

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	S19077			Issued on Date	23/04/2019
Assessment Reference	Solar Apartment(1)	Prop Type Ref			
Property	Test, Solar System, BS5 9HF				
SAP Rating	83 B	DER	18.77	TER	21.99
Environmental	86 B	% DER<TER	14.66		
CO₂ Emissions (t/year)	1.08	DFEE	52.92	TFEE	54.85
General Requirements Compliance	Pass	% DFEE<TFEE	3.52		
Assessor Details	Mr. Malcolm Lisle, Malcolm Lisle, Tel: 0114 2521999, malcolm.lisle@skaino.co.uk			Assessor ID	8227-0002
Client					

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

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DWELLING AS DESIGNED

Top-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
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 21.99 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.77 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 52.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Eco Hometec (UK) EC38S
Combi boiler
Efficiency: 88.9% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage: No cylinder
Solar water heating
Dedicated solar storage volume: 150 litres
Minimum: 61 litres OK

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Severn Valley): Not significant OK

Based on:

Overshading: Average
Windows facing North: 5.04 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Solar water heating

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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	74.5500 (1b)	x 3.0000 (2b)	= 223.6500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 223.6500 (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) =	0.0894 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3394	(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) =		0.2885 (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	0.3679	0.3606	0.3534	0.3174	0.3101	0.2741	0.2741	0.2669	0.2885	0.3101	0.3246	0.3390 (22b)
Effective ac	0.5677	0.5650	0.5625	0.5504	0.5481	0.5376	0.5376	0.5356	0.5416	0.5481	0.5527	0.5575 (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
Windows (Uw = 1.60)			2.5200	1.5038	3.7895		(27)
Fully Glazed Doors (Uw = 1.60)			2.5200	1.5038	3.7895		(27)
Cavity Walls	49.0500	5.0400	44.0100	0.2000	8.8020	60.0000	2640.6000 (29a)
Flat Roof	74.5500		74.5500	0.1800	13.4190	9.0000	670.9500 (30)
Total net area of external elements Aum(A, m ²)			123.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.7999		(33)
Party Wall to Flat 2			12.1500	0.0000	0.0000	180.0000	2187.0000 (32)
Party Floor 1			74.5500			30.0000	2236.5000 (32d)
Internal Wall			78.0000			100.0000	7800.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15535.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							208.3843 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0555 (36)
Total fabric heat loss						(33) + (36) =	40.8554 (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	41.8957	41.7018	41.5117	40.6190	40.4520	39.6745	39.6745	39.5305	39.9740	40.4520	40.7899	41.1431 (38)
Heat transfer coeff	82.7511	82.5572	82.3672	81.4745	81.3074	80.5299	80.5299	80.3859	80.8294	81.3074	81.6453	81.9986 (39)
Average = Sum(39)m / 12 =												81.4737 (39)
HLP	1.1100	1.1074	1.1049	1.0929	1.0906	1.0802	1.0802	1.0783	1.0842	1.0906	1.0952	1.0999 (40)
HLP (average)												1.0929 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.3513 (42)
Average daily hot water use (litres/day)												90.0443 (43)
Daily hot water use	99.0488	95.4470	91.8452	88.2434	84.6417	81.0399	81.0399	84.6417	88.2434	91.8452	95.4470	99.0488 (44)
Energy conte	146.8865	128.4678	132.5673	115.5754	110.8973	95.6960	88.6764	101.7574	102.9728	120.0048	130.9946	142.2517 (45)
Energy content (annual)										Total = Sum(45)m =		1416.7480 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.0330	19.2702	19.8851	17.3363	16.6346	14.3544	13.3015	15.2636	15.4459	18.0007	19.6492	21.3378 (46)
Water storage loss:												
Total storage loss												

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
Combi loss	50.4742	43.9318	46.8033	43.5173	43.1325	39.9649	41.2970	43.1325	43.5173	46.8033	47.0698	50.4742	50.4742	50.4742	50.4742	50.4742	50.4742	(61)
Total heat required for water heating calculated for each month	197.3606	172.3996	179.3706	159.0927	154.0298	135.6609	129.9734	144.8899	146.4901	166.8081	178.0644	192.7259	192.7259	192.7259	192.7259	192.7259	192.7259	(62)
Aperture area of solar collector																		2.4480 (H1)
Zero-loss collector efficiency																		0.6000 (H2)
Collector effective heat loss coefficient																		3.0000 (H3b)
Collector performance ratio																		5.0000 (H4)
Annual solar radiation per m2																		1079.5246 (H5)
Overshading factor																		1.0000 (H6)
Solar energy available																		1585.6058 (H7)
Adjustment factor for showers																		1.2900 (H7a)
Solar-to-load ratio																		0.8676 (H8)
Utilisation factor																		0.6842 (H9)
Collector performance factor																		0.8015 (H10)
Dedicated solar storage volume																		150.0000 (H11)
Effective solar volume																		150.0000 (H13)
Daily hot water demand																		90.0443 (H14)
Volume ratio Veff/V																		1.6658 (H15)
Solar storage volume factor																		1.0000 (H16)
Solar input																		-869.5150 (H17)
Solar input	-25.2142	-42.0753	-71.6590	-96.0371	-118.6458	-116.6477	-115.1062	-100.5688	-78.7656	-53.7876	-29.9077	-21.1000	-21.1000	-21.1000	-21.1000	-21.1000	-21.1000	(63)
Solar input (sum of months) = Sum(63)m =																		-869.5150 (63)
Output from w/h	172.1464	130.3244	107.7116	63.0556	35.3840	19.0131	14.8672	44.3211	67.7245	113.0205	148.1567	171.6259	171.6259	171.6259	171.6259	171.6259	171.6259	(64)
Total per year (kWh/year) = Sum(64)m =																		1087.3510 (64)
Heat gains from water heating, kWh/month	61.4583	53.6985	55.7795	49.3081	47.6565	41.8101	39.8092	44.6175	45.1178	51.6024	55.3232	59.9172	59.9172	59.9172	59.9172	59.9172	59.9172	(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	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0204	20.4465	16.6282	12.5886	9.4101	7.9444	8.5842	11.1581	14.9764	19.0160	22.1945	23.6602
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.6756	209.8306	204.4000	192.8389	178.2451	164.5291	155.3659	153.2108	158.6414	170.2025	184.7963	198.5124
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567
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
Losses e.g. evaporation (negative values) (Table 5)	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536
Water heating gains (Table 5)	82.6052	79.9085	74.9724	68.4835	64.0544	58.0696	53.5069	59.9697	62.6636	69.3581	76.8377	80.5339
Total internal gains	374.5713	371.4557	357.2707	335.1812	312.9798	291.8132	278.7271	285.6088	297.5515	319.8467	345.0986	363.9766

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	2.5200	10.6334	0.6300	0.7000	0.7700	8.1893						
North	2.5200	10.6334	0.6300	0.7000	0.7700	8.1893						
Solar gains	16.3785	31.3002	53.1866	85.4313	115.0838	123.2007	115.0236	91.2565	63.9475	37.2587	20.2050	13.6539
Total gains	390.9498	402.7558	410.4573	420.6125	428.0636	415.0139	393.7507	376.8653	361.4990	357.1054	365.3036	377.6305

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	52.1478	52.2703	52.3909	52.9650	53.0738	53.5862	53.5862	53.6822	53.3876	53.0738	52.8541	52.6264
alpha	4.4765	4.4847	4.4927	4.5310	4.5383	4.5724	4.5724	4.5788	4.5592	4.5383	4.5236	4.5084
util living area	0.9975	0.9967	0.9946	0.9878	0.9657	0.8968	0.7748	0.8129	0.9465	0.9883	0.9960	0.9979
MIT	19.5488	19.6420	19.8487	20.1626	20.4965	20.7892	20.9275	20.9066	20.6829	20.2763	19.8685	19.5328
Th 2	19.9927	19.9948	19.9969	20.0066	20.0085	20.0170	20.0170	20.0186	20.0137	20.0085	20.0048	20.0009
util rest of house	0.9968	0.9957	0.9928	0.9831	0.9498	0.8404	0.6515	0.7015	0.9135	0.9829	0.9946	0.9973
MIT 2	18.6630	18.7577	18.9655	19.2852	19.6134	19.8883	19.9896	19.9795	19.7964	19.4004	18.9917	18.6535
Living area fraction									fLA = Living area / (4) =			
MIT	19.2845	19.3782	19.5853	19.9008	20.2330	20.5204	20.6477	20.6300	20.4184	20.0150	19.6069	19.2705
Temperature adjustment												0.0000
adjusted MIT	19.2845	19.3782	19.5853	19.9008	20.2330	20.5204	20.6477	20.6300	20.4184	20.0150	19.6069	19.2705

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	389.4210	400.7187	407.1185	413.2558	408.3865	362.0630	289.6273	292.5027	335.8943	351.0313	363.0525	376.3771
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

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Heat loss rate W	1239.9873	1195.2803	1077.7957	896.2852	693.7991	476.7697	325.9588	340.0337	510.7141	765.5097	1021.1310	1235.7598 (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	632.8213	533.9454	498.9838	347.7812	212.3470	0.0000	0.0000	0.0000	0.0000	308.3719	473.8165	639.3807 (98)
Space heating												3647.4479 (98)
Space heating per m2												(98) / (4) = 48.9262 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												89.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4061.7460 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	632.8213	533.9454	498.9838	347.7812	212.3470	0.0000	0.0000	0.0000	0.0000	308.3719	473.8165	639.3807 (98)
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000 (210)
Space heating fuel (main heating system)	704.7008	594.5940	555.6612	387.2842	236.4666	0.0000	0.0000	0.0000	0.0000	343.3986	527.6353	712.0053 (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	172.1464	130.3244	107.7116	63.0556	35.3840	19.0131	14.8672	44.3211	67.7245	113.0205	148.1567	171.6259 (64)
Efficiency of water heater	87.4306	87.6215	87.8241	88.0867	88.2035	79.7000	79.7000	79.7000	79.7000	86.8482	87.1687	79.7000 (216)
Fuel for water heating, kWh/month	196.8950	148.7356	122.6448	71.5835	40.1163	23.8559	18.6540	55.6099	84.9743	130.1358	169.9655	196.2455 (219)
Water heating fuel used												1259.4161 (219)
Annual totals kWh/year												
Space heating fuel - main system												4061.7460 (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)												406.5466 (232)
Total delivered energy for all uses												5802.7086 (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	4061.7460	0.2160	877.3371 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1259.4161	0.2160	272.0339 (264)
Space and water heating			1149.3710 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	406.5466	0.5190	210.9977 (268)
Total CO2, kg/year			1399.2937 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.7700 (273)

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

DER		18.7700 ZC1
Total Floor Area		74.5500
Assumed number of occupants	TFA	2.3513
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190
CO2 emissions from appliances, equation (L14)	EF	16.5076 ZC2
CO2 emissions from cooking, equation (L16)		2.3532 ZC3
Total CO2 emissions		37.6308 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		37.6308 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	74.5500 (1b)	3.0000 (2b)	223.6500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	223.6500 (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)	
Air changes per hour						
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) =	0.1341 (8)
Pressure test					Yes	
Measured/design AP50					5.0000	
Infiltration rate					0.3841	(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) =	0.3265 (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	0.4163	0.4081	0.4000	0.3592	0.3510	0.3102	0.3102	0.3020	0.3265	0.3510	0.3673	0.3837 (22b)
Effective ac	0.5867	0.5833	0.5800	0.5645	0.5616	0.5481	0.5481	0.5456	0.5533	0.5616	0.5675	0.5736 (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)			5.0400	1.3258	6.6818		(27)					
Cavity Walls	49.0500	5.0400	44.0100	0.1800	7.9218		(29a)					
Flat Roof	74.5500		74.5500	0.1300	9.6915		(30)					
Total net area of external elements Aum(A, m ²)			123.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.2951		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K												
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							250.0000 (35)					
Total fabric heat loss						(33) + (36) =	9.5555 (36)					
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	43.2979	43.0496	42.8061	41.6627	41.4488	40.4529	40.4529	40.2685	40.8365	41.4488	41.8816	42.3340 (38)
Average = Sum(39)m / 12 =	77.1485	76.9002	76.6568	75.5134	75.2994	74.3036	74.3036	74.1191	74.6872	75.2994	75.7322	76.1846 (39)
HLP	1.0349	1.0315	1.0283	1.0129	1.0101	0.9967	0.9967	0.9942	1.0018	1.0101	1.0159	1.0219 (40)
HLP (average)												1.0129 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.3513 (42)
Average daily hot water use (litres/day)												90.0443 (43)
Daily hot water use	99.0488	95.4470	91.8452	88.2434	84.6417	81.0399	81.0399	84.6417	88.2434	91.8452	95.4470	99.0488 (44)
Energy conte	146.8865	128.4678	132.5673	115.5754	110.8973	95.6960	88.6764	101.7574	102.9728	120.0048	130.9946	142.2517 (45)
Energy content (annual)												Total = Sum(45)m = 1416.7480 (45)
Distribution loss (46)m = 0.15 x (45)m	22.0330	19.2702	19.8851	17.3363	16.6346	14.3544	13.3015	15.2636	15.4459	18.0007	19.6492	21.3378 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Combi loss	50.4742	43.9318	46.8033	43.5173	43.1325	39.9649	41.2970	43.1325	43.5173	46.8033	47.0698	50.4742 (61)
Total heat required for water heating calculated for each month												

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Solar input	197.3606	172.3996	179.3706	159.0927	154.0298	135.6609	129.9734	144.8899	146.4901	166.8081	178.0644	192.7259 (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	197.3606	172.3996	179.3706	159.0927	154.0298	135.6609	129.9734	144.8899	146.4901	166.8081	178.0644	192.7259 (64)
Heat gains from water heating, kWh/month	61.4583	53.6985	55.7795	49.3081	47.6565	41.8101	39.8092	44.6175	45.1178	51.6024	55.3232	59.9172 (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	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670	117.5670 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0204	20.4465	16.6282	12.5886	9.4101	7.9444	8.5842	11.1581	14.9764	19.0160	22.1945	23.6602 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.6756	209.8306	204.4000	192.8389	178.2451	164.5291	155.3659	153.2108	158.6414	170.2025	184.7963	198.5124 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567	34.7567 (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)	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536	-94.0536 (71)
Water heating gains (Table 5)	82.6052	79.9085	74.9724	68.4835	64.0544	58.0696	53.5069	59.9697	62.6636	69.3581	76.8377	80.5339 (72)
Total internal gains	374.5713	371.4557	357.2707	335.1812	312.9798	291.8132	278.7271	285.6088	297.5515	319.8467	345.0986	363.9766 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
North	5.0400	10.6334	0.6300		0.7000		0.7700	16.3785 (74)				
Solar gains	16.3785	31.3002	53.1866	85.4313	115.0838	123.2007	115.0236	91.2565	63.9475	37.2587	20.2050	13.6539 (83)
Total gains	390.9498	402.7558	410.4573	420.6125	428.0636	415.0139	393.7507	376.8653	361.4990	357.1054	365.3036	377.6305 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
tau	67.1054	67.3221	67.5359	68.5585	68.7533	69.6748	69.6748	69.8481	69.3169	68.7533	68.3604	67.9544
alpha	5.4737	5.4881	5.5024	5.5706	5.5836	5.6450	5.6450	5.6565	5.6211	5.5836	5.5574	5.5303
util living area	0.9990	0.9986	0.9974	0.9928	0.9741	0.9009	0.7608	0.8041	0.9550	0.9932	0.9982	0.9992 (86)
MIT	19.8447	19.9237	20.0954	20.3590	20.6338	20.8682	20.9645	20.9509	20.7798	20.4461	20.1115	19.8358 (87)
Th 2	20.4826	20.4842	20.4859	20.4935	20.4950	20.5017	20.5017	20.5029	20.4991	20.4950	20.4921	20.4890 (88)
util rest of house	0.9988	0.9983	0.9969	0.9912	0.9672	0.8719	0.6966	0.7460	0.9398	0.9914	0.9978	0.9990 (89)
MIT 2	19.3786	19.4589	19.6318	19.9011	20.1741	20.4023	20.4814	20.4731	20.3202	19.9894	19.6531	19.3750 (90)
Living area fraction									FLA = Living area / (4) =			0.7017 (91)
MIT	19.7056	19.7851	19.9571	20.2224	20.4966	20.7292	20.8204	20.8083	20.6427	20.3099	19.9748	19.6983 (92)
Temperature adjustment												0.6000
adjusted MIT	20.3056	20.3851	20.5571	20.8224	21.0966	21.3292	21.4204	21.4083	21.2427	20.9099	20.5748	20.2983 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9987	0.9983	0.9969	0.9923	0.9752	0.9164	0.8065	0.8433	0.9609	0.9929	0.9979	0.9990 (94)
Useful gains	390.4565	402.0603	409.2002	417.3595	417.4550	380.3056	317.5721	317.8022	347.3467	354.5658	364.5249	377.2430 (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	1234.8123	1190.8033	1077.5708	900.2983	707.5606	500.0060	358.1727	371.2144	533.4647	776.3290	1020.4729	1226.4446 (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	628.2007	530.0353	497.2677	347.7160	215.8386	0.0000	0.0000	0.0000	0.0000	313.7918	472.2826	631.8060 (98)
Space heating												3636.9386 (98)
Space heating per m2										(98) / (4) =		48.7852 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	88.4000 (206)

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Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4114.1839 (211)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	628.2007	530.0353	497.2677	347.7160	215.8386	0.0000	0.0000	0.0000	0.0000	313.7918	472.2826	631.8060	(98)
Space heating efficiency (main heating system 1)	88.4000	88.4000	88.4000	88.4000	88.4000	0.0000	0.0000	0.0000	0.0000	88.4000	88.4000	88.4000	(210)
Space heating fuel (main heating system)	710.6342	599.5875	562.5200	393.3439	244.1613	0.0000	0.0000	0.0000	0.0000	354.9681	534.2563	714.7127	(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	197.3606	172.3996	179.3706	159.0927	154.0298	135.6609	129.9734	144.8899	146.4901	166.8081	178.0644	192.7259	(64)
Efficiency of water heater (217)m	87.7611	87.6929	87.4831	86.9663	85.9006	80.3000	80.3000	80.3000	80.3000	86.6186	87.3904	80.3000	(216)
Fuel for water heating, kWh/month	224.8839	196.5947	205.0346	182.9360	179.3118	168.9425	161.8598	180.4358	182.4285	192.5777	203.7573	219.4601	(219)
Water heating fuel used													2298.2226 (219)
Annual totals kWh/year													
Space heating fuel - main system													4114.1839 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													39.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													84.0000 (231)
Electricity for lighting (calculated in Appendix L)													406.5466 (232)
Total delivered energy for all uses													6902.9532 (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	4114.1839	0.2160	888.6637 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2298.2226	0.2160	496.4161 (264)
Space and water heating			1385.0798 (265)
Pumps and fans	84.0000	0.5190	43.5960 (267)
Energy for lighting	406.5466	0.5190	210.9977 (268)
Total CO2, kg/m2/year			1639.6735 (272)
Emissions per m2 for space and water heating			18.5792 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.8303 (272b)
Emissions per m2 for pumps and fans			0.5848 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.5792 * 1.00) + 2.8303 + 0.5848, rounded to 2 d.p.			21.9900 (273)