Full SAP Calculation Printout

Property Reference	Kielder DET Plot 243	Issued on Date	01/09/2023
Assessment Reference	Hampton Woods	Prop Type Ref	Plot 243
Property	Plot 243, Hampton Woods, Peterborough, PE7		

SAP Rating	92 A	DER	9.38	TER	9.54
Environmental	91 B	% DER < TER			1.68
CO_2 Emissions (t/year)	1.1	DFEE	37.87	TFEE	37.93
Compliance Check	See BREL	% DFEE < TFEE			0.15
% DPER < TPER	0.31	DPER	49.71	TPER	49.86

Assessor Details	Mr. Ben Tunningley	Assessor ID	AU36-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor	64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(5)

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2. Ventilation rate

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		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	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)+(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		4.9000	(17)
Infiltration rate		0.2450	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2266	(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	0.2889	0.2833	0.2776	0.2493	0.2436	0.2153	0.2153	0.2096	0.2266	0.2436	0.2550	0.2663	(22b)

Mechanical extract ventilation - decentralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5389	0.5333	0.5276	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5050	0.5163	(25)

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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	
entrance			2.1000	1.2000	2.5200			(26)
rear/utility entrance			2.1000	1.1000	2.3100			(26a)
glazing (Uw = 1.30)			18.7000	1.2357	23.1084			(27)

ground			64.5000	0.1200	7.7400	75.0000	4837.5000	(28a)
external wall	158.1100	22.9000	135.2100	0.2400	32.4504	9.0000	1216.8900	(29a)
cold	64.5000		64.5000	0.0900	5.8050	9.0000	580.5000	(30)
Total net area of external elements Aum(A, m2)			287.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.9338			(33)
stud			152.7000			9.0000	1374.3000	(32c)
block			37.2000			75.0000	2790.0000	(32c)
internal			64.5000			18.0000	1161.0000	(32d)
internal			64.5000			9.0000	580.5000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12540.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.2147 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3 Sill	11.9000	0.0090	0.1071
E4 Jamb	39.9000	0.0140	0.5586
E5 Ground floor (normal)	32.6000	0.0550	1.7930
E6 Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.1000	0.0460	0.5566
E12 Gable (insulation at ceiling level)	20.5000	0.0540	1.1070
E16 Corner (normal)	24.2500	0.0480	1.1640
E17 Corner (inverted – internal area greater than external area)	4.8500	-0.0970	-0.4704

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.6033 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 79.5371 (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	55.6367	55.0518	54.4669	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	52.1274	53.2972	(38)
Heat transfer coeff	135.1738	134.5889	134.0041	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.6646	132.8343	(39)
Average = Sum(39)m / 12 =												132.1949	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0479	1.0433	1.0388	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0207	1.0297	(40)
HLP (average)												1.0248	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8924 (42)
Hot water usage for mixer showers

72.7150	71.6223	70.0299	66.9832	64.7348	62.2274	60.8022	62.3825	64.1148	66.8070	69.9192	72.4364	(42a)

Hot water usage for baths

31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869	(42b)

Hot water usage for other uses

44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506	(42c)

Average daily hot water use (litres/day) 136.3749 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.3587	145.1906	141.3325	135.4661	130.7022	125.5805	123.6124	127.4538	131.5051	136.8819	142.8387	147.9739	(44)
Energy conte	234.9639	206.7494	217.2228	185.4464	175.9502	154.4159	149.4985	157.8144	162.1590	185.7475	203.4999	231.6914	(45)
Energy content (annual)										Total = Sum(45)m =		2265.1594	
Distribution loss (46)m = 0.15 x (45)m	35.2446	31.0124	32.5834	27.8170	26.3925	23.1624	22.4248	23.6722	24.3238	27.8621	30.5250	34.7537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	14.3205	12.9215	14.2779	13.7579	14.1788	13.6834	14.1154	14.1353	13.7020	14.2024	13.8012	14.3126	(61)
Total heat required for water heating calculated for each month	249.2843	219.6709	231.5007	199.2042	190.1291	168.0993	163.6139	171.9498	175.8609	199.9498	217.3011	246.0041	(62)
WWHRS	-64.0386	-56.6362	-59.3062	-49.1079	-45.7668	-39.1629	-36.7090	-39.0364	-40.5195	-47.7680	-54.1154	-62.8527	(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	185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514	(64)
									Total per year (kWh/year) = Sum(64)m =			1837.5488	(64)
12Total per year (kWh/year)												1838	(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	81.7056	71.9746	75.7961	65.1004	62.0482	54.7641	53.2371	56.0071	57.3434	65.3116	71.1140	80.6156	(65)

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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	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	159.2440	176.3058	159.2440	164.5521	159.2440	164.5521	159.2440	159.2440	164.5521	159.2440	164.5521	159.2440	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	296.5112	299.5881	291.8345	275.3280	254.4916	234.9083	221.8254	218.7486	226.5021	243.0086	263.8451	283.4284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)													
	109.8194	107.1050	101.8764	90.4172	83.3981	76.0613	71.5552	75.2784	79.6435	87.7844	98.7695	108.3542	(72)
Total internal gains													
	634.9598	652.3842	622.3402	599.6826	566.5189	541.9070	519.0099	519.6562	537.0831	559.4223	596.5519	620.4119	(73)

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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	
East	10.1500	19.6403	0.4600	0.0000	0.7700	70.6093	(76)
South	0.7000	46.7521	0.4600	0.0000	0.7700	11.5917	(78)
West	7.8500	19.6403	0.4600	0.0000	0.7700	54.6092	(80)

Solar gains	136.8102	263.9381	427.5867	615.6724	749.5150	765.5157	729.4879	629.6229	494.4372	311.1347	169.8728	112.9899	(83)
Total gains	771.7700	916.3223	1049.9269	1215.3550	1316.0339	1307.4226	1248.4978	1149.2791	1031.5203	870.5570	766.4247	733.4017	(84)

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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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.7707	25.8827	25.9957	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.4576	26.2246	
alpha	2.7180	2.7255	2.7330	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7638	2.7483	
util living area													
	0.9637	0.9424	0.9050	0.8237	0.7063	0.5591	0.4312	0.4791	0.6850	0.8723	0.9455	0.9680	(86)
MIT	18.4757	18.8227	19.3386	20.0117	20.5104	20.8171	20.9347	20.9111	20.6654	19.9800	19.1378	18.4452	(87)
Th 2	20.0436	20.0474	20.0511	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0662	20.0586	(88)
util rest of house													
	0.9586	0.9344	0.8916	0.7991	0.6651	0.4963	0.3500	0.3961	0.6272	0.8486	0.9366	0.9634	(89)
MIT 2	17.0726	17.5127	18.1621	19.0008	19.5881	19.9212	20.0304	20.0130	19.7752	18.9802	17.9277	17.0426	(90)
Living area fraction									fLA = Living area / (4) =			0.1225	(91)
MIT	17.2444	17.6731	18.3062	19.1246	19.7011	20.0309	20.1411	20.1230	19.8842	19.1027	18.0759	17.2144	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.0944	17.5231	18.1562	18.9746	19.5511	19.8809	19.9911	19.9730	19.7342	18.9527	17.9259	17.0644	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.9048	0.8568	0.7647	0.6395	0.4826	0.3428	0.3869	0.6037	0.8126	0.9079	0.9417	(94)
Useful gains	721.5924	829.1238	899.5731	929.3879	841.6011	630.9812	428.0182	444.6916	622.7334	707.4185	695.8177	690.6599	(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													
	1729.4711	1698.9347	1561.9774	1321.3162	1029.6926	692.6108	444.7598	468.6155	738.9453	1095.4785	1425.3917	1708.8328	(97)
Space heating kWh													
	749.8618	584.5129	492.8288	282.1883	139.9401	0.0000	0.0000	0.0000	0.0000	288.7167	525.2933	757.5206	(98a)
Space heating requirement - total per year (kWh/year)												3820.8626	
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													
	749.8618	584.5129	492.8288	282.1883	139.9401	0.0000	0.0000	0.0000	0.0000	288.7167	525.2933	757.5206	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3820.8626	
Space heating per m2											(98c) / (4) =	29.6191	(99)

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 %)												89.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	749.8618	584.5129	492.8288	282.1883	139.9401	0.0000	0.0000	0.0000	0.0000	288.7167	525.2933	757.5206	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	842.5413	656.7561	553.7403	317.0656	157.2361	0.0000	0.0000	0.0000	0.0000	324.4008	590.2172	851.1467	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)

Space heating fuel (main heating system 2)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)

Space heating fuel (secondary)

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

185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514 (64)

Efficiency of water heater 87.3000 (216)

(217)m	88.6580	88.6236	88.5535	88.4023	88.1286	87.3000	87.3000	87.3000	87.3000	88.4058	88.5911	88.6638 (217)

Fuel for water heating, kWh/month

208.9443	183.9630	194.4526	169.7879	163.8087	147.6934	145.3664	152.2490	155.0303	172.1401	184.2010	206.5683 (219)

Space cooling fuel requirement

(221)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 (221)
Pumps and Fa	11.6467	10.5196	11.6467	11.2710	11.6467	11.2710	11.6467	11.6467	11.2710	11.6467	11.2710	11.6467 (231)
Lighting	33.8796	27.1795	24.4721	17.9293	13.8491	11.3148	12.6336	16.4217	21.3301	27.9863	31.6104	34.8212 (232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	-24.2616	-39.1295	-64.9003	-82.1387	-94.9037	-90.7251	-89.0767	-80.4852	-65.9460	-48.0476	-28.0358	-20.2455 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)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 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)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 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)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 (235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	-8.0451	-19.8645	-47.9558	-85.2348	-124.5205	-129.8568	-126.5637	-99.7412	-63.7033	-30.8423	-11.3142	-6.0801 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)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 (234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)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 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)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 (235d)

Annual totals kWh/year

Space heating fuel - main system 1 4293.1040 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 87.3000
Water heating fuel used 2084.2051 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 4.9570, total flow = 37.0000, SFP = 0.1340)
mechanical ventilation fans (SFP = 0.1340) 51.1303 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 137.1303 (231)
Electricity for lighting (calculated in Appendix L) 273.4278 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -1481.6181 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 5306.2491 (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	4293.1040	0.2100	901.5518	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2084.2051	0.2100	437.6831	(264)
Space and water heating			1339.2349	(265)
Pumps, fans and electric keep-hot	137.1303	0.1387	19.0217	(267)
Energy for lighting	273.4278	0.1443	39.4641	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-727.8957	0.1323	-96.3204	
PV Unit electricity exported	-753.7224	0.1219	-91.9055	
Total			-188.2259	(269)
Total CO2, kg/year			1209.4947	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.3800	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4293.1040	1.1300	4851.2075	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2084.2051	1.1300	2355.1518	(278)
Space and water heating			7206.3593	(279)
Pumps, fans and electric keep-hot	137.1303	1.5128	207.4507	(281)
Energy for lighting	273.4278	1.5338	419.3927	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-727.8957	1.4889	-1083.7895	

PV Unit electricity exported	-753.7224	0.4474	-337.2079
Total			-1420.9974 (283)
Total Primary energy kWh/year			6412.2054 (286)
Dwelling Primary energy Rate (DPER)			49.7100 (287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor	64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(5)

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2. Ventilation rate

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		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	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1279	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3779	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3495	(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	0.4456	0.4369	0.4282	0.3845	0.3757	0.3321	0.3321	0.3233	0.3495	0.3757	0.3932	0.4107	(22b)
Effective ac	0.5993	0.5954	0.5917	0.5739	0.5706	0.5551	0.5551	0.5523	0.5611	0.5706	0.5773	0.5843	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Semi-glazed door			2.1000	1.0000	2.1000			(26a)
TER Opening Type (Uw = 1.20)			18.7000	1.1450	21.4122			(27)
ground			64.5000	0.1300	8.3850			(28a)
external wall	158.1100	22.9000	135.2100	0.1800	24.3378			(29a)
cold	64.5000		64.5000	0.1100	7.0950			(30)
Total net area of external elements Aum(A, m2)			287.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.4300			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	97.2147 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3 Sill	11.9000	0.0500	0.5950
E4 Jamb	39.9000	0.0500	1.9950
E5 Ground floor (normal)	32.6000	0.1600	5.2160
E6 Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.1000	0.0600	0.7260
E12 Gable (insulation at ceiling level)	20.5000	0.0600	1.2300
E16 Corner (normal)	24.2500	0.0900	2.1825
E17 Corner (inverted – internal area greater than external area)	4.8500	-0.0900	-0.4365

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.2955 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 77.7255 (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	61.8671	61.4691	61.0789	59.2463	58.9034	57.3072	57.3072	57.0116	57.9220	58.9034	59.5970	60.3222	(38)
Heat transfer coeff	139.5927	139.1946	138.8044	136.9718	136.6289	135.0327	135.0327	134.7371	135.6475	136.6289	137.3225	138.0477	(39)

Average = Sum(39)m / 12 = 136.9701

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0821	1.0790	1.0760	1.0618	1.0591	1.0468	1.0468	1.0445	1.0515	1.0591	1.0645	1.0701	(40)
HLP (average)												1.0618	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8924 (42)
Hot water usage for mixer showers

72.7150	71.6223	70.0299	66.9832	64.7348	62.2274	60.8022	62.3825	64.1148	66.8070	69.9192	72.4364	(42a)

Hot water usage for baths

31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869	(42b)

Hot water usage for other uses

44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506	(42c)

Average daily hot water use (litres/day) 136.3749 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.3587	145.1906	141.3325	135.4661	130.7022	125.5805	123.6124	127.4538	131.5051	136.8819	142.8387	147.9739	(44)
Energy conte	234.9639	206.7494	217.2228	185.4464	175.9502	154.4159	149.4985	157.8144	162.1590	185.7475	203.4999	231.6914	(45)

Energy content (annual) Total = Sum(45)m = 2265.1594

Distribution loss (46)m = 0.15 x (45)m

35.2446	31.0124	32.5834	27.8170	26.3925	23.1624	22.4248	23.6722	24.3238	27.8621	30.5250	34.7537	(46)

Water storage loss:
Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

285.9228	252.7768	268.1817	234.7614	226.9091	203.7310	200.4574	208.7734	211.4740	236.7064	252.8150	282.6503	(62)
WWHRS -33.2423	-29.3997	-30.7857	-25.4918	-23.7574	-20.3294	-19.0556	-20.2637	-21.0336	-24.7963	-28.0912	-32.6267	(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

252.6805	223.3771	237.3960	209.2696	203.1517	183.4016	181.4018	188.5097	190.4404	211.9101	224.7238	250.0237	(64)

Total per year (kWh/year) = Sum(64)m = 2556.2860 (64)

12Total per year (kWh/year) 2556 (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

90.8652	80.2510	84.9663	73.9897	71.2432	63.6721	62.4480	65.2130	66.2466	74.5008	79.9925	89.7771	(65)

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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	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	159.2440	176.3058	159.2440	164.5521	159.2440	164.5521	159.2440	159.2440	164.5521	159.2440	164.5521	159.2440	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.5112	299.5881	291.8345	275.3280	254.4916	234.9083	221.8254	218.7486	226.5021	243.0086	263.8451	283.4284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)	122.1307	119.4212	114.2020	102.7635	95.7570	88.4334	83.9355	87.6519	92.0092	100.1354	111.1007	120.6682	(72)
Total internal gains	647.2711	664.7004	634.6658	612.0289	578.8778	554.2791	531.3901	532.0297	549.4487	571.7733	608.8831	632.7258	(73)

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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	
East	10.1500	19.6403	0.6300	0.7000	0.7700	60.9235	(76)
South	0.7000	46.7521	0.6300	0.7000	0.7700	10.0016	(78)

West			7.8500	19.6403	0.6300	0.7000	0.7700				47.1182 (80)	
Solar gains	118.0434	227.7327	368.9330	531.2182	646.7011	660.5069	629.4212	543.2550	426.6134	268.4551	146.5707	97.4906 (83)
Total gains	765.3145	892.4331	1003.5987	1143.2471	1225.5789	1214.7860	1160.8113	1075.2848	976.0621	840.2284	755.4538	730.2164 (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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.9549	25.0263	25.0966	25.4324	25.4963	25.7976	25.7976	25.8542	25.6807	25.4963	25.3675	25.2342	
alpha	2.6637	2.6684	2.6731	2.6955	2.6998	2.7198	2.7198	2.7236	2.7120	2.6998	2.6912	2.6823	
util living area													
	0.9648	0.9466	0.9154	0.8473	0.7427	0.5982	0.4678	0.5139	0.7151	0.8845	0.9484	0.9687	(86)
MIT	18.3765	18.6976	19.1941	19.8572	20.4015	20.7705	20.9147	20.8878	20.6036	19.8744	19.0236	18.3335	(87)
Th 2	20.0155	20.0180	20.0205	20.0322	20.0343	20.0445	20.0445	20.0464	20.0406	20.0343	20.0299	20.0253	(88)
util rest of house													
	0.9598	0.9390	0.9030	0.8242	0.7024	0.5331	0.3800	0.4258	0.6574	0.8620	0.9398	0.9642	(89)
MIT 2	16.9312	17.3385	17.9647	18.7919	19.4420	19.8570	19.9932	19.9748	19.6897	18.8308	17.7633	16.8823	(90)
Living area fraction										fLA = Living area / (4) =		0.1225	(91)
MIT	17.1082	17.5050	18.1153	18.9224	19.5596	19.9689	20.1061	20.0867	19.8017	18.9586	17.9177	17.0601	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1082	17.5050	18.1153	18.9224	19.5596	19.9689	20.1061	20.0867	19.8017	18.9586	17.9177	17.0601	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9375	0.9117	0.8711	0.7922	0.6799	0.5275	0.3860	0.4298	0.6411	0.8300	0.9132	0.9435	(94)
Useful gains	717.5119	813.6296	874.2137	905.7072	833.2502	640.8450	448.0825	462.1659	625.7400	697.3607	689.8794	688.9823	(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													
	1787.9369	1754.5413	1612.2558	1372.7835	1073.8429	724.9799	473.4365	496.7308	773.4185	1142.0295	1485.5124	1775.3038	(97)
Space heating kWh													
	796.3962	632.2926	549.1033	336.2949	179.0010	0.0000	0.0000	0.0000	0.0000	330.8336	572.8558	808.2232	(98a)
Space heating requirement - total per year (kWh/year)												4205.0007	
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													
	796.3962	632.2926	549.1033	336.2949	179.0010	0.0000	0.0000	0.0000	0.0000	330.8336	572.8558	808.2232	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4205.0007	
Space heating per m2											(98c) / (4) =	32.5969	(99)

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 %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	796.3962	632.2926	549.1033	336.2949	179.0010	0.0000	0.0000	0.0000	0.0000	330.8336	572.8558	808.2232	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	861.9006	684.2994	594.2677	363.9556	193.7240	0.0000	0.0000	0.0000	0.0000	358.0450	619.9738	874.7004	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	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													
	252.6805	223.3771	237.3960	209.2696	203.1517	183.4016	181.4018	188.5097	190.4404	211.9101	224.7238	250.0237	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6644	86.4821	86.1162	85.3920	84.1113	80.3000	80.3000	80.3000	80.3000	85.3318	86.2960	86.7061	(217)
Fuel for water heating, kWh/month													
	291.5619	258.2929	275.6695	245.0694	241.5273	228.3955	225.9052	234.7567	237.1612	248.3366	260.4106	288.3578	(219)
Space cooling fuel requirement													
(221)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	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	33.0878	26.5442	23.9001	17.5103	13.5254	11.0504	12.3383	16.0379	20.8316	27.3322	30.8716	34.0074	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-57.3505	-79.3544	-111.9347	-123.3695	-130.8920	-121.3185	-119.7228	-114.0122	-103.6981	-89.4781	-62.4776	-49.7524	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)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	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)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	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235c)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 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-37.0902	-77.4480	-152.9275	-228.2864	-300.5708	-301.6294	-298.1654	-253.1076	-186.3317	-110.3865	-49.3884	-29.3813 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)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 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)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 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)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 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4550.8665 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	3035.4447 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	267.0371 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3188.0741 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4751.2742 (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	4550.8665	0.2100	955.6820	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3035.4447	0.2100	637.4434	(264)
Space and water heating			1593.1254	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	267.0371	0.1443	38.5417	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1163.3609	0.1350	-157.0712	
PV Unit electricity exported	-2024.7132	0.1261	-255.2561	
Total			-412.3273	(269)
Total CO2, kg/year			1231.2690	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4550.8665	1.1300	5142.4792	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3035.4447	1.1300	3430.0525	(278)
Space and water heating			8572.5317	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	267.0371	1.5338	409.5905	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1163.3609	1.4990	-1743.8974	
PV Unit electricity exported	-2024.7132	0.4628	-936.9802	
Total			-2680.8776	(283)
Total Primary energy kWh/year			6431.3453	(286)
Target Primary Energy Rate (TPER)			49.8600	(287)

Full SAP Calculation Printout

Property Reference	Kielder DET Plot 243	Issued on Date	01/09/2023
Assessment Reference	Hampton Woods	Prop Type Ref	Plot 243
Property	Plot 243, Hampton Woods, Peterborough, PE7		

SAP Rating	92 A	DER	9.38	TER	9.54
Environmental	91 B	% DER < TER			1.68
CO_2 Emissions (t/year)	1.1	DFEE	37.87	TFEE	37.93
Compliance Check	See BREL	% DFEE < TFEE			0.15
% DPER < TPER	0.31	DPER	49.71	TPER	49.86

Assessor Details	Mr. Ben Tunningley	Assessor ID	AU36-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor		64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(5)

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2. Ventilation rate

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			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		4 * 10 =	40.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5) =	0.1279	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.9000	(17)
Infiltration rate			0.3729	(18)
Number of sides sheltered			1	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3449	(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	0.4398	0.4311	0.4225	0.3794	0.3708	0.3277	0.3277	0.3190	0.3449	0.3708	0.3880	0.4053	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5967	0.5929	0.5893	0.5720	0.5687	0.5537	0.5537	0.5509	0.5595	0.5687	0.5753	0.5821	(25)

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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	
entrance			2.1000	1.2000	2.5200			(26)
rear/utility entrance			2.1000	1.1000	2.3100			(26a)
glazing (Uw = 1.30)			18.7000	1.2357	23.1084			(27)
ground			64.5000	0.1200	7.7400	75.0000	4837.5000	(28a)
external wall	158.1100	22.9000	135.2100	0.2400	32.4504	9.0000	1216.8900	(29a)

cold	64.5000	64.5000	0.0900	5.8050	9.0000	580.5000 (30)
Total net area of external elements Aum(A, m2)		287.1100				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		73.9338		(33)
stud		152.7000			9.0000	1374.3000 (32c)
block		37.2000			75.0000	2790.0000 (32c)
internal		64.5000			18.0000	1161.0000 (32d)
internal		64.5000			9.0000	580.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12540.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.2147 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3 Sill	11.9000	0.0090	0.1071
E4 Jamb	39.9000	0.0140	0.5586
E5 Ground floor (normal)	32.6000	0.0550	1.7930
E6 Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.1000	0.0460	0.5566
E12 Gable (insulation at ceiling level)	20.5000	0.0540	1.1070
E16 Corner (normal)	24.2500	0.0480	1.1640
E17 Corner (inverted – internal area greater than external area)	4.8500	-0.0970	-0.4704

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.6033 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 79.5371 (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	61.5977	61.2101	60.8301	59.0457	58.7118	57.1576	57.1576	56.8698	57.7562	58.7118	59.3872	60.0933	(38)
Heat transfer coeff	141.1348	140.7472	140.3673	138.5828	138.2489	136.6947	136.6947	136.4069	137.2934	138.2489	138.9243	139.6304	(39)
Average = Sum(39)m / 12 =												138.5812	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0941	1.0911	1.0881	1.0743	1.0717	1.0596	1.0596	1.0574	1.0643	1.0717	1.0769	1.0824	(40)
HLP (average)												1.0743	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8924 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869	(42b)

Hot water usage for other uses

44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506	(42c)

Average daily hot water use (litres/day) 69.3341 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.6436	73.5683	71.3026	68.4830	65.9674	63.3532	62.8102	65.0713	67.3903	70.0749	72.9195	75.5375	(44)
Energy conte	119.8010	104.7603	109.5895	93.7497	88.8048	77.9001	75.9636	80.5719	83.0990	95.0910	103.8872	118.2735	(45)
Energy content (annual)										Total = Sum(45)m =		1151.4915	

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:
Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
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

101.8309	89.0462	93.1511	79.6873	75.4841	66.2151	64.5690	68.4861	70.6341	80.8273	88.3041	100.5325	(62)
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

101.8309	89.0462	93.1511	79.6873	75.4841	66.2151	64.5690	68.4861	70.6341	80.8273	88.3041	100.5325	(64)
								Total per year (kWh/year) = Sum(64)m =			978.7678	(64)
12Total per year (kWh/year)											979	(64)

Electric shower(s)

58.2326	51.8858	56.6573	54.0673	55.0819	52.5428	54.2942	55.0819	54.0673	56.6573	55.5919	58.2326	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				662.3928	(64a)

Heat gains from water heating, kWh/month

40.0159	35.2330	37.4521	33.4387	32.6415	29.6895	29.7158	30.8920	31.1754	34.3711	35.9740	39.6913	(65)

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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	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	159.2440	176.3058	159.2440	164.5521	159.2440	164.5521	159.2440	159.2440	164.5521	159.2440	164.5521	159.2440	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.5112	299.5881	291.8345	275.3280	254.4916	234.9083	221.8254	218.7486	226.5021	243.0086	263.8451	283.4284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													

	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	(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)													
	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)													
	53.7848	52.4301	50.3388	46.4426	43.8730	41.2354	39.9406	41.5215	43.2991	46.1978	49.9639	53.3485	(72)
Total internal gains													
	575.9253	594.7092	567.8026	552.7080	523.9938	507.0810	487.3953	485.8993	500.7386	514.8356	544.7463	562.4061	(73)

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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	
East	10.1500	19.6403	0.4600	0.0000	0.7700	70.6093	(76)
South	0.7000	46.7521	0.4600	0.0000	0.7700	11.5917	(78)
West	7.8500	19.6403	0.4600	0.0000	0.7700	54.6092	(80)

Solar gains	136.8102	263.9381	427.5867	615.6724	749.5150	765.5157	729.4879	629.6229	494.4372	311.1347	169.8728	112.9899	(83)
Total gains	712.7354	858.6474	995.3893	1168.3804	1273.5088	1272.5967	1216.8832	1115.5222	995.1759	825.9703	714.6192	675.3960	(84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.6823	24.7502	24.8172	25.1368	25.1975	25.4840	25.4840	25.5378	25.3729	25.1975	25.0750	24.9482	
alpha	2.6455	2.6500	2.6545	2.6758	2.6798	2.6989	2.6989	2.7025	2.6915	2.6798	2.6717	2.6632	
util living area													
	0.9701	0.9511	0.9174	0.8431	0.7317	0.5833	0.4540	0.5035	0.7109	0.8893	0.9546	0.9739	(86)
MIT	18.2685	18.6204	19.1557	19.8573	20.4149	20.7798	20.9186	20.8907	20.6024	19.8372	18.9391	18.2199	(87)
Th 2	20.0057	20.0081	20.0105	20.0219	20.0240	20.0339	20.0339	20.0358	20.0301	20.0240	20.0197	20.0152	(88)
util rest of house													
	0.9657	0.9440	0.9052	0.8195	0.6904	0.5179	0.3671	0.4155	0.6525	0.8673	0.9468	0.9700	(89)
MIT 2	17.4992	17.8478	18.3745	19.0575	19.5750	19.8949	19.9962	19.9819	19.7569	19.0543	18.1743	17.4573	(90)
Living area fraction										fLA = Living area / (4) =		0.1225	(91)
MIT	17.5934	17.9424	18.4702	19.1555	19.6779	20.0032	20.1092	20.0932	19.8604	19.1502	18.2680	17.5507	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5934	17.9424	18.4702	19.1555	19.6779	20.0032	20.1092	20.0932	19.8604	19.1502	18.2680	17.5507	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9506	0.9242	0.8809	0.7948	0.6740	0.5156	0.3742	0.4211	0.6410	0.8427	0.9278	0.9562	(94)
Useful gains	677.5528	793.5631	876.8105	928.6325	858.3893	656.2093	455.3502	469.7496	637.8974	696.0040	663.0407	645.8459	(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													
	1876.1610	1835.6820	1680.2172	1421.2350	1102.9353	738.5956	479.6856	503.7765	790.8681	1182.0543	1551.5063	1864.1597	(97)
Space heating kWh													
	891.7645	700.3038	597.7346	354.6738	181.9422	0.0000	0.0000	0.0000	0.0000	361.6214	639.6953	906.4254	(98a)
Space heating requirement - total per year (kWh/year)												4634.1610	
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													
	891.7645	700.3038	597.7346	354.6738	181.9422	0.0000	0.0000	0.0000	0.0000	361.6214	639.6953	906.4254	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4634.1610	
Space heating per m2											(98c) / (4) =	35.9237	(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	1284.9301	1011.5408	1036.6923	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7635	0.8251	0.7906	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	981.0022	834.5873	819.6460	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1413.6300	1351.8203	1236.5977	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	311.4920	384.8214	310.2120	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(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	77.8730	96.2053	77.5530	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												251.6314	(107)
Energy for space heating												35.9237	(99)

Energy for space cooling 1.9506 (108)
Total 37.8744 (109)
Fabric Energy Efficiency (DFEE) 37.9 (109)

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

---
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor	64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(5)

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2. Ventilation rate
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	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	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1279	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3779	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3495	(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	0.4456	0.4369	0.4282	0.3845	0.3757	0.3321	0.3321	0.3233	0.3495	0.3757	0.3932	0.4107	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

Effective ac	0.5993	0.5954	0.5917	0.5739	0.5706	0.5551	0.5551	0.5523	0.5611	0.5706	0.5773	0.5843	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Semi-glazed door			2.1000	1.0000	2.1000			(26a)
TER Opening Type (Uw = 1.20)			18.7000	1.1450	21.4122			(27)
ground			64.5000	0.1300	8.3850			(28a)
external wall	158.1100	22.9000	135.2100	0.1800	24.3378			(29a)
cold	64.5000		64.5000	0.1100	7.0950			(30)
Total net area of external elements Aum(A, m2)			287.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.4300			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.2147 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3 Sill	11.9000	0.0500	0.5950
E4 Jamb	39.9000	0.0500	1.9950
E5 Ground floor (normal)	32.6000	0.1600	5.2160
E6 Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.1000	0.0600	0.7260
E12 Gable (insulation at ceiling level)	20.5000	0.0600	1.2300
E16 Corner (normal)	24.2500	0.0900	2.1825

E17 Corner (inverted – internal area greater than external area)									4.8500	-0.0900	-0.4365		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													12.2955 (36)
Point Thermal bridges												(36a) =	0.0000
Total fabric heat loss												(33) + (36) + (36a) =	77.7255 (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	61.8671	61.4691	61.0789	59.2463	58.9034	57.3072	57.3072	57.0116	57.9220	58.9034	59.5970	60.3222	(38)
Heat transfer coeff	139.5927	139.1946	138.8044	136.9718	136.6289	135.0327	135.0327	134.7371	135.6475	136.6289	137.3225	138.0477	(39)
Average = Sum(39)m / 12 =												136.9701	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0821	1.0790	1.0760	1.0618	1.0591	1.0468	1.0468	1.0445	1.0515	1.0591	1.0645	1.0701	(40)
HLP (average)												1.0618	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8924 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869	(42b)
Hot water usage for other uses	44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506	(42c)
Average daily hot water use (litres/day)												69.3341	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.6436	73.5683	71.3026	68.4830	65.9674	63.3532	62.8102	65.0713	67.3903	70.0749	72.9195	75.5375	(44)
Energy conte	119.8010	104.7603	109.5895	93.7497	88.8048	77.9001	75.9636	80.5719	83.0990	95.0910	103.8872	118.2735	(45)
Energy content (annual)										Total = Sum(45)m =		1151.4915	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
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	101.8309	89.0462	93.1511	79.6873	75.4841	66.2151	64.5690	68.4861	70.6341	80.8273	88.3041	100.5325	(62)
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	101.8309	89.0462	93.1511	79.6873	75.4841	66.2151	64.5690	68.4861	70.6341	80.8273	88.3041	100.5325	(64)
										Total per year (kWh/year) = Sum(64)m =		978.7678	(64)
12Total per year (kWh/year)												979	(64)
Electric shower(s)	58.2326	51.8858	56.6573	54.0673	55.0819	52.5428	54.2942	55.0819	54.0673	56.6573	55.5919	58.2326	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		662.3928	(64a)
Heat gains from water heating, kWh/month	40.0159	35.2330	37.4521	33.4387	32.6415	29.6895	29.7158	30.8920	31.1754	34.3711	35.9740	39.6913	(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	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	159.2440	176.3058	159.2440	164.5521	159.2440	164.5521	159.2440	159.2440	164.5521	159.2440	164.5521	159.2440	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.5112	299.5881	291.8345	275.3280	254.4916	234.9083	221.8254	218.7486	226.5021	243.0086	263.8451	283.4284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	(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)	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)	53.7848	52.4301	50.3388	46.4426	43.8730	41.2354	39.9406	41.5215	43.2991	46.1978	49.9639	53.3485	(72)
Total internal gains	575.9253	594.7092	567.8026	552.7080	523.9938	507.0810	487.3953	485.8993	500.7386	514.8356	544.7463	562.4061	(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	
East	10.1500	19.6403	0.6300	0.7000	0.7700	60.9235	(76)

South			0.7000		46.7521		0.6300		0.7000		0.7700		10.0016 (78)
West			7.8500		19.6403		0.6300		0.7000		0.7700		47.1182 (80)
Solar gains	118.0434	227.7327	368.9330	531.2182	646.7011	660.5069	629.4212	543.2550	426.6134	268.4551	146.5707	97.4906	(83)
Total gains	693.9686	822.4419	936.7355	1083.9262	1170.6949	1167.5879	1116.8165	1029.1543	927.3520	783.2908	691.3170	659.8967	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.9549	25.0263	25.0966	25.4324	25.4963	25.7976	25.7976	25.8542	25.6807	25.4963	25.3675	25.2342	
alpha	2.6637	2.6684	2.6731	2.6955	2.6998	2.7198	2.7198	2.7236	2.7120	2.6998	2.6912	2.6823	
util living area	0.9718	0.9552	0.9264	0.8609	0.7589	0.6142	0.4825	0.5313	0.7340	0.8990	0.9575	0.9752	(86)
MIT	18.2711	18.6001	19.1100	19.7983	20.3651	20.7546	20.9078	20.8781	20.5748	19.8095	18.9332	18.2279	(87)
Th 2	20.0155	20.0180	20.0205	20.0322	20.0343	20.0445	20.0445	20.0464	20.0406	20.0343	20.0299	20.0253	(88)
util rest of house	0.9677	0.9487	0.9152	0.8392	0.7195	0.5490	0.3931	0.4418	0.6775	0.8785	0.9502	0.9715	(89)
MIT 2	17.5081	17.8346	18.3377	19.0114	19.5421	19.8873	20.0011	19.9853	19.7449	19.0364	18.1756	17.4718	(90)
Living area fraction										fLA = Living area / (4) =		0.1225	(91)
MIT	17.6016	17.9284	18.4323	19.1078	19.6429	19.9935	20.1121	20.0947	19.8465	19.1311	18.2684	17.5644	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6016	17.9284	18.4323	19.1078	19.6429	19.9935	20.1121	20.0947	19.8465	19.1311	18.2684	17.5644	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9532	0.9299	0.8920	0.8144	0.7015	0.5452	0.3998	0.4467	0.6645	0.8544	0.9321	0.9583	(94)
Useful gains	661.4946	764.7801	835.5671	882.7452	821.2387	636.5451	446.5459	459.7058	616.2066	669.2300	644.3589	632.3832	(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	1856.8020	1813.4794	1656.2575	1398.1809	1085.2311	728.3038	474.2516	497.8089	779.5011	1165.5886	1533.6676	1844.9305	(97)
Space heating kWh	889.3087	704.7259	610.5937	371.1137	196.4104	0.0000	0.0000	0.0000	0.0000	369.2908	640.3022	902.1352	(98a)
Space heating requirement - total per year (kWh/year)												4683.8805	
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	889.3087	704.7259	610.5937	371.1137	196.4104	0.0000	0.0000	0.0000	0.0000	369.2908	640.3022	902.1352	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4683.8805	
Space heating per m2										(98c) / (4) =		36.3092	(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	1269.3075	999.2420	1024.0021	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7373	0.8032	0.7681	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	935.8678	802.5664	786.5137	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1290.8925	1234.8592	1135.6483	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	255.6177	321.6259	259.7561	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(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	63.9044	80.4065	64.9390	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												209.2499	(107)
Energy for space heating												36.3092	(99)
Energy for space cooling												1.6221	(108)
Total												37.9312	(109)
Fabric Energy Efficiency (TFEE)												37.9	(109)

Full SAP Calculation Printout

Property Reference	Kielder DET Plot 243	Issued on Date	01/09/2023
Assessment Reference	Hampton Woods	Prop Type Ref	Plot 243
Property	Plot 243, Hampton Woods, Peterborough, PE7		

SAP Rating	92 A	DER	9.38	TER	9.54
Environmental	91 B	% DER < TER			1.68
CO_2 Emissions (t/year)	1.1	DFEE	37.87	TFEE	37.93
Compliance Check	See BREL	% DFEE < TFEE			0.15
% DPER < TPER	0.31	DPER	49.71	TPER	49.86

Assessor Details	Mr. Ben Tunningley	Assessor ID	AU36-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor	64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(5)

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2. Ventilation rate

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		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	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)+(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		4.9000	(17)
Infiltration rate		0.2450	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2266	(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	0.2889	0.2833	0.2776	0.2493	0.2436	0.2153	0.2153	0.2096	0.2266	0.2436	0.2550	0.2663	(22b)

Mechanical extract ventilation - decentralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5389	0.5333	0.5276	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5050	0.5163	(25)

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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	
entrance			2.1000	1.2000	2.5200			(26)
rear/utility entrance			2.1000	1.1000	2.3100			(26a)
glazing (Uw = 1.30)			18.7000	1.2357	23.1084			(27)

ground			64.5000	0.1200	7.7400	75.0000	4837.5000	(28a)
external wall	158.1100	22.9000	135.2100	0.2400	32.4504	9.0000	1216.8900	(29a)
cold	64.5000		64.5000	0.0900	5.8050	9.0000	580.5000	(30)
Total net area of external elements Aum(A, m2)			287.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.9338			(33)
stud			152.7000			9.0000	1374.3000	(32c)
block			37.2000			75.0000	2790.0000	(32c)
internal			64.5000			18.0000	1161.0000	(32d)
internal			64.5000			9.0000	580.5000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12540.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.2147 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3 Sill	11.9000	0.0090	0.1071
E4 Jamb	39.9000	0.0140	0.5586
E5 Ground floor (normal)	32.6000	0.0550	1.7930
E6 Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.1000	0.0460	0.5566
E12 Gable (insulation at ceiling level)	20.5000	0.0540	1.1070
E16 Corner (normal)	24.2500	0.0480	1.1640
E17 Corner (inverted – internal area greater than external area)	4.8500	-0.0970	-0.4704

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.6033 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 79.5371 (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	55.6367	55.0518	54.4669	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	52.1274	53.2972	(38)
Heat transfer coeff	135.1738	134.5889	134.0041	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.6646	132.8343	(39)
Average = Sum(39)m / 12 =												132.1949	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0479	1.0433	1.0388	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0207	1.0297	(40)
HLP (average)												1.0248	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8924 (42)
Hot water usage for mixer showers

72.7150	71.6223	70.0299	66.9832	64.7348	62.2274	60.8022	62.3825	64.1148	66.8070	69.9192	72.4364	(42a)

Hot water usage for baths

31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869	(42b)

Hot water usage for other uses

44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506	(42c)

Average daily hot water use (litres/day) 136.3749 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.3587	145.1906	141.3325	135.4661	130.7022	125.5805	123.6124	127.4538	131.5051	136.8819	142.8387	147.9739	(44)
Energy conte	234.9639	206.7494	217.2228	185.4464	175.9502	154.4159	149.4985	157.8144	162.1590	185.7475	203.4999	231.6914	(45)
Energy content (annual)										Total = Sum(45)m =		2265.1594	
Distribution loss (46)m = 0.15 x (45)m	35.2446	31.0124	32.5834	27.8170	26.3925	23.1624	22.4248	23.6722	24.3238	27.8621	30.5250	34.7537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	14.3205	12.9215	14.2779	13.7579	14.1788	13.6834	14.1154	14.1353	13.7020	14.2024	13.8012	14.3126	(61)
Total heat required for water heating calculated for each month	249.2843	219.6709	231.5007	199.2042	190.1291	168.0993	163.6139	171.9498	175.8609	199.9498	217.3011	246.0041	(62)
WWHRS	-64.0386	-56.6362	-59.3062	-49.1079	-45.7668	-39.1629	-36.7090	-39.0364	-40.5195	-47.7680	-54.1154	-62.8527	(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	185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514	(64)
									Total per year (kWh/year) = Sum(64)m =			1837.5488	(64)
12Total per year (kWh/year)												1838	(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	81.7056	71.9746	75.7961	65.1004	62.0482	54.7641	53.2371	56.0071	57.3434	65.3116	71.1140	80.6156	(65)

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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	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	159.2440	176.3058	159.2440	164.5521	159.2440	164.5521	159.2440	159.2440	164.5521	159.2440	164.5521	159.2440	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	296.5112	299.5881	291.8345	275.3280	254.4916	234.9083	221.8254	218.7486	226.5021	243.0086	263.8451	283.4284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)													
	109.8194	107.1050	101.8764	90.4172	83.3981	76.0613	71.5552	75.2784	79.6435	87.7844	98.7695	108.3542	(72)
Total internal gains													
	634.9598	652.3842	622.3402	599.6826	566.5189	541.9070	519.0099	519.6562	537.0831	559.4223	596.5519	620.4119	(73)

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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	
East	10.1500	19.6403	0.4600	0.0000	0.7700	70.6093	(76)
South	0.7000	46.7521	0.4600	0.0000	0.7700	11.5917	(78)
West	7.8500	19.6403	0.4600	0.0000	0.7700	54.6092	(80)

Solar gains	136.8102	263.9381	427.5867	615.6724	749.5150	765.5157	729.4879	629.6229	494.4372	311.1347	169.8728	112.9899	(83)
Total gains	771.7700	916.3223	1049.9269	1215.3550	1316.0339	1307.4226	1248.4978	1149.2791	1031.5203	870.5570	766.4247	733.4017	(84)

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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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.7707	25.8827	25.9957	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.4576	26.2246	
alpha	2.7180	2.7255	2.7330	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7638	2.7483	
util living area													
	0.9637	0.9424	0.9050	0.8237	0.7063	0.5591	0.4312	0.4791	0.6850	0.8723	0.9455	0.9680	(86)
MIT	18.4757	18.8227	19.3386	20.0117	20.5104	20.8171	20.9347	20.9111	20.6654	19.9800	19.1378	18.4452	(87)
Th 2	20.0436	20.0474	20.0511	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0662	20.0586	(88)
util rest of house													
	0.9586	0.9344	0.8916	0.7991	0.6651	0.4963	0.3500	0.3961	0.6272	0.8486	0.9366	0.9634	(89)
MIT 2	17.0726	17.5127	18.1621	19.0008	19.5881	19.9212	20.0304	20.0130	19.7752	18.9802	17.9277	17.0426	(90)
Living area fraction									fLA = Living area / (4) =			0.1225	(91)
MIT	17.2444	17.6731	18.3062	19.1246	19.7011	20.0309	20.1411	20.1230	19.8842	19.1027	18.0759	17.2144	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.0944	17.5231	18.1562	18.9746	19.5511	19.8809	19.9911	19.9730	19.7342	18.9527	17.9259	17.0644	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9350	0.9048	0.8568	0.7647	0.6395	0.4826	0.3428	0.3869	0.6037	0.8126	0.9079	0.9417	(94)
Useful gains	721.5924	829.1238	899.5731	929.3879	841.6011	630.9812	428.0182	444.6916	622.7334	707.4185	695.8177	690.6599	(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													
	1729.4711	1698.9347	1561.9774	1321.3162	1029.6926	692.6108	444.7598	468.6155	738.9453	1095.4785	1425.3917	1708.8328	(97)
Space heating kWh													
	749.8618	584.5129	492.8288	282.1883	139.9401	0.0000	0.0000	0.0000	0.0000	288.7167	525.2933	757.5206	(98a)
Space heating requirement - total per year (kWh/year)												3820.8626	
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													
	749.8618	584.5129	492.8288	282.1883	139.9401	0.0000	0.0000	0.0000	0.0000	288.7167	525.2933	757.5206	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3820.8626	
Space heating per m2											(98c) / (4) =	29.6191	(99)

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 %)												89.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	749.8618	584.5129	492.8288	282.1883	139.9401	0.0000	0.0000	0.0000	0.0000	288.7167	525.2933	757.5206	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	842.5413	656.7561	553.7403	317.0656	157.2361	0.0000	0.0000	0.0000	0.0000	324.4008	590.2172	851.1467	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)

Space heating fuel (main heating system 2)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)

Space heating fuel (secondary)

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

185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514 (64)

Efficiency of water heater 87.3000 (216)

(217)m	88.6580	88.6236	88.5535	88.4023	88.1286	87.3000	87.3000	87.3000	87.3000	88.4058	88.5911	88.6638 (217)

Fuel for water heating, kWh/month

208.9443	183.9630	194.4526	169.7879	163.8087	147.6934	145.3664	152.2490	155.0303	172.1401	184.2010	206.5683 (219)

Space cooling fuel requirement

(221)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 (221)
Pumps and Fa	11.6467	10.5196	11.6467	11.2710	11.6467	11.2710	11.6467	11.6467	11.2710	11.6467	11.2710	11.6467 (231)
Lighting	33.8796	27.1795	24.4721	17.9293	13.8491	11.3148	12.6336	16.4217	21.3301	27.9863	31.6104	34.8212 (232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	-24.2616	-39.1295	-64.9003	-82.1387	-94.9037	-90.7251	-89.0767	-80.4852	-65.9460	-48.0476	-28.0358	-20.2455 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)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 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)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 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)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 (235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	-8.0451	-19.8645	-47.9558	-85.2348	-124.5205	-129.8568	-126.5637	-99.7412	-63.7033	-30.8423	-11.3142	-6.0801 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)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 (234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)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 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)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 (235d)

Annual totals kWh/year

Space heating fuel - main system 1 4293.1040 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 87.3000
Water heating fuel used 2084.2051 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 4.9570, total flow = 37.0000, SFP = 0.1340)
mechanical ventilation fans (SFP = 0.1340) 51.1303 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 137.1303 (231)
Electricity for lighting (calculated in Appendix L) 273.4278 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -1481.6181 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 5306.2491 (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	4293.1040	0.2100	901.5518	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2084.2051	0.2100	437.6831	(264)
Space and water heating			1339.2349	(265)
Pumps, fans and electric keep-hot	137.1303	0.1387	19.0217	(267)
Energy for lighting	273.4278	0.1443	39.4641	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-727.8957	0.1323	-96.3204	
PV Unit electricity exported	-753.7224	0.1219	-91.9055	
Total			-188.2259	(269)
Total CO2, kg/year			1209.4947	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.3800	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4293.1040	1.1300	4851.2075	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2084.2051	1.1300	2355.1518	(278)
Space and water heating			7206.3593	(279)
Pumps, fans and electric keep-hot	137.1303	1.5128	207.4507	(281)
Energy for lighting	273.4278	1.5338	419.3927	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-727.8957	1.4889	-1083.7895	

PV Unit electricity exported	-753.7224	0.4474	-337.2079
Total			-1420.9974 (283)
Total Primary energy kWh/year			6412.2054 (286)
Dwelling Primary energy Rate (DPER)			49.7100 (287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor	64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(5)

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2. Ventilation rate

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		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	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1279	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3779	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3495	(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	0.4456	0.4369	0.4282	0.3845	0.3757	0.3321	0.3321	0.3233	0.3495	0.3757	0.3932	0.4107	(22b)
Effective ac	0.5993	0.5954	0.5917	0.5739	0.5706	0.5551	0.5551	0.5523	0.5611	0.5706	0.5773	0.5843	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Semi-glazed door			2.1000	1.0000	2.1000			(26a)
TER Opening Type (Uw = 1.20)			18.7000	1.1450	21.4122			(27)
ground			64.5000	0.1300	8.3850			(28a)
external wall	158.1100	22.9000	135.2100	0.1800	24.3378			(29a)
cold	64.5000		64.5000	0.1100	7.0950			(30)
Total net area of external elements Aum(A, m2)			287.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.4300			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	97.2147 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3 Sill	11.9000	0.0500	0.5950
E4 Jamb	39.9000	0.0500	1.9950
E5 Ground floor (normal)	32.6000	0.1600	5.2160
E6 Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.1000	0.0600	0.7260
E12 Gable (insulation at ceiling level)	20.5000	0.0600	1.2300
E16 Corner (normal)	24.2500	0.0900	2.1825
E17 Corner (inverted – internal area greater than external area)	4.8500	-0.0900	-0.4365

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.2955 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 77.7255 (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	61.8671	61.4691	61.0789	59.2463	58.9034	57.3072	57.3072	57.0116	57.9220	58.9034	59.5970	60.3222	(38)
Heat transfer coeff	139.5927	139.1946	138.8044	136.9718	136.6289	135.0327	135.0327	134.7371	135.6475	136.6289	137.3225	138.0477	(39)

Average = Sum(39)m / 12 = 136.9701

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0821	1.0790	1.0760	1.0618	1.0591	1.0468	1.0468	1.0445	1.0515	1.0591	1.0645	1.0701	(40)
HLP (average)												1.0618	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8924 (42)
Hot water usage for mixer showers

72.7150	71.6223	70.0299	66.9832	64.7348	62.2274	60.8022	62.3825	64.1148	66.8070	69.9192	72.4364	(42a)

Hot water usage for baths

31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869	(42b)

Hot water usage for other uses

44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506	(42c)

Average daily hot water use (litres/day) 136.3749 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.3587	145.1906	141.3325	135.4661	130.7022	125.5805	123.6124	127.4538	131.5051	136.8819	142.8387	147.9739	(44)
Energy conte	234.9639	206.7494	217.2228	185.4464	175.9502	154.4159	149.4985	157.8144	162.1590	185.7475	203.4999	231.6914	(45)

Energy content (annual) Total = Sum(45)m = 2265.1594

Distribution loss (46)m = 0.15 x (45)m

35.2446	31.0124	32.5834	27.8170	26.3925	23.1624	22.4248	23.6722	24.3238	27.8621	30.5250	34.7537	(46)

Water storage loss:
Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

285.9228	252.7768	268.1817	234.7614	226.9091	203.7310	200.4574	208.7734	211.4740	236.7064	252.8150	282.6503	(62)
WWHRS -33.2423	-29.3997	-30.7857	-25.4918	-23.7574	-20.3294	-19.0556	-20.2637	-21.0336	-24.7963	-28.0912	-32.6267	(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

252.6805	223.3771	237.3960	209.2696	203.1517	183.4016	181.4018	188.5097	190.4404	211.9101	224.7238	250.0237	(64)

Total per year (kWh/year) = Sum(64)m = 2556.2860 (64)

12Total per year (kWh/year) 2556 (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

90.8652	80.2510	84.9663	73.9897	71.2432	63.6721	62.4480	65.2130	66.2466	74.5008	79.9925	89.7771	(65)

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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	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	144.6175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	159.2440	176.3058	159.2440	164.5521	159.2440	164.5521	159.2440	159.2440	164.5521	159.2440	164.5521	159.2440	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.5112	299.5881	291.8345	275.3280	254.4916	234.9083	221.8254	218.7486	226.5021	243.0086	263.8451	283.4284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	37.4618	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)	122.1307	119.4212	114.2020	102.7635	95.7570	88.4334	83.9355	87.6519	92.0092	100.1354	111.1007	120.6682	(72)
Total internal gains	647.2711	664.7004	634.6658	612.0289	578.8778	554.2791	531.3901	532.0297	549.4487	571.7733	608.8831	632.7258	(73)

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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	
East	10.1500	19.6403	0.6300	0.7000	0.7700	60.9235	(76)
South	0.7000	46.7521	0.6300	0.7000	0.7700	10.0016	(78)

West			7.8500	19.6403	0.6300	0.7000	0.7700				47.1182 (80)	
Solar gains	118.0434	227.7327	368.9330	531.2182	646.7011	660.5069	629.4212	543.2550	426.6134	268.4551	146.5707	97.4906 (83)
Total gains	765.3145	892.4331	1003.5987	1143.2471	1225.5789	1214.7860	1160.8113	1075.2848	976.0621	840.2284	755.4538	730.2164 (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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.9549	25.0263	25.0966	25.4324	25.4963	25.7976	25.7976	25.8542	25.6807	25.4963	25.3675	25.2342	
alpha	2.6637	2.6684	2.6731	2.6955	2.6998	2.7198	2.7198	2.7236	2.7120	2.6998	2.6912	2.6823	
util living area													
	0.9648	0.9466	0.9154	0.8473	0.7427	0.5982	0.4678	0.5139	0.7151	0.8845	0.9484	0.9687	(86)
MIT	18.3765	18.6976	19.1941	19.8572	20.4015	20.7705	20.9147	20.8878	20.6036	19.8744	19.0236	18.3335	(87)
Th 2	20.0155	20.0180	20.0205	20.0322	20.0343	20.0445	20.0445	20.0464	20.0406	20.0343	20.0299	20.0253	(88)
util rest of house													
	0.9598	0.9390	0.9030	0.8242	0.7024	0.5331	0.3800	0.4258	0.6574	0.8620	0.9398	0.9642	(89)
MIT 2	16.9312	17.3385	17.9647	18.7919	19.4420	19.8570	19.9932	19.9748	19.6897	18.8308	17.7633	16.8823	(90)
Living area fraction										fLA = Living area / (4) =		0.1225	(91)
MIT	17.1082	17.5050	18.1153	18.9224	19.5596	19.9689	20.1061	20.0867	19.8017	18.9586	17.9177	17.0601	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1082	17.5050	18.1153	18.9224	19.5596	19.9689	20.1061	20.0867	19.8017	18.9586	17.9177	17.0601	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9375	0.9117	0.8711	0.7922	0.6799	0.5275	0.3860	0.4298	0.6411	0.8300	0.9132	0.9435	(94)
Useful gains	717.5119	813.6296	874.2137	905.7072	833.2502	640.8450	448.0825	462.1659	625.7400	697.3607	689.8794	688.9823	(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													
	1787.9369	1754.5413	1612.2558	1372.7835	1073.8429	724.9799	473.4365	496.7308	773.4185	1142.0295	1485.5124	1775.3038	(97)
Space heating kWh													
	796.3962	632.2926	549.1033	336.2949	179.0010	0.0000	0.0000	0.0000	0.0000	330.8336	572.8558	808.2232	(98a)
Space heating requirement - total per year (kWh/year)												4205.0007	
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													
	796.3962	632.2926	549.1033	336.2949	179.0010	0.0000	0.0000	0.0000	0.0000	330.8336	572.8558	808.2232	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4205.0007	
Space heating per m2											(98c) / (4) =	32.5969	(99)

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 %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	796.3962	632.2926	549.1033	336.2949	179.0010	0.0000	0.0000	0.0000	0.0000	330.8336	572.8558	808.2232	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	861.9006	684.2994	594.2677	363.9556	193.7240	0.0000	0.0000	0.0000	0.0000	358.0450	619.9738	874.7004	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	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													
	252.6805	223.3771	237.3960	209.2696	203.1517	183.4016	181.4018	188.5097	190.4404	211.9101	224.7238	250.0237	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6644	86.4821	86.1162	85.3920	84.1113	80.3000	80.3000	80.3000	80.3000	85.3318	86.2960	86.7061	(217)
Fuel for water heating, kWh/month													
	291.5619	258.2929	275.6695	245.0694	241.5273	228.3955	225.9052	234.7567	237.1612	248.3366	260.4106	288.3578	(219)
Space cooling fuel requirement													
(221)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	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	33.0878	26.5442	23.9001	17.5103	13.5254	11.0504	12.3383	16.0379	20.8316	27.3322	30.8716	34.0074	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-57.3505	-79.3544	-111.9347	-123.3695	-130.8920	-121.3185	-119.7228	-114.0122	-103.6981	-89.4781	-62.4776	-49.7524	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)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	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)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	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235c)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 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-37.0902	-77.4480	-152.9275	-228.2864	-300.5708	-301.6294	-298.1654	-253.1076	-186.3317	-110.3865	-49.3884	-29.3813 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)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 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)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 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)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 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4550.8665 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	3035.4447 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	267.0371 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3188.0741 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4751.2742 (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	4550.8665	0.2100	955.6820	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3035.4447	0.2100	637.4434	(264)
Space and water heating			1593.1254	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	267.0371	0.1443	38.5417	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1163.3609	0.1350	-157.0712	
PV Unit electricity exported	-2024.7132	0.1261	-255.2561	
Total			-412.3273	(269)
Total CO2, kg/year			1231.2690	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4550.8665	1.1300	5142.4792	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3035.4447	1.1300	3430.0525	(278)
Space and water heating			8572.5317	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	267.0371	1.5338	409.5905	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1163.3609	1.4990	-1743.8974	
PV Unit electricity exported	-2024.7132	0.4628	-936.9802	
Total			-2680.8776	(283)
Total Primary energy kWh/year			6431.3453	(286)
Target Primary Energy Rate (TPER)			49.8600	(287)

Full SAP Calculation Printout

Property Reference	Kielder DET Plot 243	Issued on Date	01/09/2023
Assessment Reference	Hampton Woods	Prop Type Ref	Plot 243
Property	Plot 243, Hampton Woods, Peterborough, PE7		

SAP Rating	92 A	DER	9.38	TER	9.54
Environmental	91 B	% DER < TER			1.68
CO_2 Emissions (t/year)	1.1	DFEE	37.87	TFEE	37.93
Compliance Check	See BREL	% DFEE < TFEE			0.15
% DPER < TPER	0.31	DPER	49.71	TPER	49.86

Assessor Details	Mr. Ben Tunningley	Assessor ID	AU36-0001
Client			

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor		64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(5)

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2. Ventilation rate

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		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		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)+(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				4.9000 (17)
Infiltration rate				0.2450 (18)
Number of sides sheltered				1 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.2266 (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	0.2889	0.2833	0.2776	0.2493	0.2436	0.2153	0.2153	0.2096	0.2266	0.2436	0.2550	0.2663	(22b)

Mechanical extract ventilation - decentralised

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)

Effective ac	0.5389	0.5333	0.5276	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5050	0.5163	(25)

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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	
entrance			2.1000	1.2000	2.5200			(26)
rear/utility entrance			2.1000	1.1000	2.3100			(26a)
glazing (Uw = 1.30)			18.7000	1.2357	23.1084			(27)

ground			64.5000	0.1200	7.7400	75.0000	4837.5000	(28a)
external wall	158.1100	22.9000	135.2100	0.2400	32.4504	9.0000	1216.8900	(29a)
cold	64.5000		64.5000	0.0900	5.8050	9.0000	580.5000	(30)
Total net area of external elements Aum(A, m2)			287.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.9338			(33)
stud			152.7000			9.0000	1374.3000	(32c)
block			37.2000			75.0000	2790.0000	(32c)
internal			64.5000			18.0000	1161.0000	(32d)
internal			64.5000			9.0000	580.5000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12540.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.2147 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3 Sill	11.9000	0.0090	0.1071
E4 Jamb	39.9000	0.0140	0.5586
E5 Ground floor (normal)	32.6000	0.0550	1.7930
E6 Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.1000	0.0460	0.5566
E12 Gable (insulation at ceiling level)	20.5000	0.0540	1.1070
E16 Corner (normal)	24.2500	0.0480	1.1640
E17 Corner (inverted – internal area greater than external area)	4.8500	-0.0970	-0.4704

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.6033 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 79.5371 (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	55.6367	55.0518	54.4669	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	52.1274	53.2972	(38)
Heat transfer coeff	135.1738	134.5889	134.0041	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.6646	132.8343	(39)
Average = Sum(39)m / 12 =												132.1949	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0479	1.0433	1.0388	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0207	1.0297	(40)
HLP (average)												1.0248	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8924 (42)
Hot water usage for mixer showers

72.7150	71.6223	70.0299	66.9832	64.7348	62.2274	60.8022	62.3825	64.1148	66.8070	69.9192	72.4364	(42a)

Hot water usage for baths

31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869	(42b)

Hot water usage for other uses

44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506	(42c)

Average daily hot water use (litres/day) 136.3749 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.3587	145.1906	141.3325	135.4661	130.7022	125.5805	123.6124	127.4538	131.5051	136.8819	142.8387	147.9739	(44)
Energy conte	234.9639	206.7494	217.2228	185.4464	175.9502	154.4159	149.4985	157.8144	162.1590	185.7475	203.4999	231.6914	(45)
Energy content (annual)										Total = Sum(45)m =		2265.1594	
Distribution loss (46)m = 0.15 x (45)m	35.2446	31.0124	32.5834	27.8170	26.3925	23.1624	22.4248	23.6722	24.3238	27.8621	30.5250	34.7537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	14.3205	12.9215	14.2779	13.7579	14.1788	13.6834	14.1154	14.1353	13.7020	14.2024	13.8012	14.3126	(61)
Total heat required for water heating calculated for each month	249.2843	219.6709	231.5007	199.2042	190.1291	168.0993	163.6139	171.9498	175.8609	199.9498	217.3011	246.0041	(62)
WWHRS	-64.0386	-56.6362	-59.3062	-49.1079	-45.7668	-39.1629	-36.7090	-39.0364	-40.5195	-47.7680	-54.1154	-62.8527	(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	185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514	(64)
								Total per year (kWh/year) = Sum(64)m =				1837.5488	(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	81.7056	71.9746	75.7961	65.1004	62.0482	54.7641	53.2371	56.0071	57.3434	65.3116	71.1140	80.6156	(65)

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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	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.7065	34.3788	27.9587	21.1665	15.8222	13.3578	14.4336	18.7613	25.1814	31.9736	37.3179	39.7823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.5541	447.1464	435.5739	410.9374	379.8382	350.6094	331.0827	326.4904	338.0629	362.6994	393.7986	423.0274	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)												
	109.8194	107.1050	101.8764	90.4172	83.3981	76.0613	71.5552	75.2784	79.6435	87.7844	98.7695	108.3542 (72)
Total internal gains												
	707.1734	704.7237	681.5025	638.6146	595.1520	553.1220	530.1650	533.6236	555.9813	598.5509	645.9794	687.2574 (73)

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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	
East	10.1500	19.6403	0.4600	0.0000	0.7700	70.6093	(76)
South	0.7000	46.7521	0.4600	0.0000	0.7700	11.5917	(78)
West	7.8500	19.6403	0.4600	0.0000	0.7700	54.6092	(80)

Solar gains	136.8102	263.9381	427.5867	615.6724	749.5150	765.5157	729.4879	629.6229	494.4372	311.1347	169.8728	112.9899 (83)
Total gains	843.9836	968.6618	1109.0892	1254.2870	1344.6670	1318.6376	1259.6529	1163.2464	1050.4185	909.6856	815.8522	800.2473 (84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.7707	25.8827	25.9957	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.4576	26.2246	
alpha	2.7180	2.7255	2.7330	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7638	2.7483	
util living area													
	0.9557	0.9352	0.8943	0.8143	0.6980	0.5556	0.4280	0.4744	0.6779	0.8615	0.9376	0.9609	(86)
MIT	18.5804	18.8934	19.4083	20.0458	20.5258	20.8200	20.9360	20.9133	20.6747	20.0211	19.2057	18.5443	(87)
Th 2	20.0436	20.0474	20.0511	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0662	20.0586	(88)
util rest of house													
	0.9495	0.9263	0.8798	0.7889	0.6565	0.4929	0.3472	0.3919	0.6198	0.8366	0.9277	0.9554	(89)
MIT 2	17.2044	17.6008	18.2471	19.0404	19.6043	19.9237	20.0312	20.0145	19.7841	19.0284	18.0120	17.1676	(90)
Living area fraction										fLA = Living area / (4) =		0.1225	(91)
MIT	17.3729	17.7591	18.3894	19.1635	19.7172	20.0335	20.1420	20.1246	19.8932	19.1499	18.1582	17.3362	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.2229	17.6091	18.2394	19.0135	19.5672	19.8835	19.9920	19.9746	19.7432	18.9999	18.0082	17.1862	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9233	0.8953	0.8443	0.7550	0.6316	0.4795	0.3401	0.3830	0.5970	0.8006	0.8973	0.9312	(94)
Useful gains	779.2563	867.2903	936.3869	946.9738	849.3317	632.2843	428.4537	445.4965	627.0507	728.3324	732.0525	745.1877	(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													
	1746.8367	1710.5023	1573.1211	1326.4245	1031.8090	692.9454	444.8700	468.8205	740.1184	1101.6796	1436.2185	1725.0132	(97)
Space heating kWh													
	719.8799	566.6385	473.7303	273.2046	135.7631	0.0000	0.0000	0.0000	0.0000	277.7703	506.9995	728.9902	(98a)
Space heating requirement - total per year (kWh/year)												3682.9762	
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													
	719.8799	566.6385	473.7303	273.2046	135.7631	0.0000	0.0000	0.0000	0.0000	277.7703	506.9995	728.9902	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3682.9762	
Space heating per m2											(98c) / (4) =	28.5502	(99)

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 %) 89.0000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	719.8799	566.6385	473.7303	273.2046	135.7631	0.0000	0.0000	0.0000	0.0000	277.7703	506.9995	728.9902	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	808.8538	636.6724	532.2812	306.9714	152.5428	0.0000	0.0000	0.0000	0.0000	312.1015	569.6623	819.0901	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	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												
	185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514 (64)
Efficiency of water heater												87.3000 (216)
(217)m	88.6467	88.6144	88.5404	88.3897	88.1157	87.3000	87.3000	87.3000	87.3000	88.3908	88.5800	88.6534 (217)
Fuel for water heating, kWh/month												
	208.9709	183.9821	194.4814	169.8121	163.8326	147.6934	145.3664	152.2490	155.0303	172.1694	184.2241	206.5927 (219)
Space cooling fuel requirement												
(221)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 (221)
Pumps and Fa	11.6467	10.5196	11.6467	11.2710	11.6467	11.2710	11.6467	11.6467	11.2710	11.6467	11.2710	11.6467 (231)
Lighting	33.8796	27.1795	24.4721	17.9293	13.8491	11.3148	12.6336	16.4217	21.3301	27.9863	31.6104	34.8212 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-24.2616	-39.1295	-64.9003	-82.1387	-94.9037	-90.7251	-89.0767	-80.4852	-65.9460	-48.0476	-28.0358	-20.2455 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)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 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)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 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)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 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-8.0451	-19.8645	-47.9558	-85.2348	-124.5205	-129.8568	-126.5637	-99.7412	-63.7033	-30.8423	-11.3142	-6.0801 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)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 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)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 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)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 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4138.1756 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	87.3000
Water heating fuel used	2084.4045 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 4.9570, total flow = 37.0000, SFP = 0.1340)	
mechanical ventilation fans (SFP = 0.1340)	51.1303 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	137.1303 (231)
Electricity for lighting (calculated in Appendix L)	273.4278 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1481.6181 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5151.5201 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4138.1756	3.6400	150.6296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2084.4045	3.6400	75.8723	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	137.1303	16.4900	22.6128	(249)
Energy for lighting	273.4278	16.4900	45.0882	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-727.8957	16.4900	-120.0300	
PV Unit electricity exported	-753.7224	5.5900	-42.1331	
Total			-162.1631	(252)
Total energy cost			224.0399	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4635 (257)
SAP value		92.4862
SAP rating (Section 12)		92 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4138.1756	0.2100	869.0169	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2084.4045	0.2100	437.7249	(264)
Space and water heating			1306.7418	(265)
Pumps, fans and electric keep-hot	137.1303	0.1387	19.0217	(267)
Energy for lighting	273.4278	0.1443	39.4641	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-727.8957	0.1323	-96.3204	
PV Unit electricity exported	-753.7224	0.1219	-91.9055	
Total			-188.2259	(269)
Total CO2, kg/year			1177.0016	(272)
CO2 emissions per m2			9.1200	(273)
EI value			90.9357	
EI rating			91	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor	64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(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	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)+(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		4.9000	(17)
Infiltration rate		0.2450	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2266	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.8000	4.7000	4.7000	4.3000	4.3000	3.7000	3.8000	3.8000	3.9000	4.1000	4.2000	4.3000	(22)
Wind factor	1.2000	1.1750	1.1750	1.0750	1.0750	0.9250	0.9500	0.9500	0.9750	1.0250	1.0500	1.0750	(22a)
Adj infilt rate	0.2720	0.2663	0.2663	0.2436	0.2436	0.2096	0.2153	0.2153	0.2210	0.2323	0.2380	0.2436	(22b)

Mechanical extract ventilation - decentralised

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)

Effective ac	0.5220	0.5163	0.5163	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
entrance			2.1000	1.2000	2.5200			(26)
rear/utility entrance			2.1000	1.1000	2.3100			(26a)
glazing (Uw = 1.30)			18.7000	1.2357	23.1084			(27)

ground			64.5000	0.1200	7.7400	75.0000	4837.5000 (28a)
external wall	158.1100	22.9000	135.2100	0.2400	32.4504	9.0000	1216.8900 (29a)
cold	64.5000		64.5000	0.0900	5.8050	9.0000	580.5000 (30)
Total net area of external elements Aum(A, m2)			287.1100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.9338		(33)
stud			152.7000			9.0000	1374.3000 (32c)
block			37.2000			75.0000	2790.0000 (32c)
internal			64.5000			18.0000	1161.0000 (32d)
internal			64.5000			9.0000	580.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12540.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.2147 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3 Sill	11.9000	0.0090	0.1071
E4 Jamb	39.9000	0.0140	0.5586
E5 Ground floor (normal)	32.6000	0.0550	1.7930
E6 Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.1000	0.0460	0.5566
E12 Gable (insulation at ceiling level)	20.5000	0.0540	1.1070
E16 Corner (normal)	24.2500	0.0480	1.1640
E17 Corner (inverted – internal area greater than external area)	4.8500	-0.0970	-0.4704

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.6033 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 79.5371 (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	53.8821	53.2972	53.2972	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	(38)
Heat transfer coeff	133.4192	132.8343	132.8343	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	(39)
Average = Sum(39)m / 12 =												131.6222	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0343	1.0297	1.0297	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	(40)
HLP (average)												1.0203	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8924 (42)
Hot water usage for mixer showers

72.7150	71.6223	70.0299	66.9832	64.7348	62.2274	60.8022	62.3825	64.1148	66.8070	69.9192	72.4364	(42a)

Hot water usage for baths

31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869	(42b)

Hot water usage for other uses

44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506	(42c)

Average daily hot water use (litres/day) 136.3749 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.3587	145.1906	141.3325	135.4661	130.7022	125.5805	123.6124	127.4538	131.5051	136.8819	142.8387	147.9739	(44)
Energy conte	234.9639	206.7494	217.2228	185.4464	175.9502	154.4159	149.4985	157.8144	162.1590	185.7475	203.4999	231.6914	(45)
Energy content (annual)										Total = Sum(45)m =		2265.1594	

Distribution loss (46)m = 0.15 x (45)m

35.2446	31.0124	32.5834	27.8170	26.3925	23.1624	22.4248	23.6722	24.3238	27.8621	30.5250	34.7537	(46)

Water storage loss:
Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 14.3205	12.9215	14.2779	13.7579	14.1788	13.6834	14.1154	14.1353	13.7020	14.2024	13.8012	14.3126	(61)

Total heat required for water heating calculated for each month

249.2843	219.6709	231.5007	199.2042	190.1291	168.0993	163.6139	171.9498	175.8609	199.9498	217.3011	246.0041	(62)
WWHRS -64.0386	-56.6362	-59.3062	-49.1079	-45.7668	-39.1629	-36.7090	-39.0364	-40.5195	-47.7680	-54.1154	-62.8527	(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

185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514	(64)

Total per year (kWh/year) = Sum(64)m = 1837.5488 (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

81.7056	71.9746	75.7961	65.1004	62.0482	54.7641	53.2371	56.0071	57.3434	65.3116	71.1140	80.6156	(65)

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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	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.7065	34.3788	27.9587	21.1665	15.8222	13.3578	14.4336	18.7613	25.1814	31.9736	37.3179	39.7823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	442.5541	447.1464	435.5739	410.9374	379.8382	350.6094	331.0827	326.4904	338.0629	362.6994	393.7986	423.0274	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)												
	109.8194	107.1050	101.8764	90.4172	83.3981	76.0613	71.5552	75.2784	79.6435	87.7844	98.7695	108.3542 (72)
Total internal gains												
	707.1734	704.7237	681.5025	638.6146	595.1520	553.1220	530.1650	533.6236	555.9813	598.5509	645.9794	687.2574 (73)

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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	
East	10.1500	22.4868	0.4600	0.0000	0.7700	80.8431	(76)
South	0.7000	52.3697	0.4600	0.0000	0.7700	12.9845	(78)
West	7.8500	22.4868	0.4600	0.0000	0.7700	62.5239	(80)

Solar gains	156.3515	276.1135	446.3821	652.6828	773.0998	811.8688	760.8178	662.0059	533.6096	345.8746	193.7746	133.2103 (83)
Total gains	863.5250	980.8372	1127.8846	1291.2974	1368.2518	1364.9907	1290.9828	1195.6294	1089.5909	944.4254	839.7540	820.4677 (84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.1096	26.2246	26.2246	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	
alpha	2.7406	2.7483	2.7483	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	
util living area													
	0.9518	0.9310	0.8824	0.7918	0.6604	0.4887	0.3511	0.3761	0.6137	0.8357	0.9303	0.9572	(86)
MIT	18.6878	18.9872	19.5487	20.1583	20.6217	20.8862	20.9682	20.9621	20.7785	20.1631	19.3089	18.6521	(87)
Th 2	20.0549	20.0586	20.0586	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	(88)
util rest of house													
	0.9451	0.9217	0.8662	0.7636	0.6142	0.4204	0.2658	0.2859	0.5464	0.8060	0.9192	0.9513	(89)
MIT 2	17.3467	17.7255	18.4264	19.1747	19.7113	19.9861	20.0545	20.0514	19.8906	19.1991	18.1434	17.3103	(90)
Living area fraction										fLA = Living area / (4) =		0.1225	(91)
MIT	17.5110	17.8801	18.5638	19.2952	19.8228	20.0963	20.1664	20.1630	19.9994	19.3172	18.2861	17.4747	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.3610	17.7301	18.4138	19.1452	19.6728	19.9463	20.0164	20.0130	19.8494	19.1672	18.1361	17.3247	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9181	0.8903	0.8305	0.7310	0.5926	0.4109	0.2608	0.2802	0.5289	0.7708	0.8876	0.9261	(94)
Useful gains	792.7732	873.2670	936.7059	943.9593	810.8466	560.8614	336.6931	334.9644	576.3182	727.9224	745.3716	759.8436	(95)
Ext temp.	4.5000	5.1000	7.0000	9.4000	12.4000	15.4000	17.4000	17.4000	14.9000	11.2000	7.4000	4.4000	(96)
Heat loss rate W													
	1715.9017	1677.7068	1516.1473	1278.1119	953.8551	596.2637	343.1476	342.7008	649.1278	1044.9181	1408.0788	1695.1104	(97)
Space heating kWh													
	686.8076	540.5835	431.1044	240.5899	106.3983	0.0000	0.0000	0.0000	0.0000	235.8448	477.1491	695.8385	(98a)
Space heating requirement - total per year (kWh/year)												3414.3161	
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													
	686.8076	540.5835	431.1044	240.5899	106.3983	0.0000	0.0000	0.0000	0.0000	235.8448	477.1491	695.8385	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3414.3161	
Space heating per m2											(98c) / (4) =	26.4676	(99)

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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	686.8076	540.5835	431.1044	240.5899	106.3983	0.0000	0.0000	0.0000	0.0000	235.8448	477.1491	695.8385	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	771.6939	607.3972	484.3869	270.3257	119.5486	0.0000	0.0000	0.0000	0.0000	264.9942	536.1226	781.8410	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	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												
	185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514 (64)
Efficiency of water heater												87.3000 (216)
(217)m	88.6334	88.6002	88.5081	88.3391	88.0133	87.3000	87.3000	87.3000	87.3000	88.3254	88.5605	88.6403 (217)
Fuel for water heating, kWh/month												
	209.0023	184.0116	194.5524	169.9093	164.0233	147.6934	145.3664	152.2490	155.0303	172.2967	184.2647	206.6231 (219)
Space cooling fuel requirement												
(221)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 (221)
Pumps and Fa	11.6467	10.5196	11.6467	11.2710	11.6467	11.2710	11.6467	11.6467	11.2710	11.6467	11.2710	11.6467 (231)
Lighting	33.8796	27.1795	24.4721	17.9293	13.8491	11.3148	12.6336	16.4217	21.3301	27.9863	31.6104	34.8212 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-27.3070	-40.7343	-67.1955	-85.4831	-96.8138	-93.8287	-91.3247	-83.0925	-69.5260	-52.1852	-31.3860	-23.4411 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)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 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)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 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)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 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-9.8320	-21.3492	-51.2919	-92.8306	-130.4470	-140.9659	-134.4465	-107.2777	-71.1567	-36.0318	-13.7673	-7.7770 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)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 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)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 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)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 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	3836.3103 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	87.3000
Water heating fuel used	2085.0225 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 4.9570, total flow = 37.0000, SFP = 0.1340)	
mechanical ventilation fans (SFP = 0.1340)	51.1303 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	137.1303 (231)
Electricity for lighting (calculated in Appendix L)	273.4278 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1579.4916 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4752.3993 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3836.3103	4.8000	184.1429	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2085.0225	4.8000	100.0811	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	137.1303	21.5100	29.4967	(249)
Energy for lighting	273.4278	21.5100	58.8143	(250)
Additional standing charges			98.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-762.3179	21.5100	-163.9746	
PV Unit electricity exported	-817.1737	5.5900	-45.6800	
Total			-209.6546	(252)
Total energy cost			260.8804	(255)

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	3836.3103	0.2100	805.6252	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2085.0225	0.2100	437.8547	(264)
Space and water heating			1243.4799	(265)
Pumps, fans and electric keep-hot	137.1303	0.1387	19.0217	(267)
Energy for lighting	273.4278	0.1443	39.4641	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-762.3179	0.1326	-101.0953	

PV Unit electricity exported	-817.1737	0.1223	-99.9369
Total			-201.0323 (269)
Total CO2, kg/year			1100.9334 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3836.3103	1.1300	4335.0306 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2085.0225	1.1300	2356.0754 (278)
Space and water heating			6691.1060 (279)
Pumps, fans and electric keep-hot	137.1303	1.5128	207.4507 (281)
Energy for lighting	273.4278	1.5338	419.3927 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-762.3179	1.4900	-1135.8626
PV Unit electricity exported	-817.1737	0.4487	-366.6943
Total			-1502.5569 (283)
Total Primary energy kWh/year			5815.3925 (286)

SAP 10 EPC IMPROVEMENTS

Hampton Woods

Current energy efficiency rating: A 92
Current environmental impact rating: B 91

N Solar water heating — SAP increase too small
U Solar photovoltaic panels — Already installed
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 17	-136 kg (12.4%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, East Anglia):

	Current	Potential	Saving
Electricity	£88	£88	£0
Mains gas	£382	£382	£0
Space heating	£312	£312	£0
Water heating	£100	£100	£0
Lighting	£59	£59	£0
Generated (PV)	-£210	-£210	£0
Total cost of fuels	£260	£260	£0
Total cost of uses	£261	£261	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	45 kWh/m²	45 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor	64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(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	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)+(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		4.9000	(17)
Infiltration rate		0.2450	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2266	(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	0.2889	0.2833	0.2776	0.2493	0.2436	0.2153	0.2153	0.2096	0.2266	0.2436	0.2550	0.2663	(22b)

Mechanical extract ventilation - decentralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5389	0.5333	0.5276	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5050	0.5163	(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	
entrance			2.1000	1.2000	2.5200			(26)
rear/utility entrance			2.1000	1.1000	2.3100			(26a)
glazing (Uw = 1.30)			18.7000	1.2357	23.1084			(27)
ground			64.5000	0.1200	7.7400	75.0000	4837.5000	(28a)
external wall	158.1100	22.9000	135.2100	0.2400	32.4504	9.0000	1216.8900	(29a)
cold	64.5000		64.5000	0.0900	5.8050	9.0000	580.5000	(30)
Total net area of external elements Aum(A, m2)			287.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.9338			(33)
stud			152.7000			9.0000	1374.3000	(32c)
block			37.2000			75.0000	2790.0000	(32c)
internal			64.5000			18.0000	1161.0000	(32d)
internal			64.5000			9.0000	580.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12540.6900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	97.2147	(35)

List of Thermal Bridges

		Length	Psi-value	Total
K1	Element			
E2	Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3	Sill	11.9000	0.0090	0.1071
E4	Jamb	39.9000	0.0140	0.5586
E5	Ground floor (normal)	32.6000	0.0550	1.7930
E6	Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	12.1000	0.0460	0.5566
E12	Gable (insulation at ceiling level)	20.5000	0.0540	1.1070
E16	Corner (normal)	24.2500	0.0480	1.1640
E17	Corner (inverted – internal area greater than external area)	4.8500	-0.0970	-0.4704

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6033	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 79.5371	(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	55.6367	55.0518	54.4669	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	52.1274	53.2972	(38)
Heat transfer coeff	135.1738	134.5889	134.0041	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.6646	132.8343	(39)

Average = Sum(39)m / 12 = 132.1949

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

HLP	1.0479	1.0433	1.0388	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0207	1.0297 (40)
HLP (average)												1.0248
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8924 (42)

Hot water usage for mixer showers

72.7150	71.6223	70.0299	66.9832	64.7348	62.2274	60.8022	62.3825	64.1148	66.8070	69.9192	72.4364 (42a)

Hot water usage for baths

31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869 (42b)

Hot water usage for other uses

44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506 (42c)

Average daily hot water use (litres/day) 136.3749 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	148.3587	145.1906	141.3325	135.4661	130.7022	125.5805	123.6124	127.4538	131.5051	136.8819	142.8387	147.9739	(44)
Energy conte	234.9639	206.7494	217.2228	185.4464	175.9502	154.4159	149.4985	157.8144	162.1590	185.7475	203.4999	231.6914	(45)
Energy content (annual)										Total = Sum(45)m =		2265.1594	
Distribution loss (46)m = 0.15 x (45)m													
	35.2446	31.0124	32.5834	27.8170	26.3925	23.1624	22.4248	23.6722	24.3238	27.8621	30.5250	34.7537	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	14.3205	12.9215	14.2779	13.7579	14.1788	13.6834	14.1154	14.1353	13.7020	14.2024	13.8012	14.3126	(61)
Total heat required for water heating calculated for each month													
	249.2843	219.6709	231.5007	199.2042	190.1291	168.0993	163.6139	171.9498	175.8609	199.9498	217.3011	246.0041	(62)
WWHRS	-64.0386	-56.6362	-59.3062	-49.1079	-45.7668	-39.1629	-36.7090	-39.0364	-40.5195	-47.7680	-54.1154	-62.8527	(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													
	185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514	(64)
										Total per year (kWh/year) = Sum(64)m =		1837.5488	(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													
	81.7056	71.9746	75.7961	65.1004	62.0482	54.7641	53.2371	56.0071	57.3434	65.3116	71.1140	80.6156	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.7065	34.3788	27.9587	21.1665	15.8222	13.3578	14.4336	18.7613	25.1814	31.9736	37.3179	39.7823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	442.5541	447.1464	435.5739	410.9374	379.8382	350.6094	331.0827	326.4904	338.0629	362.6994	393.7986	423.0274	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)													
	109.8194	107.1050	101.8764	90.4172	83.3981	76.0613	71.5552	75.2784	79.6435	87.7844	98.7695	108.3542	(72)
Total internal gains													
	707.1734	704.7237	681.5025	638.6146	595.1520	553.1220	530.1650	533.6236	555.9813	598.5509	645.9794	687.2574	(73)

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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	
East	10.1500	19.6403	0.4600	0.0000	0.7700	70.6093	(76)
South	0.7000	46.7521	0.4600	0.0000	0.7700	11.5917	(78)
West	7.8500	19.6403	0.4600	0.0000	0.7700	54.6092	(80)

Solar gains	136.8102	263.9381	427.5867	615.6724	749.5150	765.5157	729.4879	629.6229	494.4372	311.1347	169.8728	112.9899 (83)
Total gains	843.9836	968.6618	1109.0892	1254.2870	1344.6670	1318.6376	1259.6529	1163.2464	1050.4185	909.6856	815.8522	800.2473 (84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.7707	25.8827	25.9957	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.4576	26.2246	
alpha	2.7180	2.7255	2.7330	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7638	2.7483	
util living area	0.9557	0.9352	0.8943	0.8143	0.6980	0.5556	0.4280	0.4744	0.6779	0.8615	0.9376	0.9609	(86)
MIT	18.5804	18.8934	19.4083	20.0458	20.5258	20.8200	20.9360	20.9133	20.6747	20.0211	19.2057	18.5443	(87)
Th 2	20.0436	20.0474	20.0511	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0662	20.0586	(88)
util rest of house	0.9495	0.9263	0.8798	0.7889	0.6565	0.4929	0.3472	0.3919	0.6198	0.8366	0.9277	0.9554	(89)
MIT 2	17.2044	17.6008	18.2471	19.0404	19.6043	19.9237	20.0312	20.0145	19.7841	19.0284	18.0120	17.1676	(90)
Living area fraction										fLA = Living area / (4) =		0.1225	(91)
MIT	17.3729	17.7591	18.3894	19.1635	19.7172	20.0335	20.1420	20.1246	19.8932	19.1499	18.1582	17.3362	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.2229	17.6091	18.2394	19.0135	19.5672	19.8835	19.9920	19.9746	19.7432	18.9999	18.0082	17.1862	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9233	0.8953	0.8443	0.7550	0.6316	0.4795	0.3401	0.3830	0.5970	0.8006	0.8973	0.9312	(94)
Useful gains	779.2563	867.2903	936.3869	946.9738	849.3317	632.2843	428.4537	445.4965	627.0507	728.3324	732.0525	745.1877	(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	1746.8367	1710.5023	1573.1211	1326.4245	1031.8090	692.9454	444.8700	468.8205	740.1184	1101.6796	1436.2185	1725.0132	(97)
Space heating kWh	719.8799	566.6385	473.7303	273.2046	135.7631	0.0000	0.0000	0.0000	0.0000	277.7703	506.9995	728.9902	(98a)
Space heating requirement - total per year (kWh/year)												3682.9762	
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	719.8799	566.6385	473.7303	273.2046	135.7631	0.0000	0.0000	0.0000	0.0000	277.7703	506.9995	728.9902	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3682.9762	
Space heating per m2											(98c) / (4) =	28.5502	(99)

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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	719.8799	566.6385	473.7303	273.2046	135.7631	0.0000	0.0000	0.0000	0.0000	277.7703	506.9995	728.9902	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	808.8538	636.6724	532.2812	306.9714	152.5428	0.0000	0.0000	0.0000	0.0000	312.1015	569.6623	819.0901	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	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	185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.6467	88.6144	88.5404	88.3897	88.1157	87.3000	87.3000	87.3000	87.3000	88.3908	88.5800	88.6534	(217)
Fuel for water heating, kWh/month	208.9709	183.9821	194.4814	169.8121	163.8326	147.6934	145.3664	152.2490	155.0303	172.1694	184.2241	206.5927	(219)
Space cooling fuel requirement													
(221)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	(221)
Pumps and Fa	11.6467	10.5196	11.6467	11.2710	11.6467	11.2710	11.6467	11.6467	11.2710	11.6467	11.2710	11.6467	(231)
Lighting	33.8796	27.1795	24.4721	17.9293	13.8491	11.3148	12.6336	16.4217	21.3301	27.9863	31.6104	34.8212	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-24.2616	-39.1295	-64.9003	-82.1387	-94.9037	-90.7251	-89.0767	-80.4852	-65.9460	-48.0476	-28.0358	-20.2455	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)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	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)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	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-8.0451	-19.8645	-47.9558	-85.2348	-124.5205	-129.8568	-126.5637	-99.7412	-63.7033	-30.8423	-11.3142	-6.0801	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)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	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)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	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)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	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4138.1756	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater		87.3000
Water heating fuel used		2084.4045 (219)
Space cooling fuel		0.0000 (221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 4.9570, total flow = 37.0000, SFP = 0.1340)		
mechanical ventilation fans (SFP = 0.1340)		51.1303 (230a)
central heating pump		41.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		137.1303 (231)
Electricity for lighting (calculated in Appendix L)		273.4278 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		-1481.6181 (233)
Wind generation		0.0000 (234)
Hydro-electric generation (Appendix N)		0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)		0.0000 (235)
Appendix Q - special features		
Energy saved or generated		-0.0000 (236)
Energy used		0.0000 (237)
Total delivered energy for all uses		5151.5201 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4138.1756	3.6400	150.6296	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2084.4045	3.6400	75.8723	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	137.1303	16.4900	22.6128	(249)
Energy for lighting	273.4278	16.4900	45.0882	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-727.8957	16.4900	-120.0300	
PV Unit electricity exported	-753.7224	5.5900	-42.1331	
Total			-162.1631	(252)
Total energy cost			224.0399	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4635 (257)
SAP value		92.4862
SAP rating (Section 12)		92 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4138.1756	0.2100	869.0169	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2084.4045	0.2100	437.7249	(264)
Space and water heating			1306.7418	(265)
Pumps, fans and electric keep-hot	137.1303	0.1387	19.0217	(267)
Energy for lighting	273.4278	0.1443	39.4641	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-727.8957	0.1323	-96.3204	
PV Unit electricity exported	-753.7224	0.1219	-91.9055	
Total			-188.2259	(269)
Total CO2, kg/year			1177.0016	(272)
CO2 emissions per m2			9.1200	(273)
EI value			90.9357	
EI rating			91	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5000 (1b)	x	2.3000 (2b)	=	148.3500 (1b)	-
First floor	64.5000 (1c)	x	2.5500 (2c)	=	164.4750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.8250	(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	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)+(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		4.9000	(17)
Infiltration rate		0.2450	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2266	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.8000	4.7000	4.7000	4.3000	4.3000	3.7000	3.8000	3.8000	3.9000	4.1000	4.2000	4.3000	(22)
Wind factor	1.2000	1.1750	1.1750	1.0750	1.0750	0.9250	0.9500	0.9500	0.9750	1.0250	1.0500	1.0750	(22a)
Adj infilt rate	0.2720	0.2663	0.2663	0.2436	0.2436	0.2096	0.2153	0.2153	0.2210	0.2323	0.2380	0.2436	(22b)

Mechanical extract ventilation - decentralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5220	0.5163	0.5163	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
entrance			2.1000	1.2000	2.5200			(26)
rear/utility entrance			2.1000	1.1000	2.3100			(26a)
glazing (Uw = 1.30)			18.7000	1.2357	23.1084			(27)
ground			64.5000	0.1200	7.7400	75.0000	4837.5000	(28a)
external wall	158.1100	22.9000	135.2100	0.2400	32.4504	9.0000	1216.8900	(29a)
cold	64.5000		64.5000	0.0900	5.8050	9.0000	580.5000	(30)
Total net area of external elements Aum(A, m2)			287.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.9338			(33)
stud			152.7000			9.0000	1374.3000	(32c)
block			37.2000			75.0000	2790.0000	(32c)
internal			64.5000			18.0000	1161.0000	(32d)
internal			64.5000			9.0000	580.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12540.6900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	97.2147	(35)

List of Thermal Bridges

		Length	Psi-value	Total
K1	Element			
E2	Other lintels (including other steel lintels)	15.7500	0.0500	0.7875
E3	Sill	11.9000	0.0090	0.1071
E4	Jamb	39.9000	0.0140	0.5586
E5	Ground floor (normal)	32.6000	0.0550	1.7930
E6	Intermediate floor within a dwelling	32.6000	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	12.1000	0.0460	0.5566
E12	Gable (insulation at ceiling level)	20.5000	0.0540	1.1070
E16	Corner (normal)	24.2500	0.0480	1.1640
E17	Corner (inverted – internal area greater than external area)	4.8500	-0.0970	-0.4704

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6033	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 79.5371	(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	53.8821	53.2972	53.2972	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	51.6161	(38)
Heat transfer coeff	133.4192	132.8343	132.8343	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	131.1532	(39)

Average = Sum(39)m / 12 = 131.6222

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

HLP	1.0343	1.0297	1.0297	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167	1.0167 (40)
HLP (average)												1.0203
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8924 (42)

Hot water usage for mixer showers

72.7150	71.6223	70.0299	66.9832	64.7348	62.2274	60.8022	62.3825	64.1148	66.8070	69.9192	72.4364 (42a)

Hot water usage for baths

31.3931	30.9268	30.2703	29.0597	28.1533	27.1482	26.6052	27.2572	27.9671	29.0426	30.2781	31.2869 (42b)

Hot water usage for other uses

44.2506	42.6415	41.0323	39.4232	37.8141	36.2050	36.2050	37.8141	39.4232	41.0323	42.6415	44.2506 (42c)

Average daily hot water use (litres/day) 136.3749 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	148.3587	145.1906	141.3325	135.4661	130.7022	125.5805	123.6124	127.4538	131.5051	136.8819	142.8387	147.9739	(44)
Energy conte	234.9639	206.7494	217.2228	185.4464	175.9502	154.4159	149.4985	157.8144	162.1590	185.7475	203.4999	231.6914	(45)
Energy content (annual)										Total = Sum(45)m =		2265.1594	
Distribution loss (46)m = 0.15 x (45)m													
	35.2446	31.0124	32.5834	27.8170	26.3925	23.1624	22.4248	23.6722	24.3238	27.8621	30.5250	34.7537	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	14.3205	12.9215	14.2779	13.7579	14.1788	13.6834	14.1154	14.1353	13.7020	14.2024	13.8012	14.3126	(61)
Total heat required for water heating calculated for each month													
	249.2843	219.6709	231.5007	199.2042	190.1291	168.0993	163.6139	171.9498	175.8609	199.9498	217.3011	246.0041	(62)
WWHRS	-64.0386	-56.6362	-59.3062	-49.1079	-45.7668	-39.1629	-36.7090	-39.0364	-40.5195	-47.7680	-54.1154	-62.8527	(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													
	185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514	(64)
										Total per year (kWh/year) = Sum(64)m =		1837.5488	(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													
	81.7056	71.9746	75.7961	65.1004	62.0482	54.7641	53.2371	56.0071	57.3434	65.3116	71.1140	80.6156	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	173.5410	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.7065	34.3788	27.9587	21.1665	15.8222	13.3578	14.4336	18.7613	25.1814	31.9736	37.3179	39.7823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	442.5541	447.1464	435.5739	410.9374	379.8382	350.6094	331.0827	326.4904	338.0629	362.6994	393.7986	423.0274	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	55.2465	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	-115.6940	(71)
Water heating gains (Table 5)													
	109.8194	107.1050	101.8764	90.4172	83.3981	76.0613	71.5552	75.2784	79.6435	87.7844	98.7695	108.3542	(72)
Total internal gains													
	707.1734	704.7237	681.5025	638.6146	595.1520	553.1220	530.1650	533.6236	555.9813	598.5509	645.9794	687.2574	(73)

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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	
East	10.1500	22.4868	0.4600	0.0000	0.7700	80.8431	(76)
South	0.7000	52.3697	0.4600	0.0000	0.7700	12.9845	(78)
West	7.8500	22.4868	0.4600	0.0000	0.7700	62.5239	(80)

Solar gains	156.3515	276.1135	446.3821	652.6828	773.0998	811.8688	760.8178	662.0059	533.6096	345.8746	193.7746	133.2103	(83)
Total gains	863.5250	980.8372	1127.8846	1291.2974	1368.2518	1364.9907	1290.9828	1195.6294	1089.5909	944.4254	839.7540	820.4677	(84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.1096	26.2246	26.2246	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	26.5607	
alpha	2.7406	2.7483	2.7483	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	2.7707	
util living area	0.9518	0.9310	0.8824	0.7918	0.6604	0.4887	0.3511	0.3761	0.6137	0.8357	0.9303	0.9572	(86)
MIT	18.6878	18.9872	19.5487	20.1583	20.6217	20.8862	20.9682	20.9621	20.7785	20.1631	19.3089	18.6521	(87)
Th 2	20.0549	20.0586	20.0586	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	20.0694	(88)
util rest of house	0.9451	0.9217	0.8662	0.7636	0.6142	0.4204	0.2658	0.2859	0.5464	0.8060	0.9192	0.9513	(89)
MIT 2	17.3467	17.7255	18.4264	19.1747	19.7113	19.9861	20.0545	20.0514	19.8906	19.1991	18.1434	17.3103	(90)
Living area fraction										fLA = Living area / (4) =		0.1225	(91)
MIT	17.5110	17.8801	18.5638	19.2952	19.8228	20.0963	20.1664	20.1630	19.9994	19.3172	18.2861	17.4747	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.3610	17.7301	18.4138	19.1452	19.6728	19.9463	20.0164	20.0130	19.8494	19.1672	18.1361	17.3247	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9181	0.8903	0.8305	0.7310	0.5926	0.4109	0.2608	0.2802	0.5289	0.7708	0.8876	0.9261	(94)
Useful gains	792.7732	873.2670	936.7059	943.9593	810.8466	560.8614	336.6931	334.9644	576.3182	727.9224	745.3716	759.8436	(95)
Ext temp.	4.5000	5.1000	7.0000	9.4000	12.4000	15.4000	17.4000	17.4000	14.9000	11.2000	7.4000	4.4000	(96)
Heat loss rate W	1715.9017	1677.7068	1516.1473	1278.1119	953.8551	596.2637	343.1476	342.7008	649.1278	1044.9181	1408.0788	1695.1104	(97)
Space heating kWh	686.8076	540.5835	431.1044	240.5899	106.3983	0.0000	0.0000	0.0000	0.0000	235.8448	477.1491	695.8385	(98a)
Space heating requirement - total per year (kWh/year)												3414.3161	
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	686.8076	540.5835	431.1044	240.5899	106.3983	0.0000	0.0000	0.0000	0.0000	235.8448	477.1491	695.8385	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3414.3161	
Space heating per m2										(98c) / (4) =		26.4676	(99)

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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	686.8076	540.5835	431.1044	240.5899	106.3983	0.0000	0.0000	0.0000	0.0000	235.8448	477.1491	695.8385	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	771.6939	607.3972	484.3869	270.3257	119.5486	0.0000	0.0000	0.0000	0.0000	264.9942	536.1226	781.8410	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	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	185.2458	163.0347	172.1945	150.0964	144.3623	128.9364	126.9049	132.9134	135.3414	152.1818	163.1857	183.1514	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.6334	88.6002	88.5081	88.3391	88.0133	87.3000	87.3000	87.3000	87.3000	88.3254	88.5605	88.6403	(217)
Fuel for water heating, kWh/month	209.0023	184.0116	194.5524	169.9093	164.0233	147.6934	145.3664	152.2490	155.0303	172.2967	184.2647	206.6231	(219)
Space cooling fuel requirement													
(221)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	(221)
Pumps and Fa	11.6467	10.5196	11.6467	11.2710	11.6467	11.2710	11.6467	11.6467	11.2710	11.6467	11.2710	11.6467	(231)
Lighting	33.8796	27.1795	24.4721	17.9293	13.8491	11.3148	12.6336	16.4217	21.3301	27.9863	31.6104	34.8212	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-27.3070	-40.7343	-67.1955	-85.4831	-96.8138	-93.8287	-91.3247	-83.0925	-69.5260	-52.1852	-31.3860	-23.4411	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)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	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)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	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-9.8320	-21.3492	-51.2919	-92.8306	-130.4470	-140.9659	-134.4465	-107.2777	-71.1567	-36.0318	-13.7673	-7.7770	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)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	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)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	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)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	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3836.3103	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	87.3000
Water heating fuel used	2085.0225 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 4.9570, total flow = 37.0000, SFP = 0.1340)	
mechanical ventilation fans (SFP = 0.1340)	51.1303 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	137.1303 (231)
Electricity for lighting (calculated in Appendix L)	273.4278 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1579.4916 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4752.3993 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3836.3103	4.8000	184.1429	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2085.0225	4.8000	100.0811	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	137.1303	21.5100	29.4967	(249)
Energy for lighting	273.4278	21.5100	58.8143	(250)
Additional standing charges			98.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-762.3179	21.5100	-163.9746	
PV Unit electricity exported	-817.1737	5.5900	-45.6800	
Total			-209.6546	(252)
Total energy cost			260.8804	(255)

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	3836.3103	0.2100	805.6252	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2085.0225	0.2100	437.8547	(264)
Space and water heating			1243.4799	(265)
Pumps, fans and electric keep-hot	137.1303	0.1387	19.0217	(267)
Energy for lighting	273.4278	0.1443	39.4641	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-762.3179	0.1326	-101.0953	
PV Unit electricity exported	-817.1737	0.1223	-99.9369	
Total			-201.0323	(269)
Total CO2, kg/year			1100.9334	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3836.3103	1.1300	4335.0306	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2085.0225	1.1300	2356.0754	(278)
Space and water heating			6691.1060	(279)
Pumps, fans and electric keep-hot	137.1303	1.5128	207.4507	(281)
Energy for lighting	273.4278	1.5338	419.3927	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-762.3179	1.4900	-1135.8626	
PV Unit electricity exported	-817.1737	0.4487	-366.6943	
Total			-1502.5569	(283)
Total Primary energy kWh/year			5815.3925	(286)