

# Full SAP Calculation Printout



Property Reference	Apartment 2		Issued on Date	21/12/2023	
Assessment Reference	Apartment 2 Be Lean	Prop Type Ref	Apartment 1		
Property	Apartment 1, 95, Avenue Road, London, NW8 6HY				
SAP Rating	70 C	DER	32.07	TER	19.53
Environmental	72 C	% DER < TER			-64.21
CO <sub>2</sub> Emissions (t/year)	2.48	DFEE	73.31	TFEE	36.94
Compliance Check	See BREL	% DFEE < TFEE			-98.48
% DPER < TPER	-69.33	DPER	177.95	TPER	105.09
Assessor Details	Mr. Graham Suttill			Assessor ID	P035-0001
Client	Carnell Warren Associates Ltd, Wendy Warren				

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	91.1600 (1b)	2.5100 (2b)	228.8116 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	228.8116 (5)

## 2. Ventilation rate

	m <sup>3</sup> per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract 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)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		6.0000 (17)
Infiltration rate		0.3000 (18)
Number of sides sheltered		4 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2100 (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	0.2677	0.2625	0.2573	0.2310	0.2257	0.1995	0.1995	0.1943	0.2100	0.2257	0.2362	0.2467 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000 (23c)
Effective ac	0.3717	0.3665	0.3613	0.3350	0.3297	0.3035	0.3035	0.2983	0.3140	0.3297	0.3402	0.3508 (25)

## 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Windows (Uw = 1.40)			12.0300	1.3258	15.9489		(27)
Glazed Doors (Uw = 1.40)			18.2200	1.3258	24.1553		(27)
RL			1.1500	1.3258	1.5246		(27a)
Basement Floor			91.1600	0.2500	22.7900	110.0000	10027.6000 (28a)
Retaining Walls	21.8400		21.8400	0.3000	6.5520	9.0000	196.5600 (29a)
Wall to Lightwells	59.2100	27.4600	31.7500	0.3000	9.5250	9.0000	285.7500 (29a)
New External Wall	4.2100	2.7900	1.4200	0.1800	0.2556	150.0000	213.0000 (29a)
Flat Roof	3.4400	1.1500	2.2900	0.1500	0.3435	9.0000	20.6100 (30)
Total net area of external elements Aum (A, m <sup>2</sup> )			179.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.0949		(33)
Wall to Corridor			30.0100	0.0000	0.0000	20.0000	600.2000 (32)
Party Ceiling 1			87.7200			30.0000	2631.6000 (32b)
Internal Wall 1			163.0800			75.0000	12231.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26206.3200 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 287.4761 (35)  
 Thermal bridges (Default value 0.200 \* total exposed area) 35.9720 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 117.0669 (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 28.0700 27.6736 27.2772 25.2951 24.8987 22.9166 22.9166 22.5202 23.7095 24.8987 25.6915 26.4844 (38)  
 Average = Sum(39)m / 12 = 145.1369 144.7405 144.3441 142.3620 141.9656 139.9835 139.9835 139.5871 140.7763 141.9656 142.7584 143.5513 (39)  
 145.1369 144.7405 144.3441 142.3620 141.9656 139.9835 139.9835 139.5871 140.7763 141.9656 142.7584 143.5513 (39)

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 HLP (average) 1.5921 1.5878 1.5834 1.5617 1.5573 1.5356 1.5356 1.5312 1.5443 1.5573 1.5660 1.5747 (40)  
 Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6413 (42)  
 Hot water usage for mixer showers 76.7730 (42a)  
 Hot water usage for baths 29.4827 (42b)  
 Hot water usage for other uses 41.6792 (42c)  
 Average daily hot water use (litres/day) 136.3724 (43)  
 Daily hot water use  
 Energy conte 234.9187 206.7871 217.3189 185.5058 176.0237 154.4847 149.5008 157.7716 162.0784 185.6665 203.4456 231.6303 (45)  
 Energy content (annual) Total = Sum(45)m = 2265.1323  
 Distribution loss (46)m = 0.15 x (45)m  
 Water storage loss:  
 Store volume 300.0000 (47)  
 a) If manufacturer declared loss factor is known (kWh/day):  
 Temperature factor from Table 2b  
 Enter (49) or (54) in (55) 1.8000 (48)  
 Total storage loss 0.6000 (49)  
 33.4800 30.2400 33.4800 32.4000 33.4800 32.4000 33.4800 33.4800 32.4000 33.4800 32.4000 33.4800 (56)  
 If cylinder contains dedicated solar storage  
 Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 (57)  
 Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)  
 Total heat required for water heating calculated for each month  
 WWHRs 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)  
 PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)  
 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 (63c)  
 FGHRs 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)  
 Output from w/h  
 Total per year (kWh/year) = Sum(64)m = 2933.2283 (64)  
 2933 (64)  
 12Total per year (kWh/year)  
 Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)  
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month  
 123.5044 109.7577 117.6524 105.6103 103.9218 95.2958 95.1029 97.8530 97.8207 107.1280 111.5753 122.4110 (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  
 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5  
 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  
 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)  
 Water heating gains (Table 5)  
 Total internal gains  
 591.4708 604.3375 579.8010 558.9750 530.9694 511.7700 492.5440 493.7374 508.4389 525.9381 557.9189 579.3589 (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	2.2500	10.6334	0.4000	0.7000	0.5400	3.2557 (74)
South	9.7800	46.7521	0.4000	0.7000	0.5400	62.2206 (78)
North	3.6100	10.6334	0.4000	0.7000	0.5400	5.2236 (74)
West	14.6100	19.6403	0.4000	0.7000	0.5400	39.0474 (80)
East	1.1500	26.0000	0.4000	0.7000	1.0000	7.5348 (82)

Solar gains 117.2821 210.1399 310.9555 417.8705 492.9425 499.0332 477.1985 420.5713 348.3342 238.9634 142.4639 99.0296 (83)  
 Total gains 708.7529 814.4774 890.7565 976.8455 1023.9120 1010.8033 969.7425 914.3087 856.7731 764.9015 700.3828 678.3885 (84)

#### 7. Mean internal temperature (heating season)

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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	50.1563	50.2937	50.4318	51.1340	51.2767	52.0028	52.0028	52.1505	51.7099	51.2767	50.9920	50.7103
alpha	4.3438	4.3529	4.3621	4.4089	4.4184	4.4669	4.4669	4.4767	4.4473	4.4184	4.3995	4.3807
util living area	0.9966	0.9933	0.9860	0.9628	0.9024	0.7646	0.6019	0.6521	0.8637	0.9729	0.9934	0.9972 (86)
MIT	19.3157	19.5070	19.8072	20.2294	20.6092	20.8783	20.9681	20.9545	20.7714	20.2780	19.7312	19.2938 (87)
Th 2	19.6191	19.6223	19.6255	19.6416	19.6448	19.6609	19.6609	19.6642	19.6545	19.6448	19.6383	19.6319 (88)
util rest of house	0.9952	0.9906	0.9800	0.9451	0.8526	0.6509	0.4354	0.4870	0.7773	0.9564	0.9901	0.9961 (89)
MIT 2	17.7088	17.9549	18.3381	18.8754	19.3223	19.5967	19.6529	19.6510	19.5074	18.9458	18.2530	17.6894 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2253	18.4537	18.8102	19.3106	19.7359	20.0087	20.0756	20.0700	19.9137	19.3740	18.7281	18.2050 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2253	18.4537	18.8102	19.3106	19.7359	20.0087	20.0756	20.0700	19.9137	19.3740	18.7281	18.2050 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9931	0.9871	0.9749	0.9394	0.8566	0.6839	0.4900	0.5411	0.7973	0.9518	0.9869	0.9943 (94)
Useful gains	703.8801	804.0052	868.3582	917.6402	877.1313	691.2990	475.1363	494.7042	683.0692	728.0488	691.2069	674.5240 (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	2021.0704	1961.7754	1776.9116	1482.0713	1140.8249	757.1234	486.5305	512.2834	818.4314	1245.6018	1660.0087	2010.4421 (97)
Space heating kWh	979.9895	778.0216	675.9637	406.3904	196.1881	0.0000	0.0000	0.0000	0.0000	385.0595	697.5373	993.9231 (98a)
Space heating requirement - total per year (kWh/year)	5113.0732											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	979.9895	778.0216	675.9637	406.3904	196.1881	0.0000	0.0000	0.0000	0.0000	385.0595	697.5373	993.9231 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5113.0732											
Space heating per m2	(98c) / (4) = 56.0890 (99)											

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1315.8450	1035.8780	1060.8619	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7641	0.8468	0.8136	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1005.4367	877.2008	863.0777	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1164.8826	1118.0196	1050.9801	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	114.8011	179.1691	139.7994	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) = 0.6582 (105)											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	18.8900	29.4815	23.0034	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	71.3750 (107)											

## 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-Space and Water	1.0000 (303a)											
Factor for control and charging method (Table 4c(3)) for space heating	1.0000 (305)											
Factor for charging method (Table 4c(3)) for water heating	1.0000 (305a)											
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating:												
Space heating requirement	979.9895	778.0216	675.9637	406.3904	196.1881	0.0000	0.0000	0.0000	0.0000	385.0595	697.5373	993.9231 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50	1469.9843	1167.0324	1013.9455	609.5857	294.2821	0.0000	0.0000	0.0000	0.0000	577.5892	1046.3060	1490.8846
307a	1469.9843	1167.0324	1013.9455	609.5857	294.2821	0.0000	0.0000	0.0000	0.0000	577.5892	1046.3060	1490.8846 (307)
Space heating requirement	1469.9843	1167.0324	1013.9455	609.5857	294.2821	0.0000	0.0000	0.0000	0.0000	577.5892	1046.3060	1490.8846 (307)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	291.6611	258.0383	274.0613	240.4178	232.7661	209.3967	206.2432	214.5140	216.9904	242.4089	258.3576	288.3727 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50	437.4917	387.0575	411.0919	360.6267	349.1492	314.0951	309.3649	321.7711	325.4857	363.6134	387.5364	432.5590
310a	437.4917	387.0575	411.0919	360.6267	349.1492	314.0951	309.3649	321.7711	325.4857	363.6134	387.5364	432.5590 (310)
Water heating fuel	437.4917	387.0575	411.0919	360.6267	349.1492	314.0951	309.3649	321.7711	325.4857	363.6134	387.5364	432.5590 (310)
Cooling System Energy Efficiency Ratio	2.6000 (314)											
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	7.2654	11.3391	8.8475	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	22.5706	20.3864	22.5706	21.8425	22.5706	21.8425	22.5706	21.8425	21.8425	22.5706	21.8425	22.5706 (331)
Lighting	28.6349	22.9720	20.6837	15.1538	11.7052	9.5633	10.6779	13.8795	18.0281	23.6539	26.7170	29.4308 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000 (333a)											
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 (334a)											
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000 (335a)											
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000 (333b)											
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 (334b)											
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000 (335b)											
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating	7669.6099 (307)											

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Space heating fuel - secondary	0.0000 (309)
Water heating fuel - community heating	4399.8424 (310)
Efficiency of water heater	0.0000 (311)
Electricity used for heat distribution	76.6961 (313)
Space cooling fuel	27.4519 (321)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9520)	
mechanical ventilation fans (SFP = 0.9520)	265.7509 (330a)
Total electricity for the above, kWh/year	265.7509 (331)
Electricity for lighting (calculated in Appendix L)	231.1003 (332)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (333)
Wind generation	0.0000 (334)
Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	12593.7554 (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			89.5000 (367)
Space and Water heating from Boilers	13485.4215	0.2100	1799.5733 (367)
Electrical energy for heat distribution (space & water)	76.6961	0.0000	18.0709 (372)
Overall CO2 factor for heat network			0.2361 (386)
Total CO2 associated with community systems			2850.0094 (373)
Space and water heating			2850.0094 (376)
Space cooling	27.4519	0.1137	3.1214 (377)
Pumps, fans and electric keep-hot	265.7509	0.1387	36.8629 (378)
Energy for lighting	231.1003	0.1443	33.3549 (379)
Total CO2, kg/year			2923.3487 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			32.0700 (384)

## 13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Boilers			89.5000 (467a)
Space and Water heating from Boilers	13485.4215	1.1300	9683.4180 (467)
Electrical energy for heat distribution (space & water)	76.6961	0.0000	187.5691 (472)
Overall CO2 factor for heat network			1.2781 (486)
Total CO2 associated with community systems			15426.0954 (473)
Space and water heating			15426.0954 (476)
Space cooling	27.4519	1.4192	38.9590 (477)
Pumps, fans and electric keep-hot	265.7509	1.5128	402.0280 (478)
Energy for lighting	231.1003	1.5338	354.4693 (479)
Total Primary energy kWh/year			16221.5517 (483)
Dwelling Primary energy Rate (DPER)			177.9500 (484)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

## 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	91.1600 (1b)	2.5100 (2b)	228.8116 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 228.8116 (5)

## 2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract 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)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1311 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3811 (18)
Number of sides sheltered	4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2668 (21)

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	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	0.3401	0.3335	0.3268	0.2935	0.2868	0.2534	0.2534	0.2468	0.2668	0.2868	0.3001	0.3135 (22b)
	0.5578	0.5556	0.5534	0.5431	0.5411	0.5321	0.5321	0.5304	0.5356	0.5411	0.5450	0.5491 (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 = 1.20)			21.9500	1.1450	25.1336		(27)
RL			0.8300	2.0221	1.6783		(27a)
Basement Floor			91.1600	0.1300	11.8508		(28a)
Retaining Walls	21.8400		21.8400	0.1800	3.9312		(29a)
Wall to Lightwells	59.2100	19.9300	39.2800	0.1800	7.0704		(29a)
New External Wall	4.2100	2.0200	2.1900	0.1800	0.3942		(29a)
Flat Roof	3.4400	0.8300	2.6100	0.1100	0.2871		(30)
Total net area of external elements Aum(A, m2)			179.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		50.3456		(33)
Wall to Corridor			30.0100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							297.0987 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							8.9930 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	59.3386 (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	42.1219	41.9523	41.7861	41.0052	40.8591	40.1789	40.1789	40.0530	40.4409	40.8591	41.1546	41.4636 (38)
Heat transfer coeff	101.4605	101.2909	101.1247	100.3438	100.1976	99.5175	99.5175	99.3916	99.7795	100.1976	100.4932	100.8022 (39)
Average = Sum(39)m / 12 =												100.3431

  

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1130	1.1111	1.1093	1.1007	1.0991	1.0917	1.0917	1.0903	1.0946	1.0991	1.1024	1.1058 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6413 (42)
Hot water usage for mixer showers	68.5051	67.4756	65.9754	63.1051	60.9869	58.6247	57.2820	58.7708	60.4028	62.9391	65.8711	68.2427 (42a)
Hot water usage for baths	29.5827	29.1433	28.5246	27.3839	26.5297	25.5826	25.0710	25.6853	26.3542	27.3677	28.5320	29.4827 (42b)
Hot water usage for other uses	41.6792	40.1636	38.6480	37.1324	35.6168	34.1012	34.1012	35.6168	37.1324	38.6480	40.1636	41.6792 (42c)
Average daily hot water use (litres/day)												128.4774 (43)

  

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	139.7670	136.7826	133.1481	127.6214	123.1334	118.3084	116.4541	120.0729	123.8895	128.9549	134.5667	139.4045 (44)
Energy conte	221.3568	194.7766	204.6437	174.7073	165.7612	145.4740	140.8411	148.6753	152.7681	174.9905	191.7149	218.2738 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m	33.2035	29.2165	30.6965	26.2061	24.8642	21.8211	21.1262	22.3013	22.9152	26.2486	28.7572	32.7411 (46)
Water storage loss:												300.0000 (47)
Store volume												1.4400 (48)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (49)
Temperature factor from Table 2b												1.4400 (55)
Enter (49) or (54) in (55)												
Total storage loss	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400 (56)
If cylinder contains dedicated solar storage	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	265.9968	235.0966	249.2837	217.9073	210.4012	188.6740	185.4811	193.3153	195.9681	219.6305	234.9149	262.9138 (62)
WWHRS	-31.3177	-27.6976	-29.0033	-24.0159	-22.3820	-19.1524	-17.9523	-19.0905	-19.8158	-23.3607	-26.4648	-30.7377 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
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 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	234.6791	207.3989	220.2803	193.8914	188.0192	169.5216	167.5288	174.2248	176.1523	196.2699	208.4501	232.1761 (64)
Total per year (kWh/year)												2368.5926 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	109.3131	97.0192	103.7560	92.6502	90.8276	82.9301	82.5417	85.1465	85.3554	93.8964	98.3052	108.2880 (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	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	122.2043	135.2976	122.2043	126.2778	122.2043	126.2778	122.2043	122.2043	126.2778	122.2043	126.2778	122.2043 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1957	243.6986	237.3914	223.9643	207.0150	191.0851	180.4429	177.9400	184.2471	197.6742	214.6236	230.5535 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063 (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)	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507 (71)
Water heating gains (Table 5)	146.9263	144.3738	139.4570	128.6808	122.0801	115.1807	110.9431	114.4443	118.5492	126.2048	136.5350	145.5484 (72)

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Total internal gains  
572.9453 585.9890 561.6718 541.5420 513.9185 495.1626 476.2093 477.2076 491.6931 508.7024 540.0554 560.9253 (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	4.2500	10.6334	0.6300	0.7000	0.5400	0.5400	9.6858 (74)	
South	7.1000	46.7521	0.6300	0.7000	0.5400	0.5400	71.1433 (78)	
West	10.6000	19.6403	0.6300	0.7000	0.5400	0.5400	44.6198 (80)	
East	0.8300	26.0000	0.6300	0.7000	1.0000	1.0000	8.5651 (82)	

Solar gains 134.0140 240.0994 355.2442 477.3282 563.0387 569.9790 545.0468 480.3961 397.9260 273.0198 162.7845 113.1601 (83)  
Total gains 706.9593 826.0884 916.9160 1018.8701 1076.9572 1065.1416 1021.2561 957.6037 889.6191 781.7221 702.8399 674.0854 (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	74.1490	74.2732	74.3953	74.9743	75.0836	75.5967	75.5967	75.6925	75.3983	75.0836	74.8628	74.6333
alpha	5.9433	5.9515	5.9597	5.9983	6.0056	6.0398	6.0398	6.0462	6.0266	6.0056	5.9909	5.9756
util living area	0.9968	0.9913	0.9763	0.9205	0.7885	0.5869	0.4273	0.4746	0.7292	0.9487	0.9918	0.9975 (86)
MIT	19.9811	20.1639	20.4116	20.7150	20.9148	20.9878	20.9984	20.9972	20.9589	20.6900	20.2783	19.9476 (87)
Th 2	19.9902	19.9918	19.9932	20.0002	20.0015	20.0076	20.0076	20.0088	20.0053	20.0015	19.9989	19.9961 (88)
util rest of house	0.9955	0.9880	0.9673	0.8923	0.7278	0.5012	0.3318	0.3739	0.6426	0.9239	0.9881	0.9966 (89)
MIT 2	18.8169	19.0503	19.3619	19.7293	19.9380	20.0019	20.0072	20.0080	19.9820	19.7105	19.2026	18.7787 (90)
Living area fraction	19.1911	19.4082	19.6993	20.0461	20.2519	20.3188	20.3258	20.3259	20.2960	20.0253	19.5483	19.1544 (92)
MIT	19.1911	19.4082	19.6993	20.0461	20.2519	20.3188	20.3258	20.3259	20.2960	20.0253	19.5483	19.1544 (93)
Temperature adjustment												0.0000
adjusted MIT	19.1911	19.4082	19.6993	20.0461	20.2519	20.3188	20.3258	20.3259	20.2960	20.0253	19.5483	19.1544 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9941	0.9855	0.9640	0.8938	0.7441	0.5286	0.3626	0.4064	0.6693	0.9246	0.9859	0.9955 (94)
Useful gains	702.8161	814.1339	883.8707	910.6887	801.3108	563.0290	370.2655	389.1855	595.4248	722.7793	692.9266	671.0354 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.1000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1510.8577	1469.5495	1334.7748	1118.4454	856.8836	569.1179	370.7855	390.2027	618.2318	944.3975	1250.9746	1507.4351 (97)
Space heating kWh	601.1830	440.4393	335.4726	149.5849	41.3462	0.0000	0.0000	0.0000	0.0000	164.8840	401.7946	622.2813 (98a)
Space heating requirement - total per year (kWh/year)												2756.9859
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	601.1830	440.4393	335.4726	149.5849	41.3462	0.0000	0.0000	0.0000	0.0000	164.8840	401.7946	622.2813 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2756.9859
Space heating per m2												(98c) / (4) = 30.2434 (99)

## 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-Space and Water 1.0000 (303a)

Factor for control and charging method (Table 4c(3)) for space heating 1.0000 (305)

Factor for charging method (Table 4c(3)) for water heating 1.0000 (305a)

Distribution loss factor (Table 12c) for community heating system 1.5000 (306)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

Space heating:

Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	601.1830	440.4393	335.4726	149.5849	41.3462	0.0000	0.0000	0.0000	0.0000	164.8840	401.7946	622.2813 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50												
307a	901.7745	660.6590	503.2090	224.3773	62.0193	0.0000	0.0000	0.0000	0.0000	247.3259	602.6918	933.4220
Space heating requirement	901.7745	660.6590	503.2090	224.3773	62.0193	0.0000	0.0000	0.0000	0.0000	247.3259	602.6918	933.4220 (307)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)

Water heating

Annual water heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Annual water heating requirement	234.6791	207.3989	220.2803	193.8914	188.0192	169.5216	167.5288	174.2248	176.1523	196.2699	208.4501	232.1761 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50												
310a	352.0187	311.0984	330.4205	290.8371	282.0288	254.2823	251.2932	261.3372	264.2284	294.4048	312.6752	348.2641
Water heating fuel	352.0187	311.0984	330.4205	290.8371	282.0288	254.2823	251.2932	261.3372	264.2284	294.4048	312.6752	348.2641 (310)

Cooling System Energy Efficiency Ratio

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Lighting	25.3916	20.3701	18.3410	13.4374	10.3795	8.4801	9.4685	12.3075	15.9862	20.9748	23.6910	26.0974 (331)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-11.9395	-18.3148	-28.6072	-35.0297	-40.3449	-38.5895	-38.0983	-34.6583	-29.1099	-22.1235	-13.6347	-10.1558 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	-2.8912	-6.3090	-12.9860	-20.1933	-27.4107	-27.8290	-27.5256	-22.9931	-16.4355	-9.2627	-3.9324	-2.2712 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												4135.4788	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3552.8888	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												41.3548	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(331)
Electricity for lighting (calculated in Appendix L)												204.9251	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-500.6457	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												7392.6470	(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			89.5000	(367)
Space and Water heating from Boilers	8590.3549	0.2100	970.3358	(367)
Electrical energy for heat distribution (space & water)	41.3548	0.0000	11.4721	(372)
Overall CO2 factor for heat network			0.2361	(386)
Total CO2 associated with community systems			1815.4466	(373)
Space and water heating			1815.4466	(376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(378)
Energy for lighting	204.9251	0.1443	29.5770	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-320.6061	0.1329	-42.6040	
PV Unit electricity exported	-180.0396	0.1249	-22.4822	
Total			-65.0862	(380)
Total CO2, kg/year			1779.9374	(383)
EPC Target Carbon Dioxide Emission Rate (TER)			19.5300	(384)

## 13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			89.5000	(467a)
Space and Water heating from Boilers	8590.3549	1.1300	5221.3308	(467)
Electrical energy for heat distribution (space & water)	41.3548	0.0000	119.3320	(472)
Overall CO2 factor for heat network			1.2781	(486)
Total CO2 associated with community systems			9826.4331	(473)
Space and water heating			9826.4331	(476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(478)
Energy for lighting	204.9251	1.5338	314.3210	(479)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-320.6061	1.4910	-478.0320	
PV Unit electricity exported	-180.0396	0.4583	-82.5157	
Total			-560.5478	(480)
Total Primary energy kWh/year			9580.2063	(483)
Target Primary Energy Rate (TPER)			105.0900	(484)