7740	169.4513	169.0318	189.9253	200.4731	214.8869	214.8869	(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													
220.0872	194.0717	204.0208	183.1723	179.7065	160.8671	154.7740	169.4513	169.0318	189.9253	200.4731	214.8869	214.8869	(64)
Heat gains from water heating, kWh/month													
99.0209	87.8699	93.6788	85.9131	85.5943	78.4966	77.3043	82.1845	81.2114	88.9921	91.6656	97.2918	97.2918	(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	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
24.1915	21.4867	17.4741	13.2290	9.8889	8.3486	9.0209	11.7258	15.7383	19.9834	23.3236	24.8638	24.8638	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
271.3547	274.1705	267.0748	251.9688	232.9001	214.9783	203.0054	200.1896	207.2853	222.3914	241.4600	259.3818	259.3818	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	(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)													
-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	(71)
Water heating gains (Table 5)													
133.0926	130.7588	125.9124	119.3237	115.0461	109.0230	103.9036	110.4630	112.7936	119.6130	127.3133	130.7686	130.7686	(72)
Total internal gains													
493.8486	491.6257	475.6710	449.7313	423.0448	397.5596	381.1397	387.5881	401.0269	427.1975	457.3066	480.2240	480.2240	(73)

6. Solar gains

[Jan]		Area	Solar flux	g	Specific data	FF	Access	Gains					
		m2	Table 6a	W/m2	or Table 6b	Specific data	factor	W					
						or Table 6c	Table 6d						
Southeast		12.0000	36.7938	0.5000		0.8000	0.7700	122.3910	(77)				
Southwest		13.2000	36.7938	0.5000		0.8000	0.7700	134.6301	(79)				
Solar gains	257.0211	437.8020	599.0198	742.2146	831.3422	825.3304	795.7066	729.2134	648.6118	483.8645	307.8521	219.9565	(83)
Total gains	750.8697	929.4278	1074.6909	1191.9459	1254.3871	1222.8901	1176.8462	1116.8015	1049.6387	911.0620	765.1587	700.1805	(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	29.6607	29.7442	29.8282	30.2554	30.3423	30.7844	30.7844	30.8744	30.6060	30.3423	30.1690	29.9976
alpha	2.9774	2.9829	2.9885	3.0170	3.0228	3.0523	3.0523	3.0583	3.0404	3.0228	3.0113	2.9998
util living area												
	0.9503	0.9125	0.8547	0.7599	0.6329	0.4826	0.3591	0.3912	0.5791	0.8007	0.9201	0.9582 (86)
MIT	19.2357	19.5871	20.0059	20.4435	20.7497	20.9212	20.9760	20.9684	20.8577	20.4397	19.7599	19.1697 (87)
Th 2	20.1366	20.1388	20.1410	20.1521	20.1544	20.1655	20.1655	20.1678	20.1611	20.1544	20.1499	20.1455 (88)
util rest of house												
	0.9437	0.9017	0.8373	0.7324	0.5926	0.4284	0.2950	0.3256	0.5247	0.7711	0.9084	0.9526 (89)
MIT 2	17.7683	18.2711	18.8634	19.4736	19.8771	20.0931	20.1490	20.1450	20.0216	19.4844	18.5328	17.6791 (90)
Living area fraction												
MIT	18.2772	18.7275	19.2596	19.8099	20.1797	20.3803	20.4358	20.4306	20.3116	19.8157	18.9583	18.1960 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2772	18.7275	19.2596	19.8099	20.1797	20.3803	20.4358	20.4306	20.3116	19.8157	18.9583	18.1960 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9253	0.8801	0.8168	0.7203	0.5939	0.4427	0.3161	0.3468	0.5349	0.7578	0.8880	0.9358	(94)
Useful gains	694.8072	817.9631	877.8542	858.5578	744.9454	541.4328	371.9747	387.2615	561.4100	690.4403	679.4914	655.2269	(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													
	1438.0569	1418.6590	1305.4123	1100.4157	852.8477	573.0051	380.2434	398.3855	619.3444	926.8649	1199.5019	1423.8219	(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													
	552.9778	403.6676	318.1032	174.1377	80.2793	0.0000	0.0000	0.0000	0.0000	175.8999	374.4076	571.8347	(98)
Space heating													
Space heating per m2													
										(98) / (4) =		24.1335	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	2651.3077	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	689.3400	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	2757.3600	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2240.4680	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	582.5217	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2330.0868	(310b)
Electricity used for heat distribution	63.5931	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	184.2902	(330a)
Total electricity for the above, kWh/year	184.2902	(331)
Electricity for lighting (calculated in Appendix L)	427.2290	(332)
Total delivered energy for all uses	6970.8276	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1338.8018	0.2160	289.1812	(367)
Electrical efficiency of CHP unit			37.0300	(361)
Heat efficiency of CHP unit			37.5300	(362)
Space heating from Combined Heat and Power	7347.0825	0.2160	1586.9698	(363)
less credit emissions for electricity	-2720.6246	0.5190	-1412.0042	(364)
Water heating from Combined Heat and Power	6208.5978	0.2160	1341.0571	(365)
less credit emissions for electricity	-2299.0438	0.5190	-1193.2037	(366)
Electrical energy for heat distribution	63.5931	0.5190	33.0048	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			645.0050	(373)
Space and water heating			645.0050	(376)
Pumps and fans	184.2902	0.5190	95.6466	(378)
Energy for lighting	427.2290	0.5190	221.7318	(379)
Total CO2, kg/year			962.3834	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.7600	(384)

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

DER		8.7600	ZC1
Total Floor Area	TFA	109.8600	
Assumed number of occupants	N	2.8140	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.6367	ZC2
CO2 emissions from cooking, equation (L16)		1.6979	ZC3
Total CO2 emissions		25.0947	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		25.0947	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	109.8600 (1b)	x 2.5000 (2b)	= 274.6500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.6500 (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) =	0.1456 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3956 (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) =		0.3363 (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	0.4288	0.4204	0.4120	0.3699	0.3615	0.3195	0.3195	0.3111	0.3363	0.3615	0.3783	0.3951 (22b)
Effective ac	0.5919	0.5884	0.5849	0.5684	0.5653	0.5510	0.5510	0.5484	0.5565	0.5653	0.5716	0.5781 (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 Opening Type (Uw = 1.40)			25.2000	1.3258	33.4091		(27)					
External Wall 1	83.0636	25.2000	57.8636	0.1800	10.4154		(29a)					
External Roof 1	103.0300		103.0300	0.1300	13.3939		(30)					
Total net area of external elements Aum(A, m2)			186.0936				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		57.2184		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)							9.3047 (36)					
Total fabric heat loss						(33) + (36) =	66.5231 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 53.6487	Feb 53.3252	Mar 53.0081	Apr 51.5186	May 51.2399	Jun 49.9426	Jul 49.9426	Aug 49.7024	Sep 50.4423	Oct 51.2399	Nov 51.8037	Dec 52.3931 (38)
Heat transfer coeff	120.1718	119.8483	119.5312	118.0417	117.7631	116.4658	116.4658	116.2255	116.9655	117.7631	118.3268	118.9162 (39)
Average = Sum(39)m / 12 =												118.0404 (39)
HLP	Jan 1.0939	Feb 1.0909	Mar 1.0880	Apr 1.0745	May 1.0719	Jun 1.0601	Jul 1.0601	Aug 1.0579	Sep 1.0647	Oct 1.0719	Nov 1.0771	Dec 1.0824 (40)
HLP (average)												1.0745 (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												2.8140 (42)
Average daily hot water use (litres/day)												101.0321 (43)
Daily hot water use	111.1353	107.0940	103.0527	99.0115	94.9702	90.9289	90.9289	94.9702	99.0115	103.0527	107.0940	111.1353 (44)
Energy conte	164.8104	144.1443	148.7440	129.6786	124.4297	107.3734	99.4972	114.1745	115.5381	134.6485	146.9794	159.6101 (45)
Energy content (annual)										Total = Sum(45)m =		1589.6283 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7216	21.6216	22.3116	19.4518	18.6645	16.1060	14.9246	17.1262	17.3307	20.1973	22.0469	23.9415 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	211.4053	186.2300	195.3389	174.7704	171.0246	152.4652	146.0921	160.7694	160.6300	181.2434	192.0712	206.2050 (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	211.4053	186.2300	195.3389	174.7704	171.0246	152.4652	146.0921	160.7694	160.6300	181.2434	192.0712	206.2050 (64)
Heat gains from water heating, kWh/month	92.0754	81.5965	86.7333	79.1916	78.6488	71.7751	70.3587	75.2389	74.4899	82.0466	84.9441	90.3463 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991	140.6991 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.1915	21.4867	17.4741	13.2290	9.8889	8.3486	9.0209	11.7258	15.7383	19.9834	23.3236	24.8638 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.3547	274.1705	267.0748	251.9688	232.9001	214.9783	203.0054	200.1896	207.2853	222.3914	241.4600	259.3818 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699	37.0699 (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)	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593	-112.5593 (71)
Water heating gains (Table 5)	123.7573	121.4234	116.5770	109.9883	105.7108	99.6877	94.5682	101.1276	103.4582	110.2776	117.9780	121.4332 (72)
Total internal gains	487.5132	485.2904	469.3357	443.3959	416.7095	391.2243	374.8043	381.2527	394.6916	420.8621	450.9713	473.8886 (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	
Southeast					12.0000	36.7938	0.6300	0.7000		0.7700	134.9361 (77)	
Southwest					13.2000	36.7938	0.6300	0.7000		0.7700	148.4297 (79)	
Solar gains	283.3658	482.6768	660.4194	818.2916	916.5548	909.9268	877.2665	803.9578	715.0945	533.4606	339.4069	242.5021 (83)
Total gains	770.8790	967.9671	1129.7550	1261.6875	1333.2643	1301.1510	1252.0708	1185.2105	1109.7861	954.3227	790.3781	716.3906 (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	63.4855	63.6568	63.8257	64.6311	64.7840	65.5057	65.5057	65.6411	65.2258	64.7840	64.4754	64.1558
alpha	5.2324	5.2438	5.2550	5.3087	5.3189	5.3670	5.3670	5.3761	5.3484	5.3189	5.2984	5.2771
util living area	0.9959	0.9864	0.9606	0.8887	0.7490	0.5602	0.4073	0.4476	0.6856	0.9262	0.9892	0.9971 (86)
MIT	19.9297	20.1577	20.4397	20.7339	20.9163	20.9857	20.9978	20.9964	20.9599	20.7044	20.2524	19.8891 (87)
Th 2	20.0058	20.0083	20.0106	20.0217	20.0238	20.0335	20.0335	20.0353	20.0298	20.0238	20.0196	20.0152 (88)
util rest of house	0.9945	0.9822	0.9485	0.8577	0.6910	0.4811	0.3189	0.3556	0.6050	0.8979	0.9851	0.9962 (89)
MIT 2	18.5881	18.9198	19.3226	19.7289	19.9489	20.0248	20.0328	20.0340	20.0016	19.7026	19.0677	18.5358 (90)
Living area fraction	19.0534	19.3491	19.7100	20.0774	20.2844	20.3580	20.3675	20.3678	20.3339	20.0500	19.4786	19.0051 (92)
MIT	19.0534	19.3491	19.7100	20.0774	20.2844	20.3580	20.3675	20.3678	20.3339	20.0500	19.4786	19.0051 (93)
Temperature adjustment												0.0000
adjusted MIT	19.0534	19.3491	19.7100	20.0774	20.2844	20.3580	20.3675	20.3678	20.3339	20.0500	19.4786	19.0051 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9927	0.9785	0.9441	0.8597	0.7073	0.5082	0.3496	0.3876	0.6314	0.8988	0.9821	0.9948 (94)
Ext temp.	765.2682	947.2020	1066.6457	1084.6600	943.0344	661.2089	437.7527	459.3895	700.7284	857.7099	776.2385	712.6830 (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	1772.9397	1731.7008	1579.0072	1319.4050	1010.9228	670.6138	438.7792	461.1554	729.1542	1112.8624	1464.7187	1760.5709 (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	749.7076	527.1832	381.1970	169.0164	50.5089	0.0000	0.0000	0.0000	0.0000	189.8334	495.7058	779.6286 (98)
Space heating per m2												3342.7809 (98)
												(98) / (4) = 30.4276 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3575.1668 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	749.7076	527.1832	381.1970	169.0164	50.5089	0.0000	0.0000	0.0000	0.0000	189.8334	495.7058	779.6286 (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)	801.8263	563.8323	407.6973	180.7662	54.0203	0.0000	0.0000	0.0000	0.0000	203.0304	530.1666	833.8274 (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	211.4053	186.2300	195.3389	174.7704	171.0246	152.4652	146.0921	160.7694	160.6300	181.2434	192.0712	206.2050 (64)
Efficiency of water heater	87.9073	87.4395	86.5672	84.7248	82.0107	79.8000	79.8000	79.8000	79.8000	84.9374	87.2335	79.8000 (216)
(217)m	87.9073	87.4395	86.5672	84.7248	82.0107	79.8000	79.8000	79.8000	79.8000	84.9374	87.2335	88.0310 (217)
Fuel for water heating, kWh/month	240.4866	212.9816	225.6499	206.2802	208.5393	191.0592	183.0728	201.4654	201.2907	213.3847	220.1805	234.2412 (219)
Water heating fuel used	240.4866	212.9816	225.6499	206.2802	208.5393	191.0592	183.0728	201.4654	201.2907	213.3847	220.1805	2538.6323 (219)
Annual totals kWh/year												
Space heating fuel - main system												3575.1668 (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)												427.2290 (232)
Total delivered energy for all uses												6616.0280 (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	3575.1668	0.2160	772.2360 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2538.6323	0.2160	548.3446 (264)
Space and water heating			1320.5806 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	427.2290	0.5190	221.7318 (268)
Total CO2, kg/m2/year			1581.2374 (272)
Emissions per m2 for space and water heating			12.0206 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0183 (272b)
Emissions per m2 for pumps and fans			0.3543 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.0206 * 1.00) + 2.0183 + 0.3543, rounded to 2 d.p.			14.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001302_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.13_1B			
Property						
SAP Rating	86 B	DER	8.04	TER	13.24	
Environmental	94 A	% DER<TER	39.28			
CO ₂ Emissions (t/year)	0.50	DFEE	24.79	TFEE	20.98	
General Requirements Compliance	Fail	% DFEE<TFEE	-18.20			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
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

Mid-floor flat, total floor area 67 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.24 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.04 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)21.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)24.8 kWh/m²/yrFail
Excess energy =3.8 kWh/m²/yr (18.1%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:	None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South West:	11.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	67.4800 (1b)	x 2.5000 (2b)	= 168.7000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.40)			11.4000	1.3258	15.1136		(27)
External Wall 1	25.9363	11.4000	14.5363	0.1600	2.3258		(29a)
Total net area of external elements Aum(A, m ²)			25.9363				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.4394		(33)
Party Floor 1			67.4800				(32d)
Party Ceilings 1			67.4800				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							3.8904 (36)
Total fabric heat loss							(33) + (36) = 21.3299 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	14.5562	14.3944	14.2326	13.4237	13.2619	12.4529	12.4529	12.2911	12.7765	13.2619	13.5855	13.9091 (38)
Average = Sum(39)m / 12 =	35.8861	35.7243	35.5625	34.7536	34.5918	33.7828	33.7828	33.6210	34.1064	34.5918	34.9154	35.2389 (39)
												34.7131 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.5318	0.5294	0.5270	0.5150	0.5126	0.5006	0.5006	0.4982	0.5054	0.5126	0.5174	0.5222 (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												2.1834 (42)
Average daily hot water use (litres/day)												86.0563 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.6620	91.2197	87.7775	84.3352	80.8930	77.4507	77.4507	80.8930	84.3352	87.7775	91.2197	94.6620 (44)
Energy content (annual)	140.3810	122.7781	126.6960	110.4566	105.9858	91.4577	84.7490	97.2507	98.4122	114.6899	125.1930	135.9515 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1354.0013 (45)
Water storage loss:	21.0571	18.4167	19.0044	16.5685	15.8979	13.7186	12.7123	14.5876	14.7618	17.2035	18.7789	20.3927 (46)
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	195.6578	172.7055	181.9728	163.9503	161.2626	144.9513	140.0258	152.5275	151.9058	169.9667	178.6867	191.2283	(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	195.6578	172.7055	181.9728	163.9503	161.2626	144.9513	140.0258	152.5275	151.9058	169.9667	178.6867	191.2283	(64)
Total per year (kWh/year) = Sum(64)m =												2004.8411 (64)	
Heat gains from water heating, kWh/month													
	90.8981	80.7657	86.3479	79.5218	79.4617	73.2046	72.4005	76.5573	75.5170	82.3558	84.4216	89.4253	(65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	487.0153	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	126.6240	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	506.4959	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2004.8411	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	521.2587	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2085.0347	(310b)
Electricity used for heat distribution	32.3941	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	108.0524	(330a)
Total electricity for the above, kWh/year	108.0524	(331)
Electricity for lighting (calculated in Appendix L)	304.6159	(332)
Total delivered energy for all uses	3652.0816	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	681.9818	0.2160	147.3081 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1349.5762	0.2160	291.5084 (363)
less credit emissions for electricity	-499.7480	0.5190	-259.3692 (364)
Water heating from Combined Heat and Power	5555.6481	0.2160	1200.0200 (365)
less credit emissions for electricity	-2057.2565	0.5190	-1067.7161 (366)
Electrical energy for heat distribution	32.3941	0.5190	16.8126 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			328.5637 (373)
Space and water heating			328.5637 (376)
Pumps and fans	108.0524	0.5190	56.0792 (378)
Energy for lighting	304.6159	0.5190	158.0957 (379)
Total CO2, kg/year			542.7385 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.0400 (384)

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

DER	8.0400	ZC1
Total Floor Area	67.4800	TFA
Assumed number of occupants	2.1834	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	16.8031	ZC2
CO2 emissions from cooking, equation (L16)	2.5400	ZC3
Total CO2 emissions	27.3831	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	27.3831	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	67.4800 (1b)	x 2.5000 (2b)	= 168.7000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.1186 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3686 (18)
Number of sides sheltered					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2856 (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												
	0.3642	0.3570	0.3499	0.3142	0.3071	0.2713	0.2713	0.2642	0.2856	0.3071	0.3213	0.3356 (22b)
Effective ac	0.5663	0.5637	0.5612	0.5494	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563 (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 Opening Type (Uw = 1.40)			11.4000	1.3258	15.1136			(27)					
External Wall 1	25.9363	11.4000	14.5363	0.1800	2.6165			(29a)					
Total net area of external elements Aum(A, m2)			25.9363					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	17.7302		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								1.2968 (36)					
Total fabric heat loss						(33) + (36) =		19.0270 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.5272	31.3838	31.2433	30.5833	30.4598	29.8850	29.8850	29.7786	30.1064	30.4598	30.7096	30.9708	(38)
Heat transfer coeff	50.5542	50.4108	50.2703	49.6103	49.4868	48.9120	48.9120	48.8056	49.1334	49.4868	49.7366	49.9978	(39)
Average = Sum(39)m / 12 =												49.6097	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7492	0.7470	0.7450	0.7352	0.7334	0.7248	0.7248	0.7233	0.7281	0.7334	0.7371	0.7409	(40)
HLP (average)												0.7352	(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												2.1834 (42)
Average daily hot water use (litres/day)												86.0563 (43)
Daily hot water use	94.6620	91.2197	87.7775	84.3352	80.8930	77.4507	77.4507	80.8930	84.3352	87.7775	91.2197	94.6620 (44)
Energy conte	140.3810	122.7781	126.6960	110.4566	105.9858	91.4577	84.7490	97.2507	98.4122	114.6899	125.1930	135.9515 (45)
Energy content (annual)										Total = Sum(45)m =		1354.0013 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0571	18.4167	19.0044	16.5685	15.8979	13.7186	12.7123	14.5876	14.7618	17.2035	18.7789	20.3927 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	186.9759	164.8638	173.2909	155.5485	152.5807	136.5495	131.3439	143.8456	143.5040	161.2848	170.2848	182.5464 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	186.9759	164.8638	173.2909	155.5485	152.5807	136.5495	131.3439	143.8456	143.5040	161.2848	170.2848	182.5464 (64)
	83.9526	74.4923	79.4023	72.8003	72.5162	66.4831	65.4550	69.6118	68.7955	75.4103	77.7001	82.4798 (65)
								Total per year (kWh/year) =	Sum (64)m =			1902.6187 (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	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6137	15.6443	12.7228	9.6320	7.2000	6.0786	6.5681	8.5375	11.4590	14.5498	16.9818	18.1032	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.3456	193.3311	188.3276	177.6756	164.2293	151.5917	143.1491	141.1635	146.1671	156.8191	170.2653	182.9029	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	(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)	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	(71)
Water heating gains (Table 5)	112.8395	110.8516	106.7236	101.1115	97.4680	92.3377	87.9771	93.5642	95.5493	101.3579	107.9169	110.8599	(72)
Total internal gains	380.5501	378.5784	366.5253	347.1704	327.6487	308.7594	296.4456	302.0166	311.9267	331.4782	353.9153	370.6174	(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		
-----				Southwest	11.4000	36.7938	0.6300	0.7000	0.7700		128.1893 (79)		

Solar gains	128.1893	218.3538	298.7611	370.1795	414.6319	411.6335	396.8587	363.6952	323.4951	241.3274	153.5412	109.7033	(83)
Total gains	508.7394	596.9322	665.2865	717.3500	742.2806	720.3929	693.3043	665.7117	635.4219	572.8056	507.4565	480.3207	(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	92.6949	92.9584	93.2183	94.4584	94.6941	95.8070	95.8070	96.0159	95.3752	94.6941	94.2185	93.7264	
alpha	7.1797	7.1972	7.2146	7.2972	7.3129	7.3871	7.3871	7.4011	7.3583	7.3129	7.2812	7.2484	
util living area	0.9894	0.9685	0.9144	0.7886	0.6127	0.4340	0.3104	0.3372	0.5311	0.8277	0.9697	0.9925	(86)
MIT	20.4881	20.6493	20.8188	20.9479	20.9919	20.9994	21.0000	20.9999	20.9976	20.9390	20.7001	20.4537	(87)
Th 2	20.2976	20.2995	20.3013	20.3099	20.3115	20.3189	20.3189	20.3203	20.3161	20.3115	20.3082	20.3048	(88)
util rest of house	0.9864	0.9605	0.8959	0.7547	0.5698	0.3881	0.2624	0.2874	0.4795	0.7903	0.9606	0.9903	(89)
MIT 2	19.6227	19.8531	20.0861	20.2555	20.3045	20.3186	20.3189	20.3203	20.3145	20.2499	19.9347	19.5790	(90)
Living area fraction									fLA = Living area / (4) =			0.4748	(91)
MIT	20.0336	20.2311	20.4340	20.5843	20.6308	20.6419	20.6423	20.6430	20.6388	20.5771	20.2981	19.9943	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0336	20.2311	20.4340	20.5843	20.6308	20.6419	20.6423	20.6430	20.6388	20.5771	20.2981	19.9943	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9850	0.9597	0.8997	0.7686	0.5899	0.4099	0.2852	0.3110	0.5040	0.8053	0.9605	0.9892	(94)
Useful gains	501.1335	572.8601	598.5275	551.3351	437.8715	295.2782	197.7031	207.0565	320.2213	461.2999	487.4025	475.1122	(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	795.3991	772.8540	700.4665	579.6606	441.9594	295.5196	197.7164	207.0817	321.2756	493.7328	656.4299	789.6818	(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	218.9336	134.3959	75.8426	20.3944	3.0414	0.0000	0.0000	0.0000	0.0000	24.1300	121.6997	234.0398	(98)
Space heating												832.4774	(98)
Space heating per m2												12.3367	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												890.3502	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	218.9336	134.3959	75.8426	20.3944	3.0414	0.0000	0.0000	0.0000	0.0000	24.1300	121.6997	234.0398	(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)	234.1536	143.7389	81.1150	21.8122	3.2528	0.0000	0.0000	0.0000	0.0000	25.8075	130.1602	250.3099	(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	186.9759	164.8638	173.2909	155.5485	152.5807	136.5495	131.3439	143.8456	143.5040	161.2848	170.2848	182.5464	(64)
Efficiency of water heater	85.2355	84.2748	82.7795	80.9088	79.9848	79.8000	79.8000	79.8000	79.8000	81.0471	83.9363	85.4777	(216)
(217)m	85.2355	84.2748	82.7795	80.9088	79.9848	79.8000	79.8000	79.8000	79.8000	81.0471	83.9363	85.4777	(217)
Fuel for water heating, kWh/month	219.3639	195.6265	209.3404	192.2515	190.7620	171.1147	164.5913	180.2576	179.8296	199.0014	202.8738	213.5602	(219)
Water heating fuel used												2318.5731	(219)
Annual totals kWh/year													
Space heating fuel - main system												890.3502	(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)												311.0632	(232)
Total delivered energy for all uses												3594.9865	(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	890.3502	0.2160	192.3156 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2318.5731	0.2160	500.8118 (264)
Space and water heating			693.1274 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	311.0632	0.5190	161.4418 (268)
Total CO2, kg/m2/year			893.4942 (272)
Emissions per m2 for space and water heating			10.2716 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3924 (272b)
Emissions per m2 for pumps and fans			0.5768 (272c)
Target Carbon Dioxide Emission Rate (TER) = (10.2716 * 1.00) + 2.3924 + 0.5768, rounded to 2 d.p.			13.2400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001346_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.13_1B			
Property						
SAP Rating	86 B	DER	7.54	TER	13.24	
Environmental	94 A	% DER<TER	43.06			
CO ₂ Emissions (t/year)	0.49	DFEE	19.50	TFEE	20.98	
General Requirements Compliance	Fail	% DFEE<TFEE	7.03			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
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

Mid-floor flat, total floor area 67 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.24 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.54 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)21.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)19.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South West:	11.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	67.4800 (1b)	x 2.5000 (2b)	= 168.7000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.00)			11.4000	0.9615	10.9615		(27)
External Wall 1	25.9363	11.4000	14.5363	0.1600	2.3258		(29a)
Total net area of external elements Aum(A, m ²)			25.9363				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.2873		(33)
Party Floor 1			67.4800				(32d)
Party Ceilings 1			67.4800				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							3.8904 (36)
Total fabric heat loss							(33) + (36) = 17.1778 (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	14.5562	14.3944	14.2326	13.4237	13.2619	12.4529	12.4529	12.2911	12.7765	13.2619	13.5855	13.9091 (38)
Heat transfer coeff	31.7340	31.5722	31.4104	30.6015	30.4397	29.6307	29.6307	29.4689	29.9543	30.4397	30.7633	31.0868 (39)
Average = Sum(39)m / 12 =												30.5610 (39)
HLP	0.4703	0.4679	0.4655	0.4535	0.4511	0.4391	0.4391	0.4367	0.4439	0.4511	0.4559	0.4607 (40)
HLP (average)												0.4529 (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												2.1834 (42)
Average daily hot water use (litres/day)												86.0563 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.6620	91.2197	87.7775	84.3352	80.8930	77.4507	77.4507	80.8930	84.3352	87.7775	91.2197	94.6620 (44)
Energy conte	140.3810	122.7781	126.6960	110.4566	105.9858	91.4577	84.7490	97.2507	98.4122	114.6899	125.1930	135.9515 (45)
Energy content (annual)												Total = Sum(45)m = 1354.0013 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.0571	18.4167	19.0044	16.5685	15.8979	13.7186	12.7123	14.5876	14.7618	17.2035	18.7789	20.3927 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	195.6578	172.7055	181.9728	163.9503	161.2626	144.9513	140.0258	152.5275	151.9058	169.9667	178.6867	191.2283	(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	195.6578	172.7055	181.9728	163.9503	161.2626	144.9513	140.0258	152.5275	151.9058	169.9667	178.6867	191.2283	(64)
Total per year (kWh/year) = Sum(64)m =												2004.8411 (64)	
Heat gains from water heating, kWh/month													
	90.8981	80.7657	86.3479	79.5218	79.4617	73.2046	72.4005	76.5573	75.5170	82.3558	84.4216	89.4253	(65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	230.0803	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	59.8209	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	239.2835	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2004.8411	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	521.2587	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2085.0347	(310b)
Electricity used for heat distribution	29.0540	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	108.0524	(330a)
Total electricity for the above, kWh/year	108.0524	(331)
Electricity for lighting (calculated in Appendix L)	304.6159	(332)
Total delivered energy for all uses	3318.0662	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	611.6627	0.2160	132.1191 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	637.5794	0.2160	137.7171 (363)
less credit emissions for electricity	-236.0956	0.5190	-122.5336 (364)
Water heating from Combined Heat and Power	5555.6481	0.2160	1200.0200 (365)
less credit emissions for electricity	-2057.2565	0.5190	-1067.7161 (366)
Electrical energy for heat distribution	29.0540	0.5190	15.0790 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			294.6855 (373)
Space and water heating			294.6855 (376)
Pumps and fans	108.0524	0.5190	56.0792 (378)
Energy for lighting	304.6159	0.5190	158.0957 (379)
Total CO2, kg/year			508.8604 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.5400 (384)

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

DER		7.5400	ZC1
Total Floor Area	TFA	67.4800	
Assumed number of occupants	N	2.1834	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.8031	ZC2
CO2 emissions from cooking, equation (L16)		2.5400	ZC3
Total CO2 emissions		26.8831	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		26.8831	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	67.4800 (1b)	x 2.5000 (2b)	= 168.7000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1186 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3686 (18)
					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2856 (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	0.3642	0.3570	0.3499	0.3142	0.3071	0.2713	0.2713	0.2642	0.2856	0.3071	0.3213	0.3356 (22b)
Effective ac	0.5663	0.5637	0.5612	0.5494	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563 (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 Opening Type (Uw = 1.40)			11.4000	1.3258	15.1136			(27)				
External Wall 1	25.9363	11.4000	14.5363	0.1800	2.6165			(29a)				
Total net area of external elements Aum(A, m2)			25.9363					(31)				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 17.7302			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (User defined value 0.050 * total exposed area)								1.2968 (36)				
Total fabric heat loss								(33) + (36) = 19.0270 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.5272	31.3838	31.2433	30.5833	30.4598	29.8850	29.8850	29.7786	30.1064	30.4598	30.7096	30.9708 (38)
Heat transfer coeff	50.5542	50.4108	50.2703	49.6103	49.4868	48.9120	48.9120	48.8056	49.1334	49.4868	49.7366	49.9978 (39)
Average = Sum(39)m / 12 =												49.6097 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7492	0.7470	0.7450	0.7352	0.7334	0.7248	0.7248	0.7233	0.7281	0.7334	0.7371	0.7409 (40)
HLP (average)												0.7352 (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												2.1834 (42)
Average daily hot water use (litres/day)												86.0563 (43)
Daily hot water use	94.6620	91.2197	87.7775	84.3352	80.8930	77.4507	77.4507	80.8930	84.3352	87.7775	91.2197	94.6620 (44)
Energy conte	140.3810	122.7781	126.6960	110.4566	105.9858	91.4577	84.7490	97.2507	98.4122	114.6899	125.1930	135.9515 (45)
Energy content (annual)										Total = Sum(45)m =		1354.0013 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0571	18.4167	19.0044	16.5685	15.8979	13.7186	12.7123	14.5876	14.7618	17.2035	18.7789	20.3927 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	186.9759	164.8638	173.2909	155.5485	152.5807	136.5495	131.3439	143.8456	143.5040	161.2848	170.2848	182.5464 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	186.9759	164.8638	173.2909	155.5485	152.5807	136.5495	131.3439	143.8456	143.5040	161.2848	170.2848	182.5464 (64)
	83.9526	74.4923	79.4023	72.8003	72.5162	66.4831	65.4550	69.6118	68.7955	75.4103	77.7001	82.4798 (65)
								Total per year (kWh/year) =	Sum (64)m =			1902.6187 (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	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	109.1712	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6137	15.6443	12.7228	9.6320	7.2000	6.0786	6.5681	8.5375	11.4590	14.5498	16.9818	18.1032	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.3456	193.3311	188.3276	177.6756	164.2293	151.5917	143.1491	141.1635	146.1671	156.8191	170.2653	182.9029	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	33.9171	(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)	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	-87.3370	(71)
Water heating gains (Table 5)	112.8395	110.8516	106.7236	101.1115	97.4680	92.3377	87.9771	93.5642	95.5493	101.3579	107.9169	110.8599	(72)
Total internal gains	380.5501	378.5784	366.5253	347.1704	327.6487	308.7594	296.4456	302.0166	311.9267	331.4782	353.9153	370.6174	(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		
-----				Southwest	11.4000	36.7938	0.6300	0.7000	0.7700		128.1893 (79)		

Solar gains	128.1893	218.3538	298.7611	370.1795	414.6319	411.6335	396.8587	363.6952	323.4951	241.3274	153.5412	109.7033	(83)
Total gains	508.7394	596.9322	665.2865	717.3500	742.2806	720.3929	693.3043	665.7117	635.4219	572.8056	507.4565	480.3207	(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	92.6949	92.9584	93.2183	94.4584	94.6941	95.8070	95.8070	96.0159	95.3752	94.6941	94.2185	93.7264	
alpha	7.1797	7.1972	7.2146	7.2972	7.3129	7.3871	7.3871	7.4011	7.3583	7.3129	7.2812	7.2484	
util living area	0.9894	0.9685	0.9144	0.7886	0.6127	0.4340	0.3104	0.3372	0.5311	0.8277	0.9697	0.9925	(86)
MIT	20.4881	20.6493	20.8188	20.9479	20.9919	20.9994	21.0000	20.9999	20.9976	20.9390	20.7001	20.4537	(87)
Th 2	20.2976	20.2995	20.3013	20.3099	20.3115	20.3189	20.3189	20.3203	20.3161	20.3115	20.3082	20.3048	(88)
util rest of house	0.9864	0.9605	0.8959	0.7547	0.5698	0.3881	0.2624	0.2874	0.4795	0.7903	0.9606	0.9903	(89)
MIT 2	19.6227	19.8531	20.0861	20.2555	20.3045	20.3186	20.3189	20.3203	20.3145	20.2499	19.9347	19.5790	(90)
Living area fraction									fLA = Living area / (4) =			0.4748	(91)
MIT	20.0336	20.2311	20.4340	20.5843	20.6308	20.6419	20.6423	20.6430	20.6388	20.5771	20.2981	19.9943	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0336	20.2311	20.4340	20.5843	20.6308	20.6419	20.6423	20.6430	20.6388	20.5771	20.2981	19.9943	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9850	0.9597	0.8997	0.7686	0.5899	0.4099	0.2852	0.3110	0.5040	0.8053	0.9605	0.9892	(94)
Useful gains	501.1335	572.8601	598.5275	551.3351	437.8715	295.2782	197.7031	207.0565	320.2213	461.2999	487.4025	475.1122	(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	795.3991	772.8540	700.4665	579.6606	441.9594	295.5196	197.7164	207.0817	321.2756	493.7328	656.4299	789.6818	(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	218.9336	134.3959	75.8426	20.3944	3.0414	0.0000	0.0000	0.0000	0.0000	24.1300	121.6997	234.0398	(98)
Space heating												832.4774	(98)
Space heating per m2												12.3367	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												890.3502	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	218.9336	134.3959	75.8426	20.3944	3.0414	0.0000	0.0000	0.0000	0.0000	24.1300	121.6997	234.0398	(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)	234.1536	143.7389	81.1150	21.8122	3.2528	0.0000	0.0000	0.0000	0.0000	25.8075	130.1602	250.3099	(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	186.9759	164.8638	173.2909	155.5485	152.5807	136.5495	131.3439	143.8456	143.5040	161.2848	170.2848	182.5464	(64)
Efficiency of water heater	85.2355	84.2748	82.7795	80.9088	79.9848	79.8000	79.8000	79.8000	79.8000	81.0471	83.9363	85.4777	(216)
(217)m	85.2355	84.2748	82.7795	80.9088	79.9848	79.8000	79.8000	79.8000	79.8000	81.0471	83.9363	85.4777	(217)
Fuel for water heating, kWh/month	219.3639	195.6265	209.3404	192.2515	190.7620	171.1147	164.5913	180.2576	179.8296	199.0014	202.8738	213.5602	(219)
Water heating fuel used												2318.5731	(219)
Annual totals kWh/year													
Space heating fuel - main system												890.3502	(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)												311.0632	(232)
Total delivered energy for all uses												3594.9865	(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	890.3502	0.2160	192.3156 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2318.5731	0.2160	500.8118 (264)
Space and water heating			693.1274 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	311.0632	0.5190	161.4418 (268)
Total CO2, kg/m2/year			893.4942 (272)
Emissions per m2 for space and water heating			10.2716 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3924 (272b)
Emissions per m2 for pumps and fans			0.5768 (272c)
Target Carbon Dioxide Emission Rate (TER) = (10.2716 * 1.00) + 2.3924 + 0.5768, rounded to 2 d.p.			13.2400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001374_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.14_1B			
Property						
SAP Rating	85 B	DER	9.12	TER	14.70	
Environmental	94 A	% DER<TER	37.94			
CO ₂ Emissions (t/year)	0.47	DFEE	30.14	TFEE	26.29	
General Requirements Compliance	Fail	% DFEE<TFEE	-14.66			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
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

Mid-floor flat, total floor area 56 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.70 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.12 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)26.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.1 kWh/m²/yrFail
Excess energy =3.8 kWh/m²/yr (14.4%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South West:	14.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	56.2400 (1b)	x 2.5000 (2b)	= 140.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.40)			14.4000	1.3258	19.0909		(27)
External Wall 1	28.0438	14.4000	13.6438	0.1600	2.1830		(29a)
Total net area of external elements Aum(A, m ²)			28.0438				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.2739		(33)
Party Floor 1			56.2400				(32d)
Party Ceilings 1			56.2400				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							4.2066 (36)
Total fabric heat loss							(33) + (36) = 25.4805 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	12.1316	11.9968	11.8619	11.1877	11.0529	10.3787	10.3787	10.2438	10.6483	11.0529	11.3226	11.5923 (38)
Average = Sum(39)m / 12 =	37.6121	37.4773	37.3424	36.6682	36.5334	35.8591	35.8591	35.7243	36.1288	36.5334	36.8030	37.0727 (39)
												36.6345 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6688	0.6664	0.6640	0.6520	0.6496	0.6376	0.6376	0.6352	0.6424	0.6496	0.6544	0.6592 (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												1.8736 (42)
Average daily hot water use (litres/day)												78.6977 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	86.5675	83.4196	80.2717	77.1238	73.9759	70.8279	70.8279	73.9759	77.1238	80.2717	83.4196	86.5675 (44)
Energy content (annual)	128.3771	112.2794	115.8623	101.0116	96.9230	83.6372	77.5021	88.9348	89.9970	104.8828	114.4878	124.3264 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1238.2216 (45)
Water storage loss:	19.2566	16.8419	17.3793	15.1517	14.5385	12.5456	11.6253	13.3402	13.4996	15.7324	17.1732	18.6490 (46)
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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												
	183.6539	162.2069	171.1391	154.5052	152.1998	137.1309	132.7789	144.2116	143.4907	160.1596	167.9815	179.6032 (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												
	183.6539	162.2069	171.1391	154.5052	152.1998	137.1309	132.7789	144.2116	143.4907	160.1596	167.9815	179.6032 (64)
Total per year (kWh/year) = Sum(64)m = 1889.0613 (64)												
Heat gains from water heating, kWh/month												
	86.9068	77.2749	82.7457	76.3813	76.4483	70.6043	69.9909	73.7923	72.7189	79.0950	80.8621	85.5600 (65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	634.9962	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	165.0990	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	660.3960	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1889.0613	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	491.1559	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1964.6238	(310b)
Electricity used for heat distribution	32.8127	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	90.0543	(330a)
Total electricity for the above, kWh/year	90.0543	(331)
Electricity for lighting (calculated in Appendix L)	257.2223	(332)
Total delivered energy for all uses	3628.5514	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	690.7947	0.2160	149.2117 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1759.6484	0.2160	380.0841 (363)
less credit emissions for electricity	-651.5978	0.5190	-338.1793 (364)
Water heating from Combined Heat and Power	5234.8089	0.2160	1130.7187 (365)
less credit emissions for electricity	-1938.4497	0.5190	-1006.0554 (366)
Electrical energy for heat distribution	32.8127	0.5190	17.0298 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			332.8096 (373)
Space and water heating			332.8096 (376)
Pumps and fans	90.0543	0.5190	46.7382 (378)
Energy for lighting	257.2223	0.5190	133.4984 (379)
Total CO2, kg/year			513.0462 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			9.1200 (384)

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

DER		9.1200	ZC1
Total Floor Area	TFA	56.2400	
Assumed number of occupants	N	1.8736	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.2142	ZC2
CO2 emissions from cooking, equation (L16)		2.9155	ZC3
Total CO2 emissions		29.2497	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		29.2497	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	56.2400 (1b)	x 2.5000 (2b)	= 140.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.1422 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3922 (18)	
Number of sides sheltered				3 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3040 (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	0.3876	0.3800	0.3724	0.3344	0.3268	0.2888	0.2888	0.2812	0.3040	0.3268	0.3420	0.3572 (22b)
Effective ac	0.5751	0.5722	0.5693	0.5559	0.5534	0.5417	0.5417	0.5395	0.5462	0.5534	0.5585	0.5638 (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 Opening Type (Uw = 1.40)			14.0600	1.3258	18.6402		(27)
External Wall 1	28.0438	14.0600	13.9838	0.1800	2.5171		(29a)
Total net area of external elements Aum(A, m ²)			28.0438				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.1572		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							1.4022 (36)
Total fabric heat loss						(33) + (36) =	22.5594 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	26.6841	26.5488	26.4161	25.7931	25.6765	25.1338	25.1338
Heat transfer coeff	49.2435	49.1082	48.9755	48.3525	48.2359	47.6932	47.6932
Average = Sum(39)m / 12 =						47.5928	47.9023
	48.2359	48.4717	48.7183	48.3519	48.3519	48.3519	48.3519
HLP	0.8756	0.8732	0.8708	0.8598	0.8577	0.8480	0.8480
HLP (average)						0.8462	0.8517
Days in month	31	28	31	30	31	30	31
						30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.8736 (42)
Average daily hot water use (litres/day)												78.6977 (43)
Daily hot water use	86.5675	83.4196	80.2717	77.1238	73.9759	70.8279	70.8279	73.9759	77.1238	80.2717	83.4196	86.5675 (44)
Energy conte	128.3771	112.2794	115.8623	101.0116	96.9230	83.6372	77.5021	88.9348	89.9970	104.8828	114.4878	124.3264 (45)
Energy content (annual)										Total = Sum(45)m =		1238.2216 (45)
Distribution loss (46)m = 0.15 x (45)m	19.2566	16.8419	17.3793	15.1517	14.5385	12.5456	11.6253	13.3402	13.4996	15.7324	17.1732	18.6490 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	174.9720	154.3651	162.4572	146.1034	143.5179	128.7290	124.0970	135.5297	135.0888	151.4777	159.5797	170.9213 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	174.9720	154.3651	162.4572	146.1034	143.5179	128.7290	124.0970	135.5297	135.0888	151.4777	159.5797	170.9213 (64)
	79.9613	71.0015	75.8001	69.6598	69.5028	63.8828	63.0454	66.8468	65.9975	72.1495	74.1407	78.6144 (65)
								Total per year (kWh/year) =	Sum (64)m =			1786.8390 (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	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.5650	12.9365	10.5207	7.9648	5.9538	5.0264	5.4313	7.0597	9.4756	12.0314	14.0424	14.9698	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.3749	165.0703	160.7981	151.7032	140.2225	129.4323	122.2237	120.5284	124.8006	133.8955	145.3762	156.1664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	(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)	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	(71)
Water heating gains (Table 5)	107.4749	105.6570	101.8819	96.7497	93.4178	88.7262	84.7384	89.8478	91.6632	96.9751	102.9732	105.6646	(72)
Total internal gains	339.5186	337.7675	327.3045	310.5216	293.6979	277.2887	266.4972	271.5398	280.0431	297.0058	316.4956	330.9046	(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	
Southwest					14.0600	36.7938	0.6300	0.7000			0.7700	158.1001 (79)	
Solar gains	158.1001	269.3030	368.4721	456.5548	511.3794	507.6814	489.4590	448.5574	398.9773	297.6372	189.3675	135.3007	(83)
Total gains	497.6187	607.0705	695.7766	767.0764	805.0773	784.9701	755.9562	720.0972	679.0205	594.6430	505.8631	466.2053	(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	79.3111	79.5296	79.7450	80.7726	80.9678	81.8891	81.8891	82.0620	81.5317	80.9678	80.5739	80.1661	
alpha	6.2874	6.3020	6.3163	6.3848	6.3979	6.4593	6.4593	6.4708	6.4354	6.3979	6.3716	6.3444	
util living area	0.9828	0.9486	0.8720	0.7256	0.5513	0.3883	0.2775	0.3039	0.4843	0.7815	0.9544	0.9877	(86)
MIT	20.4141	20.6223	20.8180	20.9498	20.9916	20.9993	20.9999	20.9999	20.9971	20.9349	20.6634	20.3696	(87)
Th 2	20.1883	20.1903	20.1924	20.2018	20.2036	20.2119	20.2119	20.2134	20.2087	20.2036	20.2000	20.1963	(88)
util rest of house	0.9780	0.9364	0.8469	0.6868	0.5061	0.3408	0.2279	0.2520	0.4299	0.7377	0.9412	0.9842	(89)
MIT 2	19.4270	19.7204	19.9828	20.1511	20.1966	20.2115	20.2119	20.2134	20.2068	20.1401	19.7900	19.3698	(90)
Living area fraction									fLA = Living area / (4) =			0.5958	(91)
MIT	20.0152	20.2578	20.4804	20.6270	20.6703	20.6809	20.6814	20.6820	20.6777	20.6137	20.3104	19.9655	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0152	20.2578	20.4804	20.6270	20.6703	20.6809	20.6814	20.6820	20.6777	20.6137	20.3104	19.9655	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9768	0.9375	0.8563	0.7078	0.5327	0.3691	0.2575	0.2829	0.4622	0.7609	0.9432	0.9830	(94)
Useful gains	486.0965	569.1243	595.7895	542.9681	428.8837	289.7215	194.6340	203.7512	313.8747	452.4823	477.1542	458.2872	(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	773.8693	754.1941	684.6992	567.0297	432.6900	290.0161	194.6566	203.7926	315.0855	483.0176	640.3312	768.0676	(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	214.1030	124.3669	66.1488	17.3244	2.8319	0.0000	0.0000	0.0000	0.0000	22.7183	117.4875	230.4766	(98)
Space heating												795.4573	(98)
Space heating per m2										(98) / (4) =		14.1440	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													850.7564 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	214.1030	124.3669	66.1488	17.3244	2.8319	0.0000	0.0000	0.0000	0.0000	22.7183	117.4875	230.4766	(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)	228.9871	133.0127	70.7474	18.5287	3.0287	0.0000	0.0000	0.0000	0.0000	24.2976	125.6551	246.4991	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	174.9720	154.3651	162.4572	146.1034	143.5179	128.7290	124.0970	135.5297	135.0888	151.4777	159.5797	170.9213	(64)
Efficiency of water heater	85.3532	84.2442	82.6268	80.8129	79.9830	79.8000	79.8000	79.8000	79.8000	81.0498	84.0119	85.6119	(216)
(217)m	85.3532	84.2442	82.6268	80.8129	79.9830	79.8000	79.8000	79.8000	79.8000	81.0498	84.0119	85.6119	(217)
Fuel for water heating, kWh/month	204.9975	183.2353	196.6157	180.7923	179.4355	161.3146	155.5101	169.8368	169.2843	186.8948	189.9488	199.6465	(219)
Water heating fuel used												2177.5121	(219)
Annual totals kWh/year													
Space heating fuel - main system												850.7564	(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)												257.2223	(232)
Total delivered energy for all uses												3360.4909	(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	850.7564	0.2160	183.7634 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2177.5121	0.2160	470.3426 (264)
Space and water heating			654.1060 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	257.2223	0.5190	133.4984 (268)
Total CO2, kg/m2/year			826.5294 (272)
Emissions per m2 for space and water heating			11.6306 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3737 (272b)
Emissions per m2 for pumps and fans			0.6921 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.6306 * 1.00) + 2.3737 + 0.6921, rounded to 2 d.p.			14.7000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001418_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.14_1B		
Property					
SAP Rating	85 B	DER	8.31	TER	14.70
Environmental	94 A	% DER<TER	43.46		
CO ₂ Emissions (t/year)	0.44	DFEE	22.89	TFEE	26.29
General Requirements Compliance	Fail	% DFEE<TFEE	12.91		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 56 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.70 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.31 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)26.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)22.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor (no floor)			
Roof (no roof)			
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:

No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South West:	14.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	56.2400 (1b)	x 2.5000 (2b)	= 140.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			14.4000	0.9615	13.8462			(27)				
External Wall 1	28.0438	14.4000	13.6438	0.1600	2.1830			(29a)				
Total net area of external elements Aum(A, m2)			28.0438					(31)				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 16.0292			(33)				
Party Floor 1			56.2400					(32d)				
Party Ceilings 1			56.2400					(32b)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)				
Thermal bridges (Default value 0.150 * total exposed area)								4.2066 (36)				
Total fabric heat loss	(33) + (36) =							20.2357 (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	12.1316	11.9968	11.8619	11.1877	11.0529	10.3787	10.3787	10.2438	10.6483	11.0529	11.3226	11.5923 (38)
Heat transfer coeff	32.3674	32.2325	32.0977	31.4234	31.2886	30.6144	30.6144	30.4795	30.8841	31.2886	31.5583	31.8280 (39)
Average = Sum(39)m / 12 =												31.3897 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.5755	0.5731	0.5707	0.5587	0.5563	0.5444	0.5444	0.5420	0.5491	0.5563	0.5611	0.5659 (40)
HLP (average)												0.5581 (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												1.8736 (42)
Average daily hot water use (litres/day)												78.6977 (43)
Daily hot water use	86.5675	83.4196	80.2717	77.1238	73.9759	70.8279	70.8279	73.9759	77.1238	80.2717	83.4196	86.5675 (44)
Energy conte	128.3771	112.2794	115.8623	101.0116	96.9230	83.6372	77.5021	88.9348	89.9970	104.8828	114.4878	124.3264 (45)
Energy content (annual)												Total = Sum(45)m = 1238.2216 (45)
Distribution loss (46)m = 0.15 x (45)m	19.2566	16.8419	17.3793	15.1517	14.5385	12.5456	11.6253	13.3402	13.4996	15.7324	17.1732	18.6490 (46)
Water storage loss:												110.0000 (47)
Store volume												

Design SAP
elmhurst energy

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	183.6539	162.2069	171.1391	154.5052	152.1998	137.1309	132.7789	144.2116	143.4907	160.1596	167.9815	179.6032 (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													
	183.6539	162.2069	171.1391	154.5052	152.1998	137.1309	132.7789	144.2116	143.4907	160.1596	167.9815	179.6032 (64)	
								Total per year (kWh/year) = Sum(64)m =					1889.0613 (64)
Heat gains from water heating, kWh/month													
	86.9068	77.2749	82.7457	76.3813	76.4483	70.6043	69.9909	73.7923	72.7189	79.0950	80.8621	85.5600 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.5650	12.9365	10.5207	7.9648	5.9538	5.0264	5.4313	7.0597	9.4756	12.0314	14.0424	14.9698 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.3749	165.0703	160.7981	151.7032	140.2225	129.4323	122.2237	120.5284	124.8006	133.8955	145.3762	156.1664 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679 (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)	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435 (71)
Water heating gains (Table 5)	116.8102	114.9923	111.2173	106.0851	102.7531	98.0615	94.0738	99.1832	100.9985	106.3105	112.3085	114.9999 (72)
Total internal gains	345.8540	344.1029	333.6399	316.8570	300.0333	283.6241	272.8326	277.8752	286.3785	303.3412	322.8310	337.2400 (73)

[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
Southwest				14.4000	36.7938		0.5000		0.8000		0.7700		146.8692 (79)
Solar gains	146.8692	250.1726	342.2970	424.1226	475.0527	471.6174	454.6895	416.6934	370.6353	276.4940	175.9155	125.6894	(83)
Total gains	492.7232	594.2755	675.9369	740.9796	775.0860	755.2415	727.5221	694.5685	657.0138	579.8352	498.7464	462.9294	(84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nll,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.2654	48.4673	48.6709	49.7152	49.9294	51.0290	51.0290	51.2548	50.5834	49.9294	49.5027	49.0833
alpha	4.2177	4.2312	4.2447	4.3143	4.3286	4.4019	4.4019	4.4170	4.3722	4.3286	4.3002	4.2722
util living area	0.8438	0.7504	0.6373	0.4987	0.3720	0.2589	0.1851	0.2017	0.3227	0.5400	0.7559	0.8638 (86)
MIT	20.5052	20.7102	20.8624	20.9572	20.9895	20.9985	20.9997	20.9996	20.9958	20.9509	20.7540	20.4630 (87)
Th 2	20.4521	20.4542	20.4564	20.4673	20.4695	20.4803	20.4803	20.4825	20.4760	20.4695	20.4651	20.4608 (88)
util rest of house	0.8315	0.7346	0.6187	0.4787	0.3514	0.2380	0.1632	0.1791	0.2986	0.5157	0.7379	0.8526 (89)
MIT 2	19.7951	20.0774	20.2829	20.4160	20.4578	20.4789	20.4801	20.4822	20.4718	20.4122	20.1508	19.7441 (90)
Living area fraction										fLA = Living area / (4) =		0.5958 (91)
MIT	20.2182	20.4545	20.6282	20.7384	20.7746	20.7885	20.7897	20.7905	20.7840	20.7332	20.5102	20.1724 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2182	20.4545	20.6282	20.7384	20.7746	20.7885	20.7897	20.7905	20.7840	20.7332	20.5102	20.1724 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8260	0.7346	0.6246	0.4889	0.3633	0.2504	0.1762	0.1926	0.3128	0.5279	0.7394	0.8462 (94)
Useful gains	406.9657	436.5492	422.2052	362.2787	281.5913	189.1335	128.2154	133.7456	205.5311	306.0790	368.7836	391.7403 (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	515.2291	501.3591	453.4820	372.0048	283.9316	189.4561	128.2662	133.8206	206.4295	317.0524	423.2021	508.3701 (97a)
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	80.5480	43.5523	23.2699	7.0028	1.7412	0.0000	0.0000	0.0000	0.0000	8.1642	39.1813	86.7726 (98)
Space heating												290.2322 (98)
Space heating per m2												5.1606 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.09r14

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.2000	(303a)
Fraction of heat from community Combined Heat and Power	0.8000	(303b)
Fraction of total space heat from community Boilers	0.2000	(304a)
Fraction of total space heat from community Combined Heat and Power	0.8000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	290.2322	(98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	75.4604	(307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	301.8415	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1889.0613	(64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	491.1559	(310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	1964.6238	(310b)
Electricity used for heat distribution	28.3308	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	90.0543	(330a)
Total electricity for the above, kWh/year	90.0543	(331)
Electricity for lighting (calculated in Appendix L)	257.2223	(332)
Total delivered energy for all uses	3180.3583	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	596.4382	0.2160	128.8307 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	804.2673	0.2160	173.7217 (363)
less credit emissions for electricity	-297.8202	0.5190	-154.5687 (364)
Water heating from Combined Heat and Power	5234.8089	0.2160	1130.7187 (365)
less credit emissions for electricity	-1938.4497	0.5190	-1006.0554 (366)
Electrical energy for heat distribution	28.3308	0.5190	14.7037 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			287.3507 (373)
Space and water heating			287.3507 (376)
Pumps and fans	90.0543	0.5190	46.7382 (378)
Energy for lighting	257.2223	0.5190	133.4984 (379)
Total CO2, kg/year			467.5873 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3100 (384)

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

DER		8.3100	ZC1
Total Floor Area	TFA	56.2400	
Assumed number of occupants	N	1.8736	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.2142	ZC2
CO2 emissions from cooking, equation (L16)		2.9155	ZC3
Total CO2 emissions		28.4397	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		28.4397	ZC8

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

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.2400 (1b)	x 2.5000 (2b)	= 140.6000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6000 (5)

	main heating		secondary heating		other		total	m3 per hour
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans							2 * 10 =	20.0000 (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) =						20.0000 / (5) =	0.1422 (8)
Pressure test							Yes	
Measured/design AP50							5.0000	
Infiltration rate							0.3922	(18)
Number of sides sheltered							3	(19)
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3040 (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												
	0.3876	0.3800	0.3724	0.3344	0.3268	0.2888	0.2888	0.2812	0.3040	0.3268	0.3420	0.3572 (22b)
Effective ac	0.5751	0.5722	0.5693	0.5559	0.5534	0.5417	0.5417	0.5395	0.5462	0.5534	0.5585	0.5638 (25)

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 Opening Type (Uw = 1.40)			14.0600	1.3258	18.6402		(27)					
External Wall 1	28.0438	14.0600	13.9838	0.1800	2.5171		(29a)					
Total net area of external elements Aum(A, m2)			28.0438				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.1572		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal Bridges (User defined value 0.050 * total exposed area)							1.4022 (36)					
Total fabric heat loss						(33) + (36) =	22.5594 (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	26.6841	26.5488	26.4161	25.7931	25.6765	25.1338	25.1338	25.0333	25.3428	25.6765	25.9123	26.1588 (38)
Heat transfer coeff	49.2435	49.1082	48.9755	48.3525	48.2359	47.6932	47.6932	47.5928	47.9023	48.2359	48.4717	48.7183 (39)
Average = Sum(39)m / 12 =												48.3519 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8756	0.8732	0.8708	0.8598	0.8577	0.8480	0.8480	0.8462	0.8517	0.8577	0.8619	0.8663 (40)
HLP (average)												0.8597 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

Assumed occupancy												1.8736 (42)
Average daily hot water use (litres/day)												78.6977 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	86.5675	83.4196	80.2717	77.1238	73.9759	70.8279	70.8279	73.9759	77.1238	80.2717	83.4196	86.5675 (44)
Energy content (annual)	128.3771	112.2794	115.8623	101.0116	96.9230	83.6372	77.5021	88.9348	89.9970	104.8828	114.4878	124.3264 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1238.2216 (45)
	19.2566	16.8419	17.3793	15.1517	14.5385	12.5456	11.6253	13.3402	13.4996	15.7324	17.1732	18.6490 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	174.9720	154.3651	162.4572	146.1034	143.5179	128.7290	124.0970	135.5297	135.0888	151.4777	159.5797	170.9213 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	174.9720	154.3651	162.4572	146.1034	143.5179	128.7290	124.0970	135.5297	135.0888	151.4777	159.5797	170.9213 (64)
								Total per year (kWh/year) =	Sum (64)m =			1786.8390 (64)
	79.9613	71.0015	75.8001	69.6598	69.5028	63.8828	63.0454	66.8468	65.9975	72.1495	74.1407	78.6144 (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	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	93.6794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.5650	12.9365	10.5207	7.9648	5.9538	5.0264	5.4313	7.0597	9.4756	12.0314	14.0424	14.9698	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.3749	165.0703	160.7981	151.7032	140.2225	129.4323	122.2237	120.5284	124.8006	133.8955	145.3762	156.1664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	32.3679	(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)	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	-74.9435	(71)
Water heating gains (Table 5)	107.4749	105.6570	101.8819	96.7497	93.4178	88.7262	84.7384	89.8478	91.6632	96.9751	102.9732	105.6646	(72)
Total internal gains	339.5186	337.7675	327.3045	310.5216	293.6979	277.2887	266.4972	271.5398	280.0431	297.0058	316.4956	330.9046	(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	
Southwest					14.0600	36.7938	0.6300	0.7000			0.7700	158.1001 (79)	
Solar gains	158.1001	269.3030	368.4721	456.5548	511.3794	507.6814	489.4590	448.5574	398.9773	297.6372	189.3675	135.3007	(83)
Total gains	497.6187	607.0705	695.7766	767.0764	805.0773	784.9701	755.9562	720.0972	679.0205	594.6430	505.8631	466.2053	(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	79.3111	79.5296	79.7450	80.7726	80.9678	81.8891	81.8891	82.0620	81.5317	80.9678	80.5739	80.1661	
alpha	6.2874	6.3020	6.3163	6.3848	6.3979	6.4593	6.4593	6.4708	6.4354	6.3979	6.3716	6.3444	
util living area	0.9828	0.9486	0.8720	0.7256	0.5513	0.3883	0.2775	0.3039	0.4843	0.7815	0.9544	0.9877	(86)
MIT	20.4141	20.6223	20.8180	20.9498	20.9916	20.9993	20.9999	20.9999	20.9971	20.9349	20.6634	20.3696	(87)
Th 2	20.1883	20.1903	20.1924	20.2018	20.2036	20.2119	20.2119	20.2134	20.2087	20.2036	20.2000	20.1963	(88)
util rest of house	0.9780	0.9364	0.8469	0.6868	0.5061	0.3408	0.2279	0.2520	0.4299	0.7377	0.9412	0.9842	(89)
MIT 2	19.4270	19.7204	19.9828	20.1511	20.1966	20.2115	20.2119	20.2134	20.2068	20.1401	19.7900	19.3698	(90)
Living area fraction									fLA = Living area / (4) =			0.5958	(91)
MIT	20.0152	20.2578	20.4804	20.6270	20.6703	20.6809	20.6814	20.6820	20.6777	20.6137	20.3104	19.9655	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0152	20.2578	20.4804	20.6270	20.6703	20.6809	20.6814	20.6820	20.6777	20.6137	20.3104	19.9655	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9768	0.9375	0.8563	0.7078	0.5327	0.3691	0.2575	0.2829	0.4622	0.7609	0.9432	0.9830	(94)
Useful gains	486.0965	569.1243	595.7895	542.9681	428.8837	289.7215	194.6340	203.7512	313.8747	452.4823	477.1542	458.2872	(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	773.8693	754.1941	684.6992	567.0297	432.6900	290.0161	194.6566	203.7926	315.0855	483.0176	640.3312	768.0676	(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	214.1030	124.3669	66.1488	17.3244	2.8319	0.0000	0.0000	0.0000	0.0000	22.7183	117.4875	230.4766	(98)
Space heating												795.4573	(98)
Space heating per m2										(98) / (4) =		14.1440	(99)

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													850.7564 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	214.1030	124.3669	66.1488	17.3244	2.8319	0.0000	0.0000	0.0000	0.0000	22.7183	117.4875	230.4766	(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)	228.9871	133.0127	70.7474	18.5287	3.0287	0.0000	0.0000	0.0000	0.0000	24.2976	125.6551	246.4991	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	174.9720	154.3651	162.4572	146.1034	143.5179	128.7290	124.0970	135.5297	135.0888	151.4777	159.5797	170.9213	(64)
Efficiency of water heater	85.3532	84.2442	82.6268	80.8129	79.9830	79.8000	79.8000	79.8000	79.8000	81.0498	84.0119	85.6119	(216)
(217)m	85.3532	84.2442	82.6268	80.8129	79.9830	79.8000	79.8000	79.8000	79.8000	81.0498	84.0119	85.6119	(217)
Fuel for water heating, kWh/month	204.9975	183.2353	196.6157	180.7923	179.4355	161.3146	155.5101	169.8368	169.2843	186.8948	189.9488	199.6465	(219)
Water heating fuel used												2177.5121	(219)
Annual totals kWh/year													
Space heating fuel - main system												850.7564	(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)												257.2223	(232)
Total delivered energy for all uses												3360.4909	(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	850.7564	0.2160	183.7634 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2177.5121	0.2160	470.3426 (264)
Space and water heating			654.1060 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	257.2223	0.5190	133.4984 (268)
Total CO2, kg/m2/year			826.5294 (272)
Emissions per m2 for space and water heating			11.6306 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3737 (272b)
Emissions per m2 for pumps and fans			0.6921 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.6306 * 1.00) + 2.3737 + 0.6921, rounded to 2 d.p.			14.7000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001446_CLEAN			Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.15_1B		
Property					
SAP Rating	86 B	DER	8.09	TER	13.12
Environmental	94 A	% DER<TER	38.33		
CO ₂ Emissions (t/year)	0.50	DFEE	25.41	TFEE	20.99
General Requirements Compliance	Fail	% DFEE<TFEE	-21.06		
Assessor Details	admin Admin, BuroHappold, Tel: -, -			Assessor ID	Admin
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

Mid-floor flat, total floor area 68 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 (c)
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.12 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.09 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 21.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 25.4 kWh/m²/yr Fail
Excess energy = 4.4 kWh/m²/yr (21.0%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room stats OK

Hot water controls: No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system
Specific fan power: 0.42
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature

Overheating risk (Thames Valley): High Fail

Based on:

Overshading: Average
Windows facing South West: 14.40 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features

Air permeability 3.0 m³/m²h
Community CHP, Mains gas

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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	67.5600 (1b)	x 2.5000 (2b)	= 168.9000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1163 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												77.3500 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.40)			14.4000	1.3258	19.0909		(27)					
External Wall 1	21.2155	14.4000	6.8155	0.1600	1.0905		(29a)					
Total net area of external elements Aum(A, m2)			21.2155				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...	(30) + (32) =	20.1814		(33)					
Party Floor 1			67.5600				(32d)					
Party Ceilings 1			67.5600				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							3.1823 (36)					
Total fabric heat loss						(33) + (36) =	23.3637 (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	14.5735	14.4115	14.2495	13.4396	13.2776	12.4677	12.4677	12.3057	12.7916	13.2776	13.6016	13.9255 (38)
Heat transfer coeff	37.9372	37.7752	37.6132	36.8033	36.6413	35.8314	35.8314	35.6694	36.1554	36.6413	36.9653	37.2893 (39)
Average = Sum(39)m / 12 =												36.7628 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.5615	0.5591	0.5567	0.5447	0.5424	0.5304	0.5304	0.5280	0.5352	0.5424	0.5471	0.5519 (40)
HLP (average)												0.5442 (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												2.1855 (42)
Average daily hot water use (litres/day)												86.1047 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.7152	91.2710	87.8268	84.3826	80.9384	77.4942	77.4942	80.9384	84.3826	87.8268	91.2710	94.7152 (44)
Energy content (annual)	140.4599	122.8471	126.7672	110.5187	106.0453	91.5091	84.7966	97.3053	98.4675	114.7543	125.2633	136.0279 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1354.7621 (45)
	21.0690	18.4271	19.0151	16.5778	15.9068	13.7264	12.7195	14.5958	14.7701	17.2132	18.7895	20.4042 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage												
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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												
	195.7367	172.7745	182.0440	164.0124	161.3221	145.0027	140.0734	152.5821	151.9611	170.0311	178.7570	191.3047 (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	195.7367	172.7745	182.0440	164.0124	161.3221	145.0027	140.0734	152.5821	151.9611	170.0311	178.7570	191.3047 (64)
Total per year (kWh/year) = Sum(64)m =												2005.6019 (64)
Heat gains from water heating, kWh/month												
	90.9243	80.7886	86.3715	79.5424	79.4815	73.2217	72.4163	76.5755	75.5354	82.3773	84.4450	89.4507 (65)

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Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	527.3704 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	137.1163 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	548.4652 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2005.6019 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	521.4565 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2085.8260 (310b)
Electricity used for heat distribution	32.9286 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	108.1805 (330a)
Total electricity for the above, kWh/year	108.1805 (331)
Electricity for lighting (calculated in Appendix L)	301.5609 (332)
Total delivered energy for all uses	3702.6054 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	693.2345	0.2160	149.7387 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	1461.4048	0.2160	315.6634 (363)
less credit emissions for electricity	-541.1582	0.5190	-280.8611 (364)
Water heating from Combined Heat and Power	5557.7564	0.2160	1200.4754 (365)
less credit emissions for electricity	-2058.0372	0.5190	-1068.1213 (366)
Electrical energy for heat distribution	32.9286	0.5190	17.0900 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			333.9850 (373)
Space and water heating			333.9850 (376)
Pumps and fans	108.1805	0.5190	56.1457 (378)
Energy for lighting	301.5609	0.5190	156.5101 (379)
Total CO2, kg/year			546.6408 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.0900 (384)

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

DER	8.0900 ZC1
Total Floor Area	67.5600 TFA
Assumed number of occupants	2.1855 N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190 EF
CO2 emissions from appliances, equation (L14)	16.8000 ZC2
CO2 emissions from cooking, equation (L16)	2.5378 ZC3
Total CO2 emissions	27.4277 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	27.4277 ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.5600 (1b)	x 2.5000 (2b)	= 168.9000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9000 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1184 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3684 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2855 (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	0.3640	0.3569	0.3498	0.3141	0.3069	0.2712	0.2712	0.2641	0.2855	0.3069	0.3212	0.3355 (22b)
Effective ac	0.5663	0.5637	0.5612	0.5493	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563 (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 Opening Type (Uw = 1.40)			14.4000	1.3258	19.0909			(27)					
External Wall 1	21.2155	14.4000	6.8155	0.1800	1.2268			(29a)					
Total net area of external elements Aum(A, m2)			21.2155					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			20.3177		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								1.0608 (36)					
Total fabric heat loss						(33) + (36) =	21.3785	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.5617	31.4183	31.2778	30.6175	30.4940	29.9189	29.9189	29.8124	30.1404	30.4940	30.7439	31.0051	(38)
Heat transfer coeff	52.9402	52.7968	52.6562	51.9960	51.8724	51.2974	51.2974	51.1909	51.5189	51.8724	52.1223	52.3836	(39)
Average = Sum(39)m / 12 =												51.9954	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7836	0.7815	0.7794	0.7696	0.7678	0.7593	0.7593	0.7577	0.7626	0.7678	0.7715	0.7754	(40)
HLP (average)												0.7696	(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												2.1855 (42)
Average daily hot water use (litres/day)												86.1047 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.7152	91.2710	87.8268	84.3826	80.9384	77.4942	77.4942	80.9384	84.3826	87.8268	91.2710	94.7152 (44)
Energy conte	140.4599	122.8471	126.7672	110.5187	106.0453	91.5091	84.7966	97.3053	98.4675	114.7543	125.2633	136.0279 (45)
Energy content (annual)											Total = Sum(45)m =	1354.7621 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0690	18.4271	19.0151	16.5778	15.9068	13.7264	12.7195	14.5958	14.7701	17.2132	18.7895	20.4042 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325 (56)
If cylinder contains dedicated solar storage												

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Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	187.0548	164.9328	173.3621	155.6105	152.6402	136.6009	131.3915	143.9002	143.5593	161.3492	170.3552	182.6228 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	187.0548	164.9328	173.3621	155.6105	152.6402	136.6009	131.3915	143.9002	143.5593	161.3492	170.3552	182.6228 (64)
	83.9788	74.5152	79.4260	72.8209	72.5360	66.5002	65.4708	69.6299	68.8139	75.4317	77.7235	82.5052 (65)
								Total per year (kWh/year) =	Sum (64)m =			1903.3795 (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	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1061	15.1935	12.3562	9.3544	6.9925	5.9034	6.3788	8.2914	11.1287	14.1305	16.4924	17.5815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.5366	193.5241	188.5156	177.8529	164.3933	151.7431	143.2920	141.3044	146.3130	156.9756	170.4353	183.0855	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	(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)	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	(71)
Water heating gains (Table 5)	112.8748	110.8858	106.7554	101.1402	97.4946	92.3614	87.9984	93.5886	95.5749	101.3867	107.9493	110.8941	(72)
Total internal gains	380.2993	378.3853	366.4090	347.1295	327.6623	308.7898	296.4511	301.9664	311.7985	331.2748	353.6589	370.3430	(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	
Southwest					14.4000	36.7938	0.6300	0.7000			0.7700	161.9233 (79)	
Solar gains	161.9233	275.8153	377.3825	467.5952	523.7456	519.9582	501.2951	459.4044	408.6254	304.8346	193.9468	138.5726 (83)	
Total gains	542.2226	654.2006	743.7915	814.7247	851.4079	828.7480	797.7462	761.3709	720.4240	636.1094	547.6057	508.9156 (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	88.6220	88.8627	89.0999	90.2314	90.4463	91.4602	91.4602	91.6505	91.0670	90.4463	90.0126	89.5636	
alpha	6.9081	6.9242	6.9400	7.0154	7.0298	7.0973	7.0973	7.1100	7.0711	7.0298	7.0008	6.9709	
util living area	0.9865	0.9570	0.8852	0.7394	0.5620	0.3958	0.2829	0.3092	0.4917	0.7929	0.9615	0.9906 (86)	
MIT	20.4799	20.6663	20.8433	20.9601	20.9942	20.9996	21.0000	20.9999	20.9982	20.9476	20.7044	20.4392 (87)	
Th 2	20.2676	20.2694	20.2712	20.2797	20.2813	20.2888	20.2888	20.2901	20.2859	20.2813	20.2781	20.2747 (88)	
util rest of house	0.9828	0.9467	0.8627	0.7034	0.5202	0.3520	0.2372	0.2615	0.4416	0.7524	0.9504	0.9880 (89)	
MIT 2	19.5860	19.8501	20.0889	20.2390	20.2764	20.2885	20.2887	20.2901	20.2847	20.2297	19.9142	19.5334 (90)	
Living area fraction									fLA = Living area / (4) =			0.4895 (91)	
MIT	20.0235	20.2496	20.4582	20.5920	20.6278	20.6366	20.6369	20.6376	20.6339	20.5811	20.3010	19.9768 (92)	
Temperature adjustment												0.0000	
adjusted MIT	20.0235	20.2496	20.4582	20.5920	20.6278	20.6366	20.6369	20.6376	20.6339	20.5811	20.3010	19.9768 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9813	0.9464	0.8688	0.7193	0.5405	0.3734	0.2596	0.2849	0.4661	0.7699	0.9508	0.9866 (94)
Useful gains	532.0974	619.1475	646.1983	586.0566	460.1609	309.4809	207.0707	216.9041	335.7925	489.7207	520.6674	502.1146 (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	832.4069	810.4118	734.9858	607.9349	463.1048	309.6602	207.0814	216.9247	336.6203	517.7433	688.0662	826.4440 (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	223.4303	128.5296	66.0579	15.7524	2.1902	0.0000	0.0000	0.0000	0.0000	20.8488	120.5272	241.3011 (98)
Space heating												818.6375 (98)
Space heating per m2										(98) / (4) =		12.1172 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												875.5481	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	223.4303	128.5296	66.0579	15.7524	2.1902	0.0000	0.0000	0.0000	0.0000	20.8488	120.5272	241.3011	(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)	238.9629	137.4648	70.6501	16.8475	2.3425	0.0000	0.0000	0.0000	0.0000	22.2982	128.9061	258.0760	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	187.0548	164.9328	173.3621	155.6105	152.6402	136.6009	131.3915	143.9002	143.5593	161.3492	170.3552	182.6228	(64)
Efficiency of water heater	85.2887	84.1579	82.4910	80.6768	79.9337	79.8000	79.8000	79.8000	79.8000	80.8944	83.9107	79.8000	(216)
(217)m	85.2887	84.1579	82.4910	80.6768	79.9337	79.8000	79.8000	79.8000	79.8000	80.8944	83.9107	85.5579	(217)
Fuel for water heating, kWh/month	219.3194	195.9801	210.1589	192.8813	190.9586	171.1791	164.6510	180.3261	179.8989	199.4565	203.0195	213.4492	(219)
Water heating fuel used												2321.2787	(219)
Annual totals kWh/year													
Space heating fuel - main system												875.5481	(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)												302.0988	(232)
Total delivered energy for all uses												3573.9256	(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	875.5481	0.2160	189.1184 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2321.2787	0.2160	501.3962 (264)
Space and water heating			690.5146 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	302.0988	0.5190	156.7893 (268)
Total CO2, kg/m2/year			886.2289 (272)
Emissions per m2 for space and water heating			10.2208 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3207 (272b)
Emissions per m2 for pumps and fans			0.5762 (272c)
Target Carbon Dioxide Emission Rate (TER) = (10.2208 * 1.00) + 2.3207 + 0.5762, rounded to 2 d.p.			13.1200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	INDEX_001490_CLEAN				Issued on Date	18/04/2019
Assessment Reference	001	Prop Type Ref	B_2_13.15_1B			
Property						
SAP Rating	86 B	DER	7.49	TER	13.12	
Environmental	94 A	% DER<TER	42.90			
CO ₂ Emissions (t/year)	0.49	DFEE	19.29	TFEE	20.99	
General Requirements Compliance	Fail	% DFEE<TFEE	8.12			
Assessor Details	admin Admin, BuroHappold, Tel: -, -				Assessor ID	Admin
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

Mid-floor flat, total floor area 68 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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.12 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.49 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)21.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)19.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using default ψ -value of 0.15

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:	No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.42
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	High	Fail

Based on:

Overshading:	Average
Windows facing South West:	14.40 m ² , No overhang
Air change rate:	2.00 ach
Blinds/curtains:	None

10 Key features

Window U-value	1.00 W/m ² K
Air permeability	3.0 m ³ /m ² h
Community CHP, Mains gas	

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	67.5600 (1b)	x 2.5000 (2b)	= 168.9000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9000 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											3.0000	
Infiltration rate											0.1500	(18)
Number of sides sheltered											3	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1163 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												77.3500 (23c)
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.00)			14.4000	0.9615	13.8462		(27)					
External Wall 1	21.2155	14.4000	6.8155	0.1600	1.0905		(29a)					
Total net area of external elements Aum(A, m2)			21.2155				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		14.9366		(33)					
Party Floor 1			67.5600				(32d)					
Party Ceilings 1			67.5600				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							3.1823 (36)					
Total fabric heat loss	(33) + (36) =						18.1190 (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	14.5735	14.4115	14.2495	13.4396	13.2776	12.4677	12.4677	12.3057	12.7916	13.2776	13.6016	13.9255 (38)
Heat transfer coeff	32.6924	32.5305	32.3685	31.5585	31.3966	30.5866	30.5866	30.4246	30.9106	31.3966	31.7205	32.0445 (39)
Average = Sum(39)m / 12 =												31.5180 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.4839	0.4815	0.4791	0.4671	0.4647	0.4527	0.4527	0.4503	0.4575	0.4647	0.4695	0.4743 (40)
HLP (average)												0.4665 (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												2.1855 (42)
Average daily hot water use (litres/day)												86.1047 (43)
Daily hot water use	Jan 94.7152	Feb 91.2710	Mar 87.8268	Apr 84.3826	May 80.9384	Jun 77.4942	Jul 77.4942	Aug 80.9384	Sep 84.3826	Oct 87.8268	Nov 91.2710	Dec 94.7152 (44)
Energy conte	140.4599	122.8471	126.7672	110.5187	106.0453	91.5091	84.7966	97.3053	98.4675	114.7543	125.2633	136.0279 (45)
Energy content (annual)												Total = Sum(45)m = 1354.7621 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.0690	18.4271	19.0151	16.5778	15.9068	13.7264	12.7195	14.5958	14.7701	17.2132	18.7895	20.4042 (46)
Water storage loss:												
Store volume												110.0000 (47)

b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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													
	195.7367	172.7745	182.0440	164.0124	161.3221	145.0027	140.0734	152.5821	151.9611	170.0311	178.7570	191.3047	(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	195.7367	172.7745	182.0440	164.0124	161.3221	145.0027	140.0734	152.5821	151.9611	170.0311	178.7570	191.3047	(64)
Total per year (kWh/year) = Sum(64)m =												2005.6019 (64)	
Heat gains from water heating, kWh/month													
	90.9243	80.7886	86.3715	79.5424	79.4815	73.2217	72.4163	76.5755	75.5354	82.3773	84.4450	89.4507	(65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.2000 (303a)
Fraction of heat from community Combined Heat and Power	0.8000 (303b)
Fraction of total space heat from community Boilers	0.2000 (304a)
Fraction of total space heat from community Combined Heat and Power	0.8000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	218.3708 (98)
Space heat from Boilers = (98) x 0.20 x 1.00 x 1.30	56.7764 (307a)
Space heat from Combined Heat and Power = (98) x 0.80 x 1.00 x 1.30	227.1057 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2005.6019 (64)
Water heat from Boilers = (64) x 0.20 x 1.00 x 1.30	521.4565 (310a)
Water heat from Combined Heat and Power = (64) x 0.80 x 1.00 x 1.30	2085.8260 (310b)
Electricity used for heat distribution	28.9116 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	108.1805 (330a)
Total electricity for the above, kWh/year	108.1805 (331)
Electricity for lighting (calculated in Appendix L)	301.5609 (332)
Total delivered energy for all uses	3300.9059 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	608.6662	0.2160	131.4719 (367)
Electrical efficiency of CHP unit			37.0300 (361)
Heat efficiency of CHP unit			37.5300 (362)
Space heating from Combined Heat and Power	605.1310	0.2160	130.7083 (363)
less credit emissions for electricity	-224.0800	0.5190	-116.2975 (364)
Water heating from Combined Heat and Power	5557.7564	0.2160	1200.4754 (365)
less credit emissions for electricity	-2058.0372	0.5190	-1068.1213 (366)
Electrical energy for heat distribution	28.9116	0.5190	15.0051 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			293.2419 (373)
Space and water heating			293.2419 (376)
Pumps and fans	108.1805	0.5190	56.1457 (378)
Energy for lighting	301.5609	0.5190	156.5101 (379)
Total CO2, kg/year			505.8977 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.4900 (384)

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

DER		7.4900 ZC1
Total Floor Area	TFA	67.5600
Assumed number of occupants	N	2.1855
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.8000 ZC2
CO2 emissions from cooking, equation (L16)		2.5378 ZC3
Total CO2 emissions		26.8277 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		26.8277 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	67.5600 (1b)	x 2.5000 (2b)	= 168.9000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9000 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1184 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3684 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2855 (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	0.3640	0.3569	0.3498	0.3141	0.3069	0.2712	0.2712	0.2641	0.2855	0.3069	0.3212	0.3355 (22b)
Effective ac	0.5663	0.5637	0.5612	0.5493	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563 (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 Opening Type (Uw = 1.40)			14.4000	1.3258	19.0909			(27)					
External Wall 1	21.2155	14.4000	6.8155	0.1800	1.2268			(29a)					
Total net area of external elements Aum(A, m2)			21.2155					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			20.3177		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)								1.0608 (36)					
Total fabric heat loss						(33) + (36) =	21.3785	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.5617	31.4183	31.2778	30.6175	30.4940	29.9189	29.9189	29.8124	30.1404	30.4940	30.7439	31.0051	(38)
Heat transfer coeff	52.9402	52.7968	52.6562	51.9960	51.8724	51.2974	51.2974	51.1909	51.5189	51.8724	52.1223	52.3836	(39)
Average = Sum(39)m / 12 =												51.9954	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7836	0.7815	0.7794	0.7696	0.7678	0.7593	0.7593	0.7577	0.7626	0.7678	0.7715	0.7754	(40)
HLP (average)												0.7696	(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												2.1855 (42)
Average daily hot water use (litres/day)												86.1047 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	94.7152	91.2710	87.8268	84.3826	80.9384	77.4942	77.4942	80.9384	84.3826	87.8268	91.2710	94.7152 (44)
Energy conte	140.4599	122.8471	126.7672	110.5187	106.0453	91.5091	84.7966	97.3053	98.4675	114.7543	125.2633	136.0279 (45)
Energy content (annual)												
										Total = Sum(45)m =		1354.7621 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.0690	18.4271	19.0151	16.5778	15.9068	13.7264	12.7195	14.5958	14.7701	17.2132	18.7895	20.4042 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Total heat required for water heating calculated for each month	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)
Solar input	187.0548	164.9328	173.3621	155.6105	152.6402	136.6009	131.3915	143.9002	143.5593	161.3492	170.3552	182.6228 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	187.0548	164.9328	173.3621	155.6105	152.6402	136.6009	131.3915	143.9002	143.5593	161.3492	170.3552	182.6228 (64)
	83.9788	74.5152	79.4260	72.8209	72.5360	66.5002	65.4708	69.6299	68.8139	75.4317	77.7235	82.5052 (65)
								Total per year (kWh/year) =	Sum (64)m =			1903.3795 (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	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	109.2730	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1061	15.1935	12.3562	9.3544	6.9925	5.9034	6.3788	8.2914	11.1287	14.1305	16.4924	17.5815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.5366	193.5241	188.5156	177.8529	164.3933	151.7431	143.2920	141.3044	146.3130	156.9756	170.4353	183.0855	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	33.9273	(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)	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	-87.4184	(71)
Water heating gains (Table 5)	112.8748	110.8858	106.7554	101.1402	97.4946	92.3614	87.9984	93.5886	95.5749	101.3867	107.9493	110.8941	(72)
Total internal gains	380.2993	378.3853	366.4090	347.1295	327.6623	308.7898	296.4511	301.9664	311.7985	331.2748	353.6589	370.3430	(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
Southwest					14.4000	36.7938	0.6300	0.7000				0.7700	161.9233 (79)
Solar gains	161.9233	275.8153	377.3825	467.5952	523.7456	519.9582	501.2951	459.4044	408.6254	304.8346	193.9468	138.5726 (83)	
Total gains	542.2226	654.2006	743.7915	814.7247	851.4079	828.7480	797.7462	761.3709	720.4240	636.1094	547.6057	508.9156 (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	88.6220	88.8627	89.0999	90.2314	90.4463	91.4602	91.4602	91.6505	91.0670	90.4463	90.0126	89.5636	
alpha	6.9081	6.9242	6.9400	7.0154	7.0298	7.0973	7.0973	7.1100	7.0711	7.0298	7.0008	6.9709	
util living area	0.9865	0.9570	0.8852	0.7394	0.5620	0.3958	0.2829	0.3092	0.4917	0.7929	0.9615	0.9906 (86)	
MIT	20.4799	20.6663	20.8433	20.9601	20.9942	20.9996	21.0000	20.9999	20.9982	20.9476	20.7044	20.4392 (87)	
Th 2	20.2676	20.2694	20.2712	20.2797	20.2813	20.2888	20.2888	20.2901	20.2859	20.2813	20.2781	20.2747 (88)	
util rest of house	0.9828	0.9467	0.8627	0.7034	0.5202	0.3520	0.2372	0.2615	0.4416	0.7524	0.9504	0.9880 (89)	
MIT 2	19.5860	19.8501	20.0889	20.2390	20.2764	20.2885	20.2887	20.2901	20.2847	20.2297	19.9142	19.5334 (90)	
Living area fraction									fLA = Living area / (4) =			0.4895 (91)	
MIT	20.0235	20.2496	20.4582	20.5920	20.6278	20.6366	20.6369	20.6376	20.6339	20.5811	20.3010	19.9768 (92)	
Temperature adjustment												0.0000	
adjusted MIT	20.0235	20.2496	20.4582	20.5920	20.6278	20.6366	20.6369	20.6376	20.6339	20.5811	20.3010	19.9768 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9813	0.9464	0.8688	0.7193	0.5405	0.3734	0.2596	0.2849	0.4661	0.7699	0.9508	0.9866 (94)
Useful gains	532.0974	619.1475	646.1983	586.0566	460.1609	309.4809	207.0707	216.9041	335.7925	489.7207	520.6674	502.1146 (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	832.4069	810.4118	734.9858	607.9349	463.1048	309.6602	207.0814	216.9247	336.6203	517.7433	688.0662	826.4440 (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	223.4303	128.5296	66.0579	15.7524	2.1902	0.0000	0.0000	0.0000	0.0000	20.8488	120.5272	241.3011 (98)
Space heating												818.6375 (98)
Space heating per m2										(98) / (4) =		12.1172 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												875.5481	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	223.4303	128.5296	66.0579	15.7524	2.1902	0.0000	0.0000	0.0000	0.0000	20.8488	120.5272	241.3011	(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)	238.9629	137.4648	70.6501	16.8475	2.3425	0.0000	0.0000	0.0000	0.0000	22.2982	128.9061	258.0760	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	187.0548	164.9328	173.3621	155.6105	152.6402	136.6009	131.3915	143.9002	143.5593	161.3492	170.3552	182.6228	(64)
Efficiency of water heater	85.2887	84.1579	82.4910	80.6768	79.9337	79.8000	79.8000	79.8000	79.8000	80.8944	83.9107	79.8000	(216)
(217)m	85.2887	84.1579	82.4910	80.6768	79.9337	79.8000	79.8000	79.8000	79.8000	80.8944	83.9107	85.5579	(217)
Fuel for water heating, kWh/month	219.3194	195.9801	210.1589	192.8813	190.9586	171.1791	164.6510	180.3261	179.8989	199.4565	203.0195	213.4492	(219)
Water heating fuel used												2321.2787	(219)
Annual totals kWh/year													
Space heating fuel - main system												875.5481	(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)												302.0988	(232)
Total delivered energy for all uses												3573.9256	(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	875.5481	0.2160	189.1184 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2321.2787	0.2160	501.3962 (264)
Space and water heating			690.5146 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	302.0988	0.5190	156.7893 (268)
Total CO2, kg/m2/year			886.2289 (272)
Emissions per m2 for space and water heating			10.2208 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3207 (272b)
Emissions per m2 for pumps and fans			0.5762 (272c)
Target Carbon Dioxide Emission Rate (TER) = (10.2208 * 1.00) + 2.3207 + 0.5762, rounded to 2 d.p.			13.1200 (273)

Appendix C BREEAM Pre-assessment

BREEAM UK New Construction 2018

BUROHAPPOLD
ENGINEERING

Project name Thameside West
 Project Type Industrial - Shell and core
 BRE Registration Reference TBC
 Assessment stage Pre-assessment
 Date 05/11/2018
 Tracker Revision 01

BREEAM SCORE SUMMARY		
MINIMUM REQUIRED	70.0%	Excellent
TARGETED	55.8%	Very Good
POTENTIAL	76.4%	Excellent
NOT TARGETED	100.6%	
ACHIEVED	0.0%	



BREEAM Credits	Available credits	% Score Value	RIBA Stage	Applicable Criteria	Not Applicable	Targeted	Potential	Not Targeted	Not achievable	Achieved	Ownership	Comments
MANAGEMENT												
Man 01 Project Brief and Design	Credit Aim: Encouraging an integrated design process and considering BREEAM performance targets early to influence decision-making and optimise building performance, while avoiding unnecessary costs.											
Project delivery planning	1	0.61%	Stage 2			1					Project manager	Collate information from project delivery stakeholder consultations (e.g. minutes, responsibility matrix) and demonstrate the impact on the design brief.
Stakeholder consultation (interested parties)	1	0.61%	Stage 2 Stage 4			1					Project manager	Collate information from third party stakeholder consultations with compliant content and demonstrating the impact on the design brief.
Prerequisite - BREEAM AP (Concept and Developed Design)	Achieved ?								No			
BREEAM AP (Concept Design)	1	0.61%	Stage 1 Stage 2						1		n/a	Credit deadline at Stage 1 for BREEAM AP appointment.
BREEAM AP (Developed Design)	1	0.61%	Stage 2 Stage 3 Stage 4						1		n/a	Dependent of above credit.
Man 02 Life Cycle Cost and Service Life Planning	Credit Aim: Promoting the business case for sustainable buildings through the enhanced understanding of capital cost and improving design, specification, maintenance and operation, by encouraging the use of life cycle costing.											
Elemental LCC	2	1.22%	Stage 2						2		n/a	Confirm scope with QS
Component level LCC options appraisal	1	0.61%	Stage 4				1				QS	Confirm scope with QS
Capital cost reporting	1	0.61%				1					QS	Report capital cost to BREEAM Assessment Scoring and Reporting Tool.
Man 03 Responsible Construction Practices	Credit Aim: Encouraging construction sites to be managed in an environmentally and socially considerate and responsible manner and monitoring to encourage continuous improvements and utility consumption reduction.											
Prerequisite - Legally harvested and traded timber	Achieved ?					Yes					Principle Contractor	Commitment letter from contractor
Prerequisite - Healthcare NHS buildings only	Achieved ?				No						n/a	Only applicable to healthcare buildings
Environmental management	1	0.61%				1					Principle Contractor	Commitment letter from contractor
Prerequisite - BREEAM AP (site)	Achieved ?					Yes					Principle Contractor	Commitment letter from contractor
BREEAM AP (site)	1	0.61%	Stage 5 Stage 6			1					Principle Contractor	Commitment letter from contractor
Responsible construction management	2	1.22%				2					Principle Contractor	Commitment letter from contractor
Prerequisite - Monitoring of construction site impacts	Achieved ?					Yes					Principle Contractor	Commitment letter from contractor
Utility consumption (energy and water)	1	0.61%				1					Principle Contractor	Commitment letter from contractor
Transport of construction materials and waste	1	0.61%				1					Principle Contractor	Commitment letter from contractor
Exemplary - Responsible construction management	1	1.00%					1				Principle Contractor	Commitment letter from contractor (depending on appointed contractor)
Man 04 Commissioning and Handover	Credit Aim: Encouraging a well-managed handover and commissioning process, which will ensure building services and fabric defects are identified and rectified and ensuring that the building responds to the needs of the occupants.											
Commissioning - testing schedule and responsibilities	1	0.61%				1					Principle Contractor	Commitment letter from contractor
Commissioning - design and preparation	1	0.61%	Stage 3 Stage 4			1					Principle Contractor	Commitment letter from contractor Specialist commissioning manager to be appointed and provide commissionability of services at Stage 3 or 4.
Testing and inspecting building fabric	1	0.61%				1					Principle Contractor	Commitment letter from contractor - air tightness testing and thermographic survey with subsequent remediation works.
Handover	1	0.61%				1					Principle Contractor	Commitment letter from contractor - development of a Building User Guide (BUG) for users or facilities managers.
Man 05 Aftercare	Credit Aim: Encouraging aftercare support during the first year of the building operation, to ensure the building operates in accordance with the design intent and in response to the building occupants' needs.											
Aftercare Support	1	0.61%			1						N/A	N/A to Shell and Core
Commissioning - implementation	1	0.61%			1						N/A	N/A to Shell and Core
Post-Occupancy Evaluation (POE)	1	0.61%			1						N/A	N/A to Shell and Core
HEALTH & WELLBEING												
Hea 01 Visual comfort	Credit Aim: Providing occupants with the conditions that facilitate good visual comfort by designing out the potential for glare, achieving good practice daylight factors and having an adequate view out and designing internal and external lighting systems to provide appropriate illuminance (lux) levels, thereby giving a more comfortable environment for occupants. Internal lighting is zoned to allow for occupant control.											
Control of glare from sunlight	1	0.73%		N/A - Shell & Core	1						n/a	N/A to Shell and Core
Daylighting	2	1.45%				1	1				Sustainability	Daylighting analysis to confirm compliance
View Out	1	0.73%				1					Architect	If facade glazing is > 35% depth of internal space can be > 15m
Internal and external lighting levels, zoning and control	1	0.73%		Only Crit 10 for Shell & Core		1					Lighting / MEP Eng.	External lighting compliance only
Exemplary - Daylighting	1	1.00%						1			n/a	Daylighting analysis to confirm compliance
Exemplary - Internal and external lighting levels, zoning and control	1	1.00%			1							
Hea 02 Indoor air quality	Credit Aim: Facilitating good indoor air quality by considering indoor air pollution early in the design process so that a mitigation strategy can be put in place, managing harmful emissions from construction products by specifying finishes and products that have been tested in accordance with the appropriate standards and specifying an appropriate ventilation strategy that maintains good indoor air quality.											
Prerequisite - Indoor air quality	Achieved ?					Yes					MEP Eng.	
Ventilation	1	0.73%					1				MEP Eng.	Potential due to prerequisite needing confirmation first
Emissions from construction products	2	1.45%		N/A - Shell & Core	2						n/a	N/A to Shell and Core
Post-construction indoor air quality measurement	1	0.73%		N/A - Shell & Core	1						n/a	N/A to Shell and Core
Exemplary - Emissions from construction products	1	1.00%		N/A - Shell & Core	2						n/a	N/A to Shell and Core
Hea 03 Safe Containment in Laboratories	N/A to BREEAM New Construction 2018											
Hea 04 Thermal Comfort	Credit Aim: Thermal modelling informs the building design to provide a comfortable thermal environment that considers current climatic conditions, and projected climate change scenario conditions and giving occupants control over their environment through appropriate temperature control strategies and thermal zoning.											
Thermal modelling	1	0.73%				1					Sustainability	Thermal comfort modelling (compliance to CIBSE Guide A for mechanical, TMS2 for natural).
Design for future thermal comfort	1	0.73%				1					Sustainability	As above using future weather data (medium emissions scenario 2030 for mechanical, 2050 for natural)
Thermal zoning and controls	1	0.73%		N/A - Shell & Core	1						n/a	N/A to Shell and Core
Hea 05 Acoustic performance	Credit Aim: Enabling occupants to experience best practice acoustic performance levels appropriate to the functional activities in occupied spaces.											
Acoustic performance	4	2.91%		Only 1(b) for Shell & Core	3	1					Acoustics / Principal Contractor	Acoustics to design indoor ambient noise levels to requirements.
Hea 06 Security	Credit Aim: Designing the building to consider and take into account security needs to ensure occupants safety and wellbeing.											
Security of site and building	1	0.73%	Stage 2					1			n/a	Confirm appointment of security specialist, security Needs Assessment required at Stage 2. Can be achieved through Secured by Design compliance.
Exemplary - Security of site and building	1	1.00%		N/A - Shell & Core	2						n/a	N/A to Shell and Core
Hea 07 Safe and healthy surroundings	Credit Aim: Providing external site areas that are safe for occupant use and enhancing the wellbeing of building users by giving access to an outdoor space.											
Safe access	1	0.73%				1					Architect	Dedicated pedestrian and cyclist paths and delivery access routes.
Outside space	1	0.73%	Stage 2			1					F+P	Provision of outside amenity area (landscape, seating etc.)
ENERGY												
Ene 01 Reduction of energy and CO₂ emissions	Credit Aim: Encouraging the design of energy efficient buildings with energy performance above national building regulations and encouraging the accurate modelling of operational energy consumption											
Energy performance	9	5.73%				4	1	2	2		Sustainability	minimum requirement for BREEAM Excellent
Prediction of operational energy consumption	4	2.55%				2	2					Operational energy modelling required - TBC
Exemplary - Energy performance	3	3.00%							3		n/a	Need to achieve all credits to achieve exemplary.
Ene 02 Energy monitoring	Credit Aim: Helping to identify and reduce high energy demands where possible by accurate measurement of the energy consumption of the building by end use.											

BREEM Credits	Available credits	% Score Value	RIBA Stage	Applicable Criteria	Not Applicable	Targeted	Potential	Not Targeted	Not achievable	Achieved	Ownership	Comments
Sub-metering of end-use categories	1	0.64%				1					MEP Eng.	
Sub-metering of high energy load and tenancy areas	1	0.64%				1					MEP Eng.	
Ene 03 External lighting	Credit Aim: Reducing the building's energy consumption through the specification of energy efficient external lighting.											
External lighting specification	1	0.64%				1					MEP Eng.	
Ene 04 Low Carbon Design	Credit Aim: Reducing the building's energy consumption through the adoption of passive design solutions, free cooling and low or zero carbon (LZC) energy sources.											
Passive design analysis	1	0.64%	Stage 2			1					Sustainability	Passive design analysis received for Stage 2.
Free cooling	1	0.64%				1					Sustainability	Free cooling study to be undertaken
Low and zero carbon technologies	1	0.64%	Stage 2			1					Sustainability	LZC feasibility study received for Stage 2.
Ene 05 Energy efficient cold storage	Credit Aim: Reducing the building's operational greenhouse gas emissions (CO ₂ -eq) through the design, installation and commissioning of energy efficient refrigeration systems.											
Refrigeration energy consumption	1	0.64%			1						N/A	No cold storage.
Indirect greenhouse gas emissions	1	0.64%			1						N/A	No cold storage.
Ene 06 Energy efficient transportation systems	Credit Aim: Reducing the building's energy consumption by specifying the optimum number and size of energy efficient transportation systems.											
Energy consumption	1	0.64%				1					Lift consultant	Transportation analysis and lift/escalator energy consumption analysis.
Energy efficient features	2	1.27%				2					Lift consultant	Lift/escalator energy efficient features.
Ene 07 Energy efficient laboratory systems	Credit Aim: Reducing the building's operational greenhouse gas emissions (CO ₂ -eq) by specifying best practice energy efficient laboratory equipment.											
Design specification	1	0.64%	Stage 1		1						N/A	No labs.
Best practice energy efficient measures	4	2.55%			4						N/A	No labs.
Ene 08 Energy efficient equipment	Credit Aim: Demonstrating a meaningful reduction in the total unregulated energy demand of the building by using energy efficient equipment.											
Energy efficient equipment	2	1.27%			2						N/A	N/A to Shell and Core
TRANSPORT												
Tra 01 Transport assessment and travel plan	Credit Aim: Recognising developments in proximity to good public transport networks, thereby helping to reduce transport-related pollution and congestion.											
Travel plan	2	1.92%				2					Transport	Travel plan and site-specific travel assessment/statement required during the feasibility and design stages.
Tra 02 Sustainable transport measures	Credit Aim: Recognising developments in close proximity of, and accessible to, local amenities which are likely to be frequently required and used by building occupants.											
Prerequisite - Achieve Tra 01	Achieved ?					Yes					Transport / BH MEP	
Transport options implementation	10	9.58%				8	2				Transport / BH MEP	Transport consultant to complete study and assess applicable measure to be implemented.
WATER												
Wat 01 Water Consumption	Credit Aim: Reducing the demand for potable water through the provision of efficient sanitary fittings, rainwater collection and water recycling systems.											
Water consumption	5	3.89%						5			/ n/a	Possible credits if sanitary fittings are specified as part of the shell & core. If not, all credits are lost.
Exemplary - Water consumption	1	1.00%						1			/ n/a	Greywater/Rainwater required to achieve maximum credits
Wat 02 Water Monitoring	Credit Aim: Specification of water meters to allow for management and monitoring of water use in the building. This encourages reductions in water use by identifying areas of high usage and investigating potential causes.											
Water monitoring	1	0.78%				1					MEP Eng.	Metering of mains water supply plus sub-metering of areas consuming more than 10% of the total (submetering by floorplate)
Wat 03 Water Leak Detection	Credit Aim: Reducing the unintended water consumption due to leaks by installing leak detection systems and flow control devices.											
Leak detection system	1	0.78%				1					MEP Eng.	Leak detection system to be specified.
Flow control devices	1	0.78%				1					MEP Eng.	Flow control devices to be specified to the water supply to the WCs (even if sanitary fittings are not specified).
Wat 04 Water Efficient Equipment	Credit Aim: Reducing water consumption for non-domestic scale, non-sanitary water uses by specifying efficient systems and improving the design efficiency of any water-using processes.											
Water efficient equipment	1	0.78%				1					MEP Eng.	Unregulated water demands to be identified and reduced.
MATERIALS												
Mat 01 Building Life Cycle Assessment (LCA)	Credit Aim: Reducing buildings' environmental life cycle impacts through conducting Life Cycle Assessment and integrating its outcomes in the design decision-making process.											
Superstructure	6	7.50%						6			n/a	LCA analysis for the environmental impact of superstructure materials required
Substructure and hard landscaping options appraisal	1							1				LCA analysis for the environmental impact of substructure and landscaping materials required
Exemplary - Core building services	1	1.00%							1		n/a	Credit not targeted unless all credits above required to be achieved first.
Exemplary - LCA and LCC alignment	1	1.00%						1			n/a	Alignment of the LCA analyses with LCC analyses in Man02
Exemplary - Third party verification	1	1.00%						1			n/a	LCA analyses to be completed by a recognised third party.
Mat 02 Environment Product Declarations (EPD)	Credit Aim: To encourage availability of robust and comparable data on the impacts of construction products by rewarding the specification of products with environmental products declarations.											
Hard Landscaping and Boundary Protection	1	1.25%				1					Architect / Landscape	Materials with EPDs to be specified, achieving at least 20 EPD points using the BREEM tool.
Mat 03 Responsible sourcing of materials	Credit Aim: Recognising and encouraging responsible sourcing of construction products. This includes the source of products and the intermediary companies processing and transporting the product to site.											
Prerequisite - Legally harvested and traded timber	Achieved ?					Yes					Principle Contractor	To be included in contractor requirements.
Enabling sustainable procurement	1	1.25%		Stage 2			1				Principle Contractor	Sustainable procurement plan required at Stage 2 and required to be used by the design team in specifying materials
Measuring responsible sourcing	3	3.75%				1	1	1			Architect / MEP Eng / Principle Contractor	Design team/contractor to review responsible sourcing certification achieved by materials being specified
Exemplary - Measuring responsible sourcing	1	1.25%								1	/ / n/a	Credit not targeted.
Mat 04 Insulation	N/A to BREEM New Construction 2018											
Mat 05 Designing for durability and resilience	Credit Aim: Increasing the lifespan of the building through designing for durability and protection from degradation and specifying appropriate construction products.											
Protecting vulnerable parts of the building from damage	1	1.25%				1						
Protecting exposed parts of the building from material degradation												
Mat 06 Material Efficiency	Credit Aim: Encouraging the reduction of environmental impacts through optimising the use of materials during all stages of the project.											
Material Efficiency	1	1.25%	Stages 1-6							1	n/a	Stage 1 deadline missed.
WASTE												
Wst 01 Construction waste management	Credit Aim: Improving resource efficiency through developing a pre-demolition audit and a Resource Management Plan, maximising the recovery of material during demolition and diverting non-hazardous waste from landfill.											
Pre-demolition audit	1	0.64%	Stage 2			1					Principle Contractor	Waste reduction to be included in contractor requirements.
Construction resource efficiency	3	1.91%				1	1			1	Principle Contractor	
Diversion of resources from landfill	1	0.64%				1					Principle Contractor	
Exemplary - Construction resource efficiency and diversion from landfill	1	1.00%								1	n/a	Credit not targeted.
Simple Buildings - Pre-demolition audit	1		Stage 2		1						n/a	N/A - not a simple building
Simple buildings - Construction resource efficiency	1				1						n/a	
Simple Buildings - RMP Measurements and Reporting	2				2						n/a	N/A - not a simple building
Simple buildings - Diversion from landfill	1				1						n/a	
Simple Buildings - Exemplary Level Criteria	1				1						n/a	N/A - not a simple building
Wst 02 Recycled and sustainably sourced aggregates	Credit Aim: Encouraging the use of recycled or secondary aggregate or aggregate types with lower environmental impact to reduce waste and optimise material efficiency.											
Prerequisite - Pre-demolition audit	Achieved ?					Yes					Principle Contractor	as above for Wst 01
Project sustainable aggregate points	1	0.64%						1			Structures	Evaluation of aggregate types/suppliers to determine travel distances and number of points achievable
Exemplary - Project sustainable aggregate points	1	1.00%								1	n/a	Dependant on the above being achieved.
Wst 03 Operational waste	Credit Aim: Encouraging the diversion of operational waste from landfill through the provision of space and facilities allowing the segregation and storage of recyclable waste.											
Operational Waste	1	0.64%				1					Principle Contractor	Operational recyclable and general waste requirements of building to be provided by waste consultant and included in design by Foster.
Wst 04 Speculative finishes	Credit Aim: To encourage the specification and fitting of floor and ceiling finishes selected by the building occupant and therefore avoid unnecessary waste of materials.											

BREEAM Credits	Available credits	% Score Value	RIBA Stage	Applicable Criteria	Not Applicable	Targeted	Potential	Not Targeted	Not achievable	Achieved	Ownership	Comments
Speculative floor and ceiling finishes	1	0.64%			1		1				Principle Contractor	TBC if finishes are provided and for what area
Wst 05 Adaptation to climate change	Credit Aim: To encourage the specification and fitting of floor and ceiling finishes selected by the building occupant and therefore avoid unnecessary waste of materials.											
Resilience of structure, fabric, building services and renewables installation	1	0.64%	Stage 2 Stage 4				1				LDS	
Exemplary - Responding to climate change	1	1.00%							1		n/a	Dependant of Hse04, Ene01 (8 credits), Ene04, Wst01 (3 credits), Mat05, Pol03 (3 credits).
Wst 06 Design for disassembly and adaptability	Credit Aim: To encourage the specification and fitting of floor and ceiling finishes selected by the building occupant and therefore avoid unnecessary waste of materials.											
Design for disassembly and functional adaptability - recommendations	1	0.64%	Stage 2					1			n/a	Functional adaptability strategy required at Stage 2 looking at feasibility, accessibility, versatility, adaptability, convertibility, expandability, refurbishment potential
Design for disassembly and functional adaptability - implementation	1	0.64%	Stage 4					1			n/a	Adaptability and disassembly guide communicating the implementation of the strategy required at Stage 4
LAND USE AND ECOLOGY												
LE 01 Site selection	Credit Aim: Recognising the reuse of previously developed and contaminated land where appropriate remediation has taken place.											
Previously occupied land	1	1.15%				1					Principle Contractor	Evidence (drawings and reports) showing at least 75% of the site is on previously occupied land.
Contaminated land	1	1.15%				1					Principle Contractor	Site investigation report for land contamination required along with remediation measures for the principal contractor.
LE 02 Identifying and understanding the risks and opportunities for the project	Credit Aim: Identifying and understanding the ecological risks and opportunities associated with the site to inform the determination of the strategic outcome for the site.											
Prerequisite - Assessment route selection	Achieved ?					Yes					Ecologist / Principal Contractor	Assuming route 2 for assessment (more detailed) as assumed that there will be some statutory requirements and regulations for the site ecology
Survey and evaluation	1	1.15%	Stage 1			1					Ecologist	Survey and evaluation by ecologist required at Stage 1 but could happen later if credit aim is met.
Determining the ecological outcomes for the site	1	1.15%				1					Ecologist	Project team liaison with stakeholders (local government, local community groups at Stage 2 to identify and consider the ecological outcome of the site
Exemplary - Determining ecological outcomes for the site	1	1.15%							1		Ecologist / Landscape architect	Identify opportunities for integrating ecology with wider site sustainability-related activities and ecosystem service
LE 03 Managing negative impacts on ecology	Credit Aim: Recognition of steps taken to avoid impacts on existing site ecology as far as possible.											
Prerequisite - Identification and understanding the risks and opportunities for the site	Achieved ?					Yes					Ecologist / Principal Contractor	Contractor confirms compliance is monitoring against relevant UK and EU legislation
Planning, liaison, implementation and data	1	1.15%	Stage 2					1			Ecologist / Client	Define and allocate roles and responsibilities at Stage 2 to support and implement measures
Managing negative impacts of the project	2	2.31%				1	1				Ecologist / Principal Contractor	Impacts from site preparation and construction: 2 credits if no ecological loss 1 credit if loss has been limited as far as possible
LE 04 Change and enhancement of ecological value	Credit Aim: Recognition of steps taken to enhance site ecology.											
Prerequisite - Identifying and understanding the risks and opportunities for the project	Achieved ?					Yes					Ecologist / Principal Contractor	Contractor confirms compliance is monitoring against relevant UK and EU legislation and achieve LE 03 credit 1
Liaison, implementation and data collation	1	1.15%					1				Ecologist / Landscape architect	Implementation of measures for ecological enhancement, first on site then if not possible, off site.
Enhancement of ecology	3	3.46%				1	2				Ecologist	Credits awarded based on the calculation of the change in ecological value
LE 05 Long term ecology management and maintenance	Credit Aim: Encouraging the long term maintenance and management of ecology on site to ensure both new and existing ecological features continue to thrive.											
Prerequisite - Roles and responsibilities, implementation, statutory obligations	Achieved ?					Yes					Ecologist / Principal Contractor	Contractor confirms compliance is monitoring against relevant UK and EU legislation and achieve LE 04 credit 1
Planning, liaison, data, monitoring and review management and maintenance	1	1.15%				1					Ecologist	Project team liaison with stakeholder for monitoring. Reviewing and maintenance of measures and inclusion of Ecology and Biodiversity in the building owner information provided
Landscape and ecology management plan (or similar) development	1	1.15%					1				Ecologist	Provision of a compliant landscape and ecology management plan.
POLLUTION												
Pol 01 Impact of refrigerants	Credit Aim: Rewarding buildings that reduce the impact of refrigerant gas emissions.											
Prerequisite - Ammonia refrigerants	Achieved ?					Yes					BH MEP	Prerequisite if ammonia refrigerants are present to meet BS EN 378:2016
Impact of refrigerant	2	1.80%				1	1				BH MEP	Feasibility of direct effect life cycle CO2 emissions from refrigerants to be assessed by MEP
Leak detection	1	0.90%				1					BH MEP	Compliant refrigerant leak detection system to be specified.
Pol 02 Local air quality	Credit Aim: Recognising buildings which limit their impact on local air quality, by consideration of the combustion plant and fuel used on site.											
Local air quality	2	1.80%				1	1				BH MEP	MEP to assess feasibility based on systems NOx and PM emission rates (based on the worst performing system).
Pol 03 Flood and surface water management	Credit Aim: Rewarding buildings, and their sites that limit on-site and off-site local flooding and hence the damage this can cause.											
Prerequisite - Appropriate consultant	Achieved ?					Yes					Flood risk consultant	Appointment of a suitably qualified professional to carry out a flood risk assessment
Flood Resilience	2	1.80%				1			1		Flood risk consultant	Flood risk assumed to be medium or high (1 credit only)
Prerequisite - Surface water run-off	Achieved ?					Yes					SuDS/runoff consultant	Appointment of a suitably qualified professional to carry out drainage and surface water runoff calculations
Surface water run-off - Rate	1	0.90%				1					SuDS/runoff consultant	30% improvement in peak rate runoff post-development
Surface water run-off - Volume	1	0.90%					1				SuDS/runoff consultant	No increase in volume runoff post-development or limiting peak rate runoff to 1-year rate, Qbar or 2l/s/ha - SuDs to review
Minimising watercourse pollution	1	0.90%					1				SuDS/runoff consultant	No discharge for rainfall up to 5mm and design of SuDS for watercourse pollution prevention - SuDs to review
Simple Buildings - Surface water run-off (credit 1)	1	0.90%			1						N/A	N/A - not a simple building
Simple Buildings - Surface water run-off (credit 2)	1	0.90%			1						N/A	N/A - not a simple building
Pol 04 Reduction of night time light pollution	Credit Aim: Avoiding or reducing the impact of night time light pollution, through careful design and specification of light sources.											
Reduction of night time light pollution	1	0.90%				1					BH MEP	External lighting automatic switch off 23:00-7:00 and meets ILP guidance requirements.
Pol 05 Reduction of noise pollution	Credit Aim: Avoiding or reducing the impact of external noise from the building.											
Reduction of noise pollution	1	0.90%				1					Acoustics / Principal Contractor	Testing pre and post-completion. Noise levels at sensitive receptors within 800m to be at least 5dB lower than background noise through day and night
INNOVATION												
Im 01 Innovation	Credit Aim: To support innovation within the construction industry through the recognition of sustainability related benefits which are not rewarded by standard BREEAM issues.											
Exemplary level of performance in existing BREEAM issues	10	10.00%			6		1	4	5		see relevant issues above	For information on the methodology for exemplary level credits refer to the Methodology section of the relevant BREEAM issues above.
Approved Innovations											Client / Assessor	Innovation applications can be submitted to BRE Global by a licensed BREEAM Assessor using the formal Approved Innovation Application Form

Appendix D Evidence of communication with Engie

[Redacted]

From: [Redacted]
Sent: 07 September 2018 16:51
To: [Redacted]
Cc: [Redacted]
Subject: 035668 Thames Side West
Attachments: Thameside West plant requirements and potential connection charge options
 180907 TSW predicted capital costs and connection costs of site wide energy options.pdf; 180515 Peak and Annual heat demands for TSW_Rev 02.xlsx

Hi [Redacted]

It was good to see you the other day and glad we are making some progress on the potential connection.

[Redacted] and I have been working through the plant requirements for each option and have worked up the attached slide pack to help explain the potential strategies.

As discussed there are two options for connection scenarios. These were agreed as follows:

- Option 1 - Phase 1 standalone energy centre (CHP as outlined in the proposal) + Phase 2, 3 & 4 energy centre (with Heat pumps)
- Option 2 - Phase 1 temporary then move to site wide energy centre (with Heat pumps)

We have also reviewed the indicative costs of these systems based on a plant breakdown, as per the attachment. The connection charge would then be the avoided cost of phase 1 as a proportion of the total site wide energy cost rather than the straight cost of a boiler only plant room. We have looked to calculate this based on unit numbers, 1319 in phase1 of 5607 in total, as per the heat demands previously issued.

For the connection charge we have outlined the capital cost 10% discount approach as per your proposal, calculated as [Redacted]. We have also outlined an option where the connection charge would equal the net cost of the developer building an energy centre then an ESCo providing and adoption payment of [Redacted] per unit, resulting in a connection charge of [Redacted]. We foresee this as the potential net capital cost to the developer if they were to open it up to the ESCo market.

As discussed deadlines for any further proposals are as follows:

5th October -
 ENGIE to review of Standalone energy centre with heat pumps to understand if ENGIE would be able to adopt the site wide energy centre with Heat pumps only (to reduce delivery risk of a policy compliant energy centre)
 ENGIE to review connection charge and proposal for phase 1 on information provided and discussions had

15th Oct - BuroHappold to provide Draft energy strategy for planning to Silvertown Homes for Review
 5th Nov - BuroHappold final submission of energy strategy for planning

I propose that we have a call next week to discuss further and review the figures. The afternoon of Wednesday 12th looks free for [Redacted] please let me know if this works for yourself.

Kind regards and have a good weekend

[Redacted]

From:
Sent: 15 October 2018 19:10
To:
Cc:
Subject: Thames Side West District Heating Connection To Excel District Heating Scheme
Attachments: Thames Side West Full Consumer Services Outline (15-10-18) (002).pdf
Follow Up Flag: Flag for follow up
Flag Status: Flagged

**** External Email ****

Hi All,

Please find our revised proposal attached for district heating connection of the Thames Side West to Excel district heating scheme.
Look forward to your feedback.

Kind regards,



ENGIE Mail Disclaimer: <http://www.engie.com/disclaimer/>

**** External Email ****

"ENGIE_TSW Queries_REDACTED"

Hi [REDACTED]

As discussed today please find our responses in red below.

I hope this is useful, please do let us know if there are further questions.

Kind regards,



engie.co.uk

Kings Yard, 1 Waterden Road, Queen Elizabeth Olympic Park,
London, E15 2GP - UK

Please consider the environment before printing this message

From: [REDACTED]

Sent: 25 March 2019 09:43

To: [REDACTED]

Cc: [REDACTED]

Subject: [REDACTED]

Dear [REDACTED]

I hope you are well.

As you know we submitted the planning application for Thameside West on behalf of Silvertown Homes late last year which outlined the potential to connect to the Engie Energy centre for supply of heat to the development.

We have had some comments back from the GLA on our application, some of will require written clarification from Engie. Specific points we would appreciate comment on are as follows:

- 1) *The applicant has identified the Excel energy centre and district heating network within the vicinity of the development and is proposing to connect to the network for Phase 1 (the detailed application) and Phases 2 and 3 (part of the outline application). It is suggested by the applicant that the network operator (ENGIE) has confirmed that the energy centre could be expanded to meet the peak demand of the full site, although there are no plans or permission to do this currently; correspondence from ENGIE should be provided confirming this.*

We presently have 3 x 6 MW Gas boilers and 2 CHPs (1.2MWe and 1.6MWe) installed in our Excel Energy Centre, there is also additional space in it for the installation of future plant which should be sufficient to meet the heat load for the development. Additionally, we are exploring new locations, energy centres on potential customers site to install low carbon plant i.e. Heat pumps further CHPs and also addition of Thermal stores to decarbonise our network and also add resilience to it.

- 2) *The applicant has provided some correspondence from ENGIE, and suggests the CO2 emissions factor would be 0.135kgCO2/kWh including residential distribution or 0.114 for non-domestic, but further information is required from them. The correspondence provided from ENGIE must include confirmation or otherwise that the network has the capacity to serve the new development, together with supporting estimates of the CO2 emission factor, installation cost, timescales for connection.*

Attaching the table that shows how the CO2 factors have been worked out. We have quite a bit of heating capacity available in our Energy centre presently and the ability to install more plant in there should we feel more plant capacity is required. Installation cost are high level only at this stage for the connection of Thames Side West development, however based on the limited due diligence we have carried out to date we feel that connection to Thames Side West is commercially viable and the connection programme for the Thames Side West development achievable. More work needs to be done to understand the connection cost in more detail and this will be progressed in future stages of the project.

- 3) *In order for it to be acceptable to use the SAP 2012 carbon factors, the applicant is required to provide details from ENGIE on their future plans to decarbonise the Excel heat network.*

ENGIE is the UK's leading district heating solutions provider and providing low carbon heat, cooling and power to our customers across the UK. As we grow our Excel District Energy scheme, we are committed to investing in solutions which deliver the carbon savings and low cost energy bills required by our customers, ensuring that our proportion of renewable / low carbon heat remains high. To achieve this we are exploring the potential installation of further low carbon plant i.e. Heatpumps, CHPs and Thermal stores etc on potential customer site and elsewhere to benefit not just them but the wider EDEC scheme.

As a reminder of the scheme, please find attached again an email sent to you from 

We are required to respond to the GLA by the end of this week so we would appreciate **written** responses to the 3 queries above by Thursday please.

Best regards,



www.burohappold.com | [@burohappold](https://twitter.com/burohappold) |

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