



green**box**
associates

Energy Statement Bryanston Road
Oct 2023

GREENBOX ASSOCIATES CONTACT DETAILS

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FABRIC FIRST	3
ENERGY DEMAND REDUCTION AND ENERGY EFFICIENCY	3
AIR PERMEABILITY AND VENTILATION	4
COOLING	4
HEATING AND HOT WATER	4
RENEWABLE ENERGY	4
BUILDING PERFORMANCE	5
CONCLUSION	6
APPENDIX ONE: SAP OUTPUTS	7

INTRODUCTION

Greenbox Associates Ltd has been appointed to model the proposed development at Bryanston Road Southampton in SAP 10 and provide a statement to demonstrate the predicted energy and carbon performance of the eight new dwellings.



Figure 1. Bryanston Road Southampton

The building’s design and subsequent energy strategy has incorporated the principles of a fabric first approach. The target U values have been set by the proposed Future Homes Standard (FHS), which was subject to public consultation in winter 2021 and is due for implementation in 2025, when AD Part L1A will be further revised. The design philosophy of the Future Homes Standard is to:

- Set a performance level which means that new homes will not be built with fossil fuel heating, such as a natural gas boiler.
- Be future-proofed with low carbon heating and high levels of energy efficiency.
- Require no further energy efficiency retrofit work to enable them to become zero-carbon as the electricity grid continues to decarbonise.

Whilst the FHS is yet to be finalized, it will be a further improvement over Part L1A 2021 and the key design elements followed at Bryanston Road Southampton are:

1. A fabric first approach with low U values for walls, floors and roofs
2. Triple glazing
3. Reduction in thermal bridge
4. Air source heat pump for heating and hot water
5. Additional photovoltaics

FABRIC FIRST

It is better and cheaper to save energy rather than generate it, so called negawatts. By investing in the fabric of the structure, the carbon and energy benefits are locked in for the lifetime of the building. Increasing insulation levels and reducing air tightness lowers heat loss from the building and therefore space heating demand, which in turn reduces energy bills. In addition, attention to detail to the building fabric, though insulation and reduced thermal bridges, increases internal surface temperatures, which if kept above 17°C, will eliminate condensation risk and mould growth. This provides a healthy indoor environment and protects the structure, which prolongs the life of the building.

ENERGY DEMAND REDUCTION AND ENERGY EFFICIENCY

Energy demand at Bryanston Road has been reduced, through the following measures :

- The walls, roof and floors will be highly insulated to reduce heat losses through the building fabric. U values for opaque elements between 0.11 and 0.15 W/m²K
- Triple Glazed windows to retain energy and reduce noise and improve internal comfort, with a proposed U value of 0.8 W/m²K
- Reduced thermal bridges

The sample specification in Table 1 below gives an indication of the target U values at Bryanston Road Southampton for these building elements.

Fabric first - table of proposed u values Bryanston road		
	Bryanston Road	Minimum Standards for Part L1A 2021
Ground Floor	0.11 W/m ² K	0.18 W/m ² K
External Walls	0.15 W/m ² K	0.26 W/m ² K
Roofs	0.11 W/m ² K	0.16 W/m ² K
Windows	0.80 W/m ² K	1.6 W/m ² K
External Doors	0.80 W/m ² K	1.6 W/m ² K

Table 1 Summary of the building fabric performance at Bryanston Road

AIR PERMEABILITY AND VENTILATION

Once insulation levels have been increased, the heat losses from uncontrolled ventilation and infiltration can be considerable. Under current Building Regulations a dwelling must have an infiltration rate of less than 8 m³/hm²@50Pa. The target for this building will be 5.0 m³/hm²@50Pa. Additional ventilation to meet Part F will be provided in the kitchens and bathrooms.

COOLING

The dwellings have been designed not to require additional cooling.

HEATING AND HOT WATER

As these are highly insulated houses, the space heating demand will be lower and the greater energy demand will be for hot water. In line with the phasing out of gas as the main form of energy for heating and hot water and the decarbonisation of the National Grid, the homes will be heated by an efficient air source heat pump (ASHP) via low temperature radiators. Hot water will also be met by the same system.

RENEWABLE ENERGY

In addition to the improved building fabric the following photovoltaic (PV) arrays will be installed on each property to further reduce carbon emissions and will also reduce energy bills for occupants.

Summary of photovoltaics at Bryanston Road		
	No of Panels	kWp
Plot 1	6	2.4
Plot 2	10	4
Plot 3	10	4
Plot 4	8	3.2
Plot 5	8	3.2
Plot 6	8	3.2
Plot 7	10	4
Plot 8	10	4

Table 2 Summary of photovoltaics at Bryanston Road

BUILDING PERFORMANCE

The dwellings have been modelled in SAP 10 software and the following results achieved.

Energy performance and building fabric				
	Space heating demand	Hot water demand	Design Fabric Energy Efficiency (DFEE)	Improvement over Part L1A 2021
Plot 1 End	744 kWh/year	1503 kWh/year	33.1 kWh/m ² /year	10.5%
Plot 2 Mid	740 kWh/year	1572 kWh/year	27.9 kWh/m ² /year	10.6%
Plot 3 End	918 kWh/year	1581 kWh/year	32.2 kWh/m ² /year	9.7%
Plot 4 End	710 kWh/year	1501 kWh/year	35.4 kWh/m ² /year	10.7%
Plot 5 Mid	484 kWh/year	1496 kWh/year	24.7 kWh/m ² /year	13.4%
Plot 6 End	723 kWh/year	1501 kWh/year	32.1 kWh/m ² /year	10.2%
Plot 7 End	855 kWh/year	1579 kWh/year	30.8 kWh/m ² /year	9.9%
Plot 8 End	922 kWh/year	1580 kWh/year	32.3 kWh/m ² /year	9.5%

Table 3. Summary of the energy and carbon performance at Bryanston Road

SAP rating and carbon emission reductions				
	SAP rating	CO ₂ Emissions	Dwelling Emission Rate (DER)	Improvement over Part L1A 2021
Plot 1 End	90B	0.08 t/y	1.98 kgCO ₂ /m ² /year	83%
Plot 2 Mid	94A	-0.05 t/y	0.39 kgCO ₂ /m ² /year	96%
Plot 3 End	93A	-0.03 t/y	0.69 kgCO ₂ /m ² /year	93%
Plot 4 End	92A	0.01 t/y	1.06 kgCO ₂ /m ² /year	91%
Plot 5 Mid	94A	-0.02 t/y	0.62 kgCO ₂ /m ² /year	94%
Plot 6 End	92A	0.01 t/y	1.09 kgCO ₂ /m ² /year	90%
Plot 7 End	93A	-0.04 t/y	0.58 kgCO ₂ /m ² /year	94%
Plot 8 End	93A	-0.03 t/y	0.7 kgCO ₂ /m ² /year	93%

Table 4 Summary of SAP ratings and carbon emissions reductions Bryanston Road

CONCLUSION

The proposed development of 8 dwellings at Bryanston Road Southampton has been modelled in SAP 10 and the calculations can be found in appendix one.

The designs are in line with the proposed Future Homes Standard, with the following key design features:

- Low U values for walls, roof, and floors between 0.11 W/m²K and 0.15 W/m²K
- Highly efficient triple glazed windows with a U value of 0.80 W/m²K
- Reduced heat losses from thermal bridging
- Addition photovoltaics to further reduce emissions and costs

It is proposed to meet the reduced domestic space heating and hot water demand with an efficient ASHP. This future proofs the dwellings against the phasing out of the gas network and allows the scheme to benefit from the further decarbonisation of the National Grid.

From the SAP 10 modelling the dwellings will have between a 83% and 96% reduction in carbon emissions compared to a similar dwelling designed to meet Part L1A 2021 and a SAP rating between 90 and 94.

APPENDIX ONE: SAP OUTPUTS

Full SAP Calculation Printout



Property Reference	all plots		Issued on Date	30/06/2023	
Assessment Reference	Plot 1 DS	Prop Type Ref			
Property	Plot 1 , Bryanston Road , Southampton, Hampshire , SO19				
SAP Rating	90 B	DER	1.98	TER	11.45
Environmental	98 A	% DER < TER	82.71		
CO ₂ Emissions (t/year)	0.08	DFEE	33.01	TFEE	36.86
Compliance Check	See BREL	% DFEE < TFEE	10.46		
% DPER < TPER	52.75	DPER	28.22	TPER	59.74
Assessor Details	Dr. Rachel Mitchell			Assessor ID	L772-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.7000 (2b)	= 106.6500 (1b)
First floor	39.5000 (1c)	x 2.4000 (2c)	= 94.8000 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.4500 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 =	0.0000 (6a)										
Number of open flues	0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)										
Number of blocked chimneys	0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	Air changes per hour	0.0000 / (5) = 0.0000 (8)										
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50		5.0000 (17)										
Infiltration rate		0.2500 (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) =	0.2313 (21)										
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5448	0.5391	0.5333	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5102	0.5217 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
window 0.8 (Uw = 0.80)			20.3100	0.7752	15.7442		(27)
front door			2.1800	0.8000	1.7440		(26)
Heatloss Floor 1			39.5000	0.1100	4.3450		(28a)

Full SAP Calculation Printout



External Wall 1	99.7000	22.4900	77.2100	0.1500	11.5815	(29a)
External Roof 1	39.5000		39.5000	0.1100	4.3450	(30)
Total net area of external elements Aum(A, m2)			178.7000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.7597	(33)
Party Wall 1			29.1000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)						8.9350 (36)
Point Thermal bridges						(36a) = 0.0500 (36a)
Total fabric heat loss						(33) + (36) + (36a) = 46.7447 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	36.2204	35.8361	35.4517	33.5301	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392	33.9144	34.6831 (38)
Average = Sum(39)m / 12 =	82.9651	82.5808	82.1964	80.2748	79.9839	79.9839	79.9839	79.9839	79.9839	79.9839	80.6591	81.4278 (39)
												80.8340

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0502	1.0453	1.0405	1.0161	1.0125	1.0125	1.0125	1.0125	1.0125	1.0125	1.0210	1.0307 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4436 (42)
Hot water usage for mixer showers	65.1911	64.2114	62.7838	60.0523	58.0365	55.7886	54.5108	55.9276	57.4807	59.8943	62.6845	64.9413 (42a)
Hot water usage for baths	28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623 (42b)
Hot water usage for other uses	39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550 (42c)
Average daily hot water use (litres/day)												122.2605 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587 (44)
Energy content (annual)	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114 (45)
Distribution loss (46)m = 0.15 x (45)m	31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567 (46)
Total = Sum(45)m =												2030.7208

Water storage loss:												200.0000 (47)
Store volume												1.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.6588 (55)
Enter (49) or (54) in (55)												
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228 (56)

If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
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	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966 (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	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966 (64)
Total per year (kWh/year) = Sum(64)m =												2545.0788 (64)

12Total per year (kWh/year)												2545 (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	104.9877	93.1954	99.6996	89.1001	87.3968	79.8504	79.5118	81.9906	82.1582	90.3169	94.4814	104.0122 (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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.6068	121.3504	109.6068	113.2603	109.6068	113.2603	109.6068	109.6068	113.2603	109.6068	113.2603	109.6068 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	141.1125	138.6837	134.0049	123.7501	117.4688	110.9033	106.8707	110.2024	114.1086	121.3937	131.2241	139.8013 (72)
Total internal gains	527.7113	539.2814	517.1757	498.4756	473.2680	456.0017	438.7261	439.8025	453.0455	468.7760	497.5327	516.8107 (73)

Full SAP Calculation Printout



6. Solar gains

[Jan]				Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
Southeast				4.1000	36.7938	0.6400		0.7000		0.7700	46.8350 (77)	
Southwest				5.8100	36.7938	0.6400		0.7000		0.7700	66.3686 (79)	
Northwest				10.4000	11.2829	0.6400		0.7000		0.7700	36.4306 (81)	
Solar gains	149.6342	266.9831	397.4398	546.3219	661.1004	677.9498	644.6144	555.6777	448.4771	303.7395	181.4309	126.6297 (83)
Total gains	677.3455	806.2645	914.6156	1044.7975	1134.3683	1133.9515	1083.3405	995.4802	901.5226	772.5155	678.9636	643.4404 (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	66.1255	66.4333	66.7439	68.3417	68.5902	68.5902	68.5902	68.5902	68.5902	68.5902	68.0160	67.3740	
alpha	5.4084	5.4289	5.4496	5.5561	5.5727	5.5727	5.5727	5.5727	5.5727	5.5727	5.5344	5.4916	
util living area	0.9892	0.9729	0.9329	0.8149	0.6328	0.4485	0.3244	0.3687	0.5961	0.8774	0.9745	0.9915 (86)	
Living	20.0112	20.2459	20.5312	20.8333	20.9638	20.9953	20.9994	20.9987	20.9799	20.7856	20.3614	19.9874	
Non living	19.1597	19.3920	19.6665	19.9505	20.0521	20.0711	20.0728	20.0726	20.0637	19.9211	19.5239	19.1494	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4942	20.2459	20.5312	20.8333	20.9638	20.9953	20.9994	20.9987	20.9799	20.7856	20.3614	20.1291 (87)	
Th 2	20.0417	20.0457	20.0498	20.0699	20.0730	20.0730	20.0730	20.0730	20.0730	20.0730	20.0659	20.0578 (88)	
util rest of house	0.9860	0.9652	0.9150	0.7760	0.5771	0.3849	0.2563	0.2949	0.5226	0.8395	0.9659	0.9889 (89)	
MIT 2	19.5905	19.3920	19.6665	19.9505	20.0521	20.0711	20.0728	20.0726	20.0637	19.9211	19.5239	19.2764 (90)	
Living area fraction	fLA = Living area / (4) =											0.2608 (91)	
MIT	19.8262	19.6147	19.8919	20.1807	20.2898	20.3121	20.3144	20.3141	20.3026	20.1465	19.7423	19.4988 (92)	
Temperature adjustment	0.0000												
adjusted MIT	19.8262	19.6147	19.8919	20.1807	20.2898	20.3121	20.3144	20.3141	20.3026	20.1465	19.7423	19.4988 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9851	0.9609	0.9116	0.7810	0.5905	0.4014	0.2741	0.3141	0.5413	0.8429	0.9622	0.9870 (94)
Useful gains	667.2503	774.7487	833.7875	815.9602	669.8401	455.1512	296.9351	312.7273	487.9524	651.1316	653.2702	635.0604 (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	1288.1294	1215.1491	1100.7691	905.5528	687.0467	456.8766	297.0946	313.0678	496.1109	763.5665	1019.7155	1245.7445 (97)
Space heating kWh	461.9340	295.9491	198.6343	64.5067	12.8017	0.0000	0.0000	0.0000	0.0000	83.6515	263.8406	454.3490 (98a)
Space heating requirement - total per year (kWh/year)												1835.6669
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	461.9340	295.9491	198.6343	64.5067	12.8017	0.0000	0.0000	0.0000	0.0000	83.6515	263.8406	454.3490 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1835.6669
Space heating per m ²												(98c) / (4) = 23.2363 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)	246.7034 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	461.9340	295.9491	198.6343	64.5067	12.8017	0.0000	0.0000	0.0000	0.0000	83.6515	263.8406	454.3490 (98)
Space heating efficiency (main heating system 1)	246.7034	246.7034	246.7034	246.7034	246.7034	0.0000	0.0000	0.0000	0.0000	246.7034	246.7034	246.7034 (210)
Space heating fuel (main heating system)	187.2427	119.9615	80.5154	26.1475	5.1891	0.0000	0.0000	0.0000	0.0000	33.9077	106.9465	184.1681 (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

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Efficiency of water heater (217)m	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966 (64)
Fuel for water heating, kWh/month	169.3006	169.3006	169.3006	169.3006	169.3006	169.3006	169.3006	169.3006	169.3006	169.3006	169.3006	169.3006 (216)
Space cooling fuel requirement (221)m	150.2242	132.7869	140.8303	123.1712	118.9751	106.7396	104.9679	109.3713	110.8393	124.1625	132.7306	148.4913 (219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Lighting	3.0709	2.7737	3.0709	2.9719	3.0709	2.9719	3.0709	3.0709	2.9719	3.0709	2.9719	3.0709 (231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	21.8949	17.5649	15.8152	11.5869	8.9501	7.3123	8.1645	10.6126	13.7847	18.0863	20.4284	22.5034 (232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-32.6207	-49.6362	-76.4523	-89.4803	-99.3218	-93.6512	-92.2421	-85.2037	-72.4000	-57.3790	-36.6430	-27.6468 (233a)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	-9.6975	-22.9100	-51.3918	-86.7206	-121.5778	-124.5970	-122.6887	-100.6307	-69.8923	-36.6092	-13.9529	-7.4852 (233b)
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												744.0785 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												169.3006
Water heating fuel used												1503.2901 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471) mechanical ventilation fans (SFP = 0.1471)												36.1577 (230a)
Total electricity for the above, kWh/year												36.1577 (231)
Electricity for lighting (calculated in Appendix L)												176.7041 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1580.8308 (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												879.3996 (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	744.0785	0.1576	117.2371 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1503.2901	0.1410	211.9623 (264)
Space and water heating			329.1994 (265)
Pumps, fans and electric keep-hot	36.1577	0.1387	5.0155 (267)
Energy for lighting	176.7041	0.1443	25.5039 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-812.6772	0.1336	-108.5580
PV Unit electricity exported	-768.1536	0.1232	-94.6251
Total			-203.1831 (269)
Total CO2, kg/year			156.5357 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.9800 (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	744.0785	1.5832	1178.0570 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1503.2901	1.5214	2287.0574 (278)
Space and water heating			3465.1144 (279)
Pumps, fans and electric keep-hot	36.1577	1.5128	54.6994 (281)
Energy for lighting	176.7041	1.5338	271.0346 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-812.6772	1.4936	-1213.8490
PV Unit electricity exported	-768.1536	0.4521	-347.2558
Total			-1561.1047 (283)
Total Primary energy kWh/year			2229.7437 (286)
Dwelling Primary energy Rate (DPER)			28.2200 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.7000 (2b)	= 106.6500 (1b) -
First floor	39.5000 (1c)	x 2.4000 (2c)	= 94.8000 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.4500 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) =	0.1489 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3989 (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) =	0.3690 (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	0.4705	0.4613	0.4520	0.4059	0.3967	0.3506	0.3506	0.3413	0.3690	0.3967	0.4151	0.4336 (22b)
Effective ac	0.6107	0.6064	0.6022	0.5824	0.5787	0.5614	0.5614	0.5583	0.5681	0.5787	0.5862	0.5940 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1800	1.0000	2.1800		(26)
TER Opening Type (Uw = 1.20)			17.5900	1.1450	20.1412		(27)
Heatloss Floor 1			39.5000	0.1300	5.1350		(28a)
External Wall 1	99.7000	19.7700	79.9300	0.1800	14.3874		(29a)
External Roof 1	39.5000		39.5000	0.1100	4.3450		(30)
Total net area of external elements Aum(A, m ²)			178.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1886		(33)
Party Wall 1			29.1000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E5 Ground floor (normal)				19.5000	0.1600	3.1200	
E6 Intermediate floor within a dwelling				19.5000	0.0000	0.0000	
E16 Corner (normal)				10.2000	0.0900	0.9180	
E18 Party wall between dwellings				10.2000	0.0600	0.6120	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6500 (36)
Point Thermal bridges						(36a) =	0.0500 (36a)
Total fabric heat loss						(33) + (36) + (36a) =	50.8886 (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	40.5967	40.3110	40.0310	38.7156	38.4695	37.3239	37.3239	37.1117	37.7652	38.4695	38.9674	39.4879 (38)
Heat transfer coeff	91.4853	91.1996	90.9196	89.6042	89.3581	88.2125	88.2125	88.0004	88.6538	89.3581	89.8560	90.3765 (39)
Average = Sum(39)m / 12 =												89.6031
HLP	1.1580	1.1544	1.1509	1.1342	1.1311	1.1166	1.1166	1.1139	1.1222	1.1311	1.1374	1.1440 (40)
HLP (average)												1.1342

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Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.4436 (42)
Hot water usage for mixer showers												64.9413 (42a)
Hot water usage for baths												28.0623 (42b)
Hot water usage for other uses												39.6550 (42c)
Average daily hot water use (litres/day)												122.2605 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587 (44)
Energy content (annual)	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114 (45)
Distribution loss (46)m = 0.15 x (45)m												2030.7208
Water storage loss:												200.0000 (47)
Store volume												1.6525 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8924 (55)
Enter (49) or (54) in (55)												
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
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	261.5713	231.3492	245.6673	215.5368	208.6664	187.7181	184.9521	192.4070	194.6589	217.4487	231.7211	258.6375 (62)
WWHRS	-29.8026	-26.3577	-27.6003	-22.8541	-21.2992	-18.2259	-17.0839	-18.1670	-18.8572	-22.2306	-25.1845	-29.2507 (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	231.7687	204.9915	218.0671	192.6827	187.3672	169.4922	167.8682	174.2401	175.8017	195.2181	206.5365	229.3867 (64)
												2353.4207 (64)
12Total per year (kWh/year)												2353 (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	110.7804	98.4275	105.4923	94.7059	93.1895	85.4562	85.3045	87.7833	87.7640	96.1096	100.0872	109.8049 (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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.6250	121.3705	109.6250	113.2791	109.6250	113.2791	109.6250	109.6250	113.2791	109.6250	113.2791	109.6250 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	148.8984	146.4696	141.7908	131.5360	125.2547	118.6892	114.6566	117.9883	121.8945	129.1796	139.0100	147.5872 (72)
Total internal gains	538.5154	550.0874	527.9798	509.2802	484.0720	463.8064	446.5301	447.6065	460.8501	479.5801	508.3374	527.6147 (73)
6. Solar gains												
[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Southeast	3.5500	36.7938	0.6300	0.7000	0.7700	39.9186 (77)						
Southwest	5.0400	36.7938	0.6300	0.7000	0.7700	56.6732 (79)						
Northwest	9.0000	11.2829	0.6300	0.7000	0.7700	31.0339 (81)						
Solar gains	127.6257	227.7019	338.9322	465.8473	563.6775	578.0272	549.6119	473.8091	382.4394	259.0416	154.7434	108.0063 (83)
Total gains	666.1411	777.7893	866.9120	975.1275	1047.7496	1041.8336	996.1420	921.4157	843.2895	738.6217	663.0807	635.6210 (84)
7. Mean internal temperature (heating season)												

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.9671	60.1550	60.3403	61.2260	61.3946	62.1920	62.1920	62.3419	61.8824	61.3946	61.0545	60.7029
alpha	4.9978	5.0103	5.0227	5.0817	5.0930	5.1461	5.1461	5.1561	5.1255	5.0930	5.0703	5.0469
util living area	0.9910	0.9801	0.9547	0.8765	0.7265	0.5310	0.3878	0.4358	0.6807	0.9154	0.9807	0.9928 (86)
MIT	19.8244	20.0428	20.3342	20.6877	20.9049	20.9846	20.9975	20.9955	20.9486	20.6553	20.1857	19.7947 (87)
Th 2	19.9537	19.9566	19.9595	19.9730	19.9755	19.9873	19.9873	19.9895	19.9827	19.9755	19.9704	19.9651 (88)
util rest of house	0.9882	0.9740	0.9410	0.8427	0.6658	0.4517	0.2995	0.3419	0.5972	0.8837	0.9737	0.9905 (89)
MIT 2	18.6084	18.8857	19.2492	19.6754	19.9023	19.9793	19.9865	19.9880	19.9514	19.6522	19.0789	18.5789 (90)
Living area fraction	18.9255	19.1874	19.5322	19.9394	20.1637	20.2414	20.2501	20.2507	fLA = Living area / (4) =			0.2608 (91)
MIT	18.9255	19.1874	19.5322	19.9394	20.1637	20.2414	20.2501	20.2507	20.2115	19.9138	19.3675	18.8960 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9255	19.1874	19.5322	19.9394	20.1637	20.2414	20.2501	20.2507	20.2115	19.9138	19.3675	18.8960 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9844	0.9682	0.9341	0.8415	0.6776	0.4720	0.3226	0.3664	0.6170	0.8815	0.9683	0.9872 (94)
Useful gains	655.7357	753.0428	809.7807	820.5595	709.9447	491.7772	321.3362	337.6300	520.3132	651.0588	642.0392	627.4891 (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	1338.0146	1303.0037	1184.8781	989.1733	756.3041	497.6416	321.9888	338.8655	541.8039	832.2594	1102.3060	1328.1693 (97)
Space heating kWh	507.6155	369.5737	279.0725	121.4019	34.4914	0.0000	0.0000	0.0000	0.0000	134.8133	331.3921	521.3061 (98a)
Space heating requirement - total per year (kWh/year)												2299.6664
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	507.6155	369.5737	279.0725	121.4019	34.4914	0.0000	0.0000	0.0000	0.0000	134.8133	331.3921	521.3061 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2299.6664
Space heating per m2										(98c) / (4) =		29.1097 (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 %)												92.3000 (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	507.6155	369.5737	279.0725	121.4019	34.4914	0.0000	0.0000	0.0000	0.0000	134.8133	331.3921	521.3061 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	549.9627	400.4049	302.3537	131.5297	37.3688	0.0000	0.0000	0.0000	0.0000	146.0599	359.0380	564.7953 (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	231.7687	204.9915	218.0671	192.6827	187.3672	169.4922	167.8682	174.2401	175.8017	195.2181	206.5365	229.3867 (64)
Efficiency of water heater (217)m	85.7679	85.3651	84.6141	83.0536	81.0775	79.8000	79.8000	79.8000	79.8000	83.2465	85.1143	79.8000 (216)
Fuel for water heating, kWh/month	270.2279	240.1351	257.7197	231.9979	231.0964	212.3963	210.3612	218.3459	220.3028	234.5063	242.6577	267.2207 (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	22.7779	18.2733	16.4531	12.0542	9.3110	7.6072	8.4938	11.0406	14.3406	18.8157	21.2523	23.4110 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-36.8229	-51.8488	-74.4442	-83.6132	-90.0923	-84.0666	-83.0161	-78.3917	-70.2383	-59.2266	-40.4543	-31.8422 (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	-21.0129	-44.1775	-87.7583	-131.7420	-174.1369	-174.9480	-172.9000	-146.4336	-107.3768	-63.1711	-28.0527	-16.6196 (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												

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Space heating fuel - main system 1	2491.5129 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2836.9678 (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)	183.8307 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1952.3865 (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	3645.9250 (238)

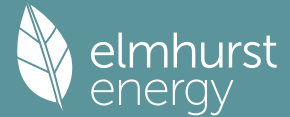
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2491.5129	0.2100	523.2177 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2836.9678	0.2100	595.7632 (264)
Space and water heating			1118.9810 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	183.8307	0.1443	26.5325 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-784.0572	0.1346	-105.5422
PV Unit electricity exported	-1168.3293	0.1259	-147.1038
Total			-252.6459 (269)
Total CO2, kg/year			904.7967 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4500 (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	2491.5129	1.1300	2815.4096 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2836.9678	1.1300	3205.7736 (278)
Space and water heating			6021.1832 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	183.8307	1.5338	281.9657 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-784.0572	1.4975	-1174.1243
PV Unit electricity exported	-1168.3293	0.4622	-539.9727
Total			-1714.0969 (283)
Total Primary energy kWh/year			4719.1528 (286)
Target Primary Energy Rate (TPER)			59.7400 (287)

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Property Reference	all plots		Issued on Date	30/06/2023	
Assessment Reference	Plot 2 DS	Prop Type Ref			
Property	Plot 1 , Bryanston Road , Southampton, Hampshire , SO19				
SAP Rating	94 A	DER	0.39	TER	9.52
Environmental	100 A	% DER < TER	95.90		
CO ₂ Emissions (t/year)	-0.05	DFEE	27.91	TREE	31.23
Compliance Check	See BREL	% DFEE < TREE	10.63		
% DPER < TPER	66.54	DPER	16.54	TPER	49.42
Assessor Details	Dr. Rachel Mitchell			Assessor ID	L772-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b)
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.1700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.2500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5209	0.5156	0.5103	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
window 0.8 (Uw = 0.80)			16.2000	0.7752	12.5581		(27)
front door			2.1800	0.8000	1.7440		(26)
Heatloss Floor 1			46.7000	0.1100	5.1370		(28a)

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External Wall 1	70.0000	18.3800	51.6200	0.1500	7.7430	(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370	(30)
Total net area of external elements Aum(A, m2)			163.4000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3191	(33)
Party Wall 1			77.0100	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)						8.1700 (36)
Point Thermal bridges						(36a) = 0.0500 (36a)
Total fabric heat loss						(33) + (36) + (36a) = 40.5391 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	40.9437	40.5261	40.1086	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	
Average = Sum(39)m / 12 =	81.4828	81.0653	80.6477	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	(39)
													80.1442

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.8724	0.8679	0.8635	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8581
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6695 (42)
Hot water usage for mixer showers	68.9778	67.9412	66.4307	63.5405	61.4077	59.0292	57.6772	59.1763	60.8196	63.3734	66.3256	68.7135	(42a)
Hot water usage for baths	29.7859	29.3436	28.7206	27.5720	26.7120	25.7583	25.2432	25.8618	26.5353	27.5558	28.7280	29.6852	(42b)
Hot water usage for other uses	41.9679	40.4418	38.9157	37.3896	35.8635	34.3374	34.3374	35.8635	37.3896	38.9157	40.4418	41.9679	(42c)
Average daily hot water use (litres/day)													129.3641 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667	(44)
Energy content (annual)	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803	(45)
Distribution loss (46)m = 0.15 x (45)m	33.4327	29.4181	30.9084	26.3870	25.0358	21.9717	21.2720	22.4552	23.0734	26.4297	28.9557	32.9670	(46)
Water storage loss:													200.0000 (47)

Store volume													1.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.6588 (55)
Enter (49) or (54) in (55)													
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)

If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(64)
Total per year (kWh/year) = Sum(64)m =													2663.0693 (64)

12Total per year (kWh/year)													2663 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

Heat gains from water heating, kWh/month	109.0573	96.7763	103.4618	92.3119	90.4441	82.5247	82.1010	84.7239	84.9668	93.5341	98.0060	108.0251	(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	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	130.4154	144.3884	130.4154	134.7626	130.4154	130.4154	130.4154	130.4154	134.7626	130.4154	134.7626	130.4154	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1957	247.7401	241.3283	227.6786	210.4482	194.2540	183.4353	180.8910	187.3027	200.9525	218.1829	234.3770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	(71)
Water heating gains (Table 5)	146.5824	144.0123	139.0615	128.2110	121.5647	114.6177	110.3509	113.8762	118.0094	125.7179	136.1194	145.1950	(72)
Total internal gains	585.2353	599.1826	573.8471	553.6939	525.4701	506.6761	487.2434	488.2244	503.1165	520.1276	552.1067	573.0293	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Southeast			5.3900	36.7938	0.6400	0.7000	0.7700	61.5708 (77)				
Northwest			10.8100	11.2829	0.6400	0.7000	0.7700	37.8669 (81)				
Solar gains	99.4377	181.9570	282.3705	405.8693	505.7204	524.5462	496.3621	418.4315	324.5963	210.1092	121.3940	83.6158 (83)
Total gains	684.6730	781.1396	856.2176	959.5633	1031.1905	1031.2222	983.6055	906.6559	827.7128	730.2367	673.5007	656.6451 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	79.6010	80.0110	80.4252	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417
alpha	6.3067	6.3341	6.3617	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161
util living area	0.9934	0.9841	0.9590	0.8680	0.6932	0.4927	0.3568	0.4043	0.6484	0.9139	0.9836	0.9948 (86)
Living	20.1773	20.3510	20.5783	20.8386	20.9664	20.9965	20.9996	20.9992	20.9828	20.8024	20.4575	20.1654
Non living	19.4463	19.6204	19.8433	20.0858	20.1859	20.2046	20.2060	20.2059	20.1978	20.0601	19.7359	19.4471
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5791	20.3510	20.5783	20.8386	20.9664	20.9965	20.9996	20.9992	20.9828	20.8024	20.4575	20.2822 (87)
Th 2	20.1910	20.1948	20.1987	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061 (88)
util rest of house	0.9914	0.9795	0.9475	0.8373	0.6424	0.4329	0.2926	0.3350	0.5807	0.8854	0.9781	0.9932 (89)
MIT 2	19.8101	19.6204	19.8433	20.0858	20.1859	20.2046	20.2060	20.2059	20.1978	20.0601	19.7359	19.5533 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.9723	19.7745	19.9983	20.2446	20.3505	20.3717	20.3734	20.3732	20.3634	20.2167	19.8881	19.7070 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.9723	19.7745	19.9983	20.2446	20.3505	20.3717	20.3734	20.3732	20.3634	20.2167	19.8881	19.7070 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9908	0.9765	0.9441	0.8389	0.6519	0.4454	0.3062	0.3496	0.5945	0.8858	0.9753	0.9919 (94)
Useful gains	678.3761	762.7917	808.3781	805.0009	672.2722	459.3391	301.1521	316.9652	492.0555	646.8667	656.8536	651.3239 (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	1277.0211	1205.8062	1088.6059	905.7178	690.6341	460.7939	301.2576	317.2097	500.0494	767.7670	1020.9683	1238.0378 (97)
Space heating kWh	445.3919	297.7058	208.4895	72.5161	13.6612	0.0000	0.0000	0.0000	0.0000	89.9498	262.1626	436.5151 (98a)
Space heating requirement - total per year (kWh/year)												1826.3921
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	445.3919	297.7058	208.4895	72.5161	13.6612	0.0000	0.0000	0.0000	0.0000	89.9498	262.1626	436.5151 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1826.3921
Space heating per m2												(98c) / (4) = 19.5545 (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 %)												246.9769 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	445.3919	297.7058	208.4895	72.5161	13.6612	0.0000	0.0000	0.0000	0.0000	89.9498	262.1626	436.5151 (98)
Space heating efficiency (main heating system 1)	246.9769	246.9769	246.9769	246.9769	246.9769	0.0000	0.0000	0.0000	0.0000	246.9769	246.9769	246.9769 (210)
Space heating fuel (main heating system)	180.3375	120.5399	84.4166	29.3615	5.5314	0.0000	0.0000	0.0000	0.0000	36.4203	106.1486	176.7433 (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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655 (64)

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Efficiency of water heater (217)m	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	(216)
Fuel for water heating, kWh/month	157.4264	139.1240	147.4881	128.8545	124.3670	111.4712	109.5486	114.2071	115.8086	129.8552	138.9679	155.5931			(217)
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	0.0000	0.0000	(221)
Pumps and Fa	3.6307	3.2793	3.6307	3.5136	3.6307	3.5136	3.6307	3.5136	3.6307	3.5136	3.6307	3.5136	3.6307	3.5136	(231)
Lighting	26.0516	20.8995	18.8177	13.7867	10.6492	8.7005	9.7146	12.6274	16.4017	21.5199	24.3067	26.7756			(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-50.7978	-75.2485	-112.5295	-127.0696	-136.8413	-127.5785	-125.6501	-117.9029	-102.7457	-85.0112	-56.3273	-43.2748			(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	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	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	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-19.7325	-45.6618	-100.5440	-166.5985	-231.3247	-236.1684	-232.5679	-191.8211	-134.4082	-71.6358	-27.9992	-15.2786			(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	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	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	0.0000	0.0000	(235d)
Annual totals kWh/year															
Space heating fuel - main system 1															739.4992 (211)
Space heating fuel - main system 2															0.0000 (213)
Space heating fuel - secondary															0.0000 (215)
Efficiency of water heater															169.3298
Water heating fuel used															1572.7118 (219)
Space cooling fuel															0.0000 (221)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471) mechanical ventilation fans (SFP = 0.1471)															42.7485 (230a)
Total electricity for the above, kWh/year															42.7485 (231)
Electricity for lighting (calculated in Appendix L)															210.2509 (232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV generation															-2634.7180 (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															-69.5077 (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	739.4992	0.1573	116.3167 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1572.7118	0.1410	221.7911 (264)
Space and water heating			338.1078 (265)
Pumps, fans and electric keep-hot	42.7485	0.1387	5.9297 (267)
Energy for lighting	210.2509	0.1443	30.3457 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1160.9772	0.1343	-155.8882
PV Unit electricity exported	-1473.7408	0.1236	-182.1508
Total			-338.0391 (269)
Total CO2, kg/year			36.3442 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.3900 (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	739.4992	1.5823	1170.0863 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1572.7118	1.5215	2392.8245 (278)
Space and water heating			3562.9108 (279)
Pumps, fans and electric keep-hot	42.7485	1.5128	64.6699 (281)
Energy for lighting	210.2509	1.5338	322.4899 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1160.9772	1.4962	-1737.1048
PV Unit electricity exported	-1473.7408	0.4536	-668.4873
Total			-2405.5921 (283)
Total Primary energy kWh/year			1544.4784 (286)
Dwelling Primary energy Rate (DPER)			16.5400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	2.7000 (2b)	126.0900 (1b)
First floor	46.7000 (1c)	2.4000 (2c)	112.0800 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		
Dwelling volume			238.1700 (5)

2. Ventilation rate

	Value	Reference
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) =	0.1260 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3760	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3196 (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	0.4074	0.3995	0.3915	0.3515	0.3435	0.3036	0.3036	0.2956	0.3196	0.3435	0.3595	0.3755 (22b)
Effective ac	0.5830	0.5798	0.5766	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5646	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1800	1.0000	2.1800		(26)
TER Opening Type (Uw = 1.20)			16.2000	1.1450	18.5496		(27)
Heatloss Floor 1			46.7000	0.1300	6.0710		(28a)
External Wall 1	70.0000	18.3800	51.6200	0.1800	9.2916		(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370		(30)
Total net area of external elements Aum(A, m ²)			163.4000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	41.2292	(33)
Party Wall 1			77.0100	0.0000	0.0000		(32)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	19.5000	0.1600	3.1200
E6 Intermediate floor within a dwelling	19.5000	0.0000	0.0000
E16 Corner (normal)	10.2000	0.0900	0.9180
E18 Party wall between dwellings	10.2000	0.0600	0.6120
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.6500 (36)
Point Thermal bridges			0.0500 (36a)
Total fabric heat loss			(33) + (36) + (36a) = 45.9292 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.8220	45.5687	45.3204	44.1540	43.9358	42.9200	42.9200	42.7319	43.3113	43.9358	44.3773	44.8388 (38)
Average = Sum(39)m / 12 =	91.7513	91.4979	91.2496	90.0833	89.8650	88.8492	88.8492	88.6611	89.2405	89.8650	90.3065	90.7680 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9823	0.9796	0.9770	0.9645	0.9622	0.9513	0.9513	0.9493	0.9555	0.9622	0.9669	0.9718 (40)
HLP (average)												0.9645
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												2.6695 (42)	
Hot water usage for mixer showers												68.7135 (42a)	
Hot water usage for baths												29.6852 (42b)	
Hot water usage for other uses												41.9679 (42c)	
Average daily hot water use (litres/day)												129.3641 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667	(44)
Distribution loss (46) _m = 0.15 x (45) _m	22.2845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803	(45)
Water storage loss:												2148.7113	
Store volume												200.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.8924 (55)	
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	273.8106	242.1186	256.9821	225.1964	217.8313	195.7612	192.7392	200.6275	203.1058	227.1244	242.3214	270.7064	(62)
WWHRS	-31.5338	-27.8887	-29.2035	-24.1816	-22.5364	-19.2846	-18.0762	-19.2222	-19.9526	-23.5219	-26.6474	-30.9498	(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	242.2768	214.2298	227.7786	201.0147	195.2949	176.4767	174.6630	181.4053	183.1532	203.6025	215.6740	239.7566	(64)
12Total per year (kWh/year)												2455.3261 (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	114.8500	102.0084	109.2545	97.9177	96.2368	88.1306	87.8937	90.5166	90.5726	99.3268	103.6118	113.8178	(65)

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

Metabolic gains (Table 5), Watts													
(66) _m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	127.0988	140.7166	127.0988	131.3355	127.0988	131.3355	127.0988	127.0988	131.3355	127.0988	131.3355	127.0988	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	245.1957	247.7401	241.3283	227.6786	210.4482	194.2540	183.4353	180.8910	187.3027	200.9525	218.1829	234.3770	(68)
Pumps, fans	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	(71)
Total internal gains	154.3682	151.7982	146.8474	135.9968	129.3506	122.4035	118.1367	121.6621	125.7953	133.5037	143.9053	152.9809	(72)
	592.7046	606.2967	581.3165	561.0527	532.9395	511.0349	491.7128	492.6938	507.4753	527.5969	559.4655	580.4986	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m ²	Table 6a	Specific data	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
Southeast	5.3900	36.7938	0.6300	0.7000	0.7700	60.6088 (77)						
Northwest	10.8100	11.2829	0.6300	0.7000	0.7700	37.2752 (81)						
Solar gains	97.8840	179.1139	277.9585	399.5276	497.8185	516.3501	488.6065	411.8935	319.5244	206.8262	119.4972	82.3093 (83)
Total gains	690.5886	785.4106	859.2749	960.5804	1030.7580	1027.3850	980.3192	904.5873	826.9998	734.4232	678.9627	662.8079 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	70.6923	70.8881	71.0810	72.0013	72.1761	73.0013	73.0013	73.1562	72.6813	72.1761	71.8233	71.4581
alpha	5.7128	5.7259	5.7387	5.8001	5.8117	5.8668	5.8668	5.8771	5.8454	5.8117	5.7882	5.7639
util living area	0.9942	0.9871	0.9689	0.9011	0.7512	0.5457	0.3977	0.4486	0.7055	0.9346	0.9867	0.9953 (86)
MIT	19.9988	20.1734	20.4186	20.7334	20.9270	20.9904	20.9987	20.9975	20.9615	20.7050	20.3050	19.9737 (87)
Th 2	20.0981	20.1003	20.1026	20.1130	20.1150	20.1241	20.1241	20.1258	20.1206	20.1150	20.1110	20.1069 (88)
util rest of house	0.9924	0.9831	0.9593	0.8735	0.6969	0.4744	0.3191	0.3646	0.6304	0.9096	0.9819	0.9939 (89)
MIT 2	18.9372	19.1601	19.4686	19.8523	20.0572	20.1190	20.1237	20.1250	20.0962	19.8298	19.3366	18.9119 (90)
Living area fraction										fLA = Living area / (4) =		
MIT	19.1611	19.3738	19.6689	20.0382	20.2407	20.3028	20.3083	20.3090	20.2787	20.0144	19.5409	19.1358 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1611	19.3738	19.6689	20.0382	20.2407	20.3028	20.3083	20.3090	20.2787	20.0144	19.5409	19.1358 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9898	0.9789	0.9536	0.8709	0.7050	0.4892	0.3357	0.3823	0.6446	0.9063	0.9778	0.9917 (94)
Useful gains	683.5214	768.8694	819.3831	836.5333	726.7205	502.5949	329.1135	345.8149	533.0641	665.5826	663.9099	657.2863 (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	1363.5261	1324.3226	1201.6608	1003.3615	767.5072	506.6869	329.4782	346.5768	551.3941	846.0273	1123.4909	1355.6968 (97)
Space heating kWh	505.9235	373.2646	284.4146	120.1163	30.3453	0.0000	0.0000	0.0000	0.0000	134.2508	330.8984	519.6174 (98a)
Space heating requirement - total per year (kWh/year)												2298.8309
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	505.9235	373.2646	284.4146	120.1163	30.3453	0.0000	0.0000	0.0000	0.0000	134.2508	330.8984	519.6174 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2298.8309
Space heating per m2												(98c) / (4) = 24.6128 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	505.9235	373.2646	284.4146	120.1163	30.3453	0.0000	0.0000	0.0000	0.0000	134.2508	330.8984	519.6174 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	548.1295	404.4036	308.1415	130.1368	32.8768	0.0000	0.0000	0.0000	0.0000	145.4505	358.5031	562.9658 (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	242.2768	214.2298	227.7786	201.0147	195.2949	176.4767	174.6630	181.4053	183.1532	203.6025	215.6740	239.7566 (64)
Efficiency of water heater												79.8000 (216)
(217)m	85.6713	85.2923	84.5589	82.9444	80.9027	79.8000	79.8000	79.8000	79.8000	83.1487	85.0165	85.7467 (217)
Fuel for water heating, kWh/month	282.7983	251.1714	269.3727	242.3488	241.3946	221.1487	218.8760	227.3249	229.5153	244.8656	253.6848	279.6103 (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	26.4086	21.1860	19.0756	13.9756	10.7952	8.8197	9.8477	12.8004	16.6265	21.8149	24.6398	27.1426 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.0007	-60.2705	-86.1293	-96.2467	-103.2660	-96.1737	-94.9498	-89.8680	-80.8537	-68.6034	-47.1350	-37.2152 (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	-25.3772	-53.2593	-105.6391	-158.3631	-209.1264	-210.0537	-207.6143	-175.9382	-129.1368	-76.1048	-33.8594	-20.0801 (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												2490.6077 (211)
Space heating fuel - main system 2												0.0000 (213)

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2962.1114 (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)	213.1328 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2308.2645 (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	3443.5874 (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	2490.6077	0.2100	523.0276 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2962.1114	0.2100	622.0434 (264)
Space and water heating			1145.0710 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	213.1328	0.1443	30.7616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-903.7120	0.1347	-121.7477
PV Unit electricity exported	-1404.5525	0.1259	-176.9009
Total			-298.6486 (269)
Total CO2, kg/year			889.1133 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5200 (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	2490.6077	1.1300	2814.3867 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2962.1114	1.1300	3347.1859 (278)
Space and water heating			6161.5726 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	213.1328	1.5338	326.9102 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-903.7120	1.4979	-1353.6778
PV Unit electricity exported	-1404.5525	0.4623	-649.3509
Total			-2003.0288 (283)
Total Primary energy kWh/year			4615.5548 (286)
Target Primary Energy Rate (TPER)			49.4200 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b) -
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.1700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)

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Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	Air changes per hour 0.1260 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3760 (18)
Number of sides sheltered		2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3196 (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	0.4074	0.3995	0.3915	0.3515	0.3435	0.3036	0.3036	0.2956	0.3196	0.3435	0.3595	0.3755	(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	0.5830	0.5798	0.5766	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5646	0.5705	(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	
window 0.8 (Uw = 0.80)			16.2000	0.7752	12.5581			(27)
front door			2.1800	0.8000	1.7440			(26)
Heatloss Floor 1			46.7000	0.1100	5.1370			(28a)
External Wall 1	70.0000	18.3800	51.6200	0.1500	7.7430			(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370			(30)
Total net area of external elements Aum(A, m2)			163.4000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	32.3191		(33)
Party Wall 1			77.0100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)													8.1700 (36)
Point Thermal bridges													(36a) = 0.0500 (36a)
Total fabric heat loss													(33) + (36) + (36a) = 40.5391 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	45.8220	45.5687	45.3204	44.1540	43.9358	42.9200	42.9200	42.7319	43.3113	43.9358	44.3773	44.8388	(38)
Heat transfer coeff	86.3612	86.1078	85.8595	84.6932	84.4750	83.4591	83.4591	83.2710	83.8504	84.4750	84.9164	85.3779	(39)
Average = Sum(39)m / 12 =													84.6921

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9246	0.9219	0.9193	0.9068	0.9044	0.8936	0.8936	0.8916	0.8978	0.9044	0.9092	0.9141	(40)
HLP (average)													0.9068
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6695 (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	29.7859	29.3436	28.7206	27.5720	26.7120	25.7583	25.2432	25.8618	26.5353	27.5558	28.7280	29.6852	(42b)
Hot water usage for other uses	41.9679	40.4418	38.9157	37.3896	35.8635	34.3374	34.3374	35.8635	37.3896	38.9157	40.4418	41.9679	(42c)
Average daily hot water use (litres/day)													65.7689 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	71.7539	69.7854	67.6363	64.9616	62.5755	60.0957	59.5806	61.7253	63.9249	66.4715	69.1698	71.6532	(44)
Energy conte	113.6406	99.3735	103.9545	88.9292	84.2386	73.8947	72.0576	76.4288	78.8258	90.2012	98.5451	112.1915	(45)
Energy content (annual)													Total = Sum(45)m = 1092.2811

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													
WWHRS	96.5945	84.4674	88.3614	75.5899	71.6028	62.8105	61.2489	64.9645	67.0019	76.6710	83.7633	95.3628	(62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

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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	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	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	0.0000	(63d)
Output from w/h	96.5945	84.4674	88.3614	75.5899	71.6028	62.8105	61.2489	64.9645	67.0019	76.6710	83.7633	95.3628	928.4389	(64)
								Total per year (kWh/year) = Sum(64)m =					928.4389	(64)
12Total per year (kWh/year)													928	(64)
Electric shower(s)	55.2397	49.2190	53.7453	51.2885	52.2509	49.8423	51.5037	52.2509	51.2885	53.7453	52.7347	55.2397	628.3486	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					628.3486	(64a)
Heat gains from water heating, kWh/month	37.9585	33.4216	35.5267	31.7196	30.9634	28.1632	28.1882	29.3038	29.5726	32.6041	34.1245	37.6506		(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	130.4154	144.3884	130.4154	134.7626	130.4154	134.7626	130.4154	130.4154	134.7626	130.4154	134.7626	130.4154	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	245.1957	247.7401	241.3283	227.6786	210.4482	194.2540	183.4353	180.8910	187.3027	200.9525	218.1829	234.3770	(68)
Pumps, fans	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	(71)
Total internal gains	51.0196	49.7346	47.7509	44.0550	41.6175	39.1156	37.8873	39.3869	41.0731	43.8227	47.3951	50.6057	(72)
	489.6725	504.9049	482.5365	469.5380	445.5229	431.1740	414.7799	413.7351	426.1802	438.2324	463.3824	478.4399	(73)

6. Solar gains

[Jan]		Area	Solar flux											
		m2	Table 6a	Specific data	g	Specific data	FF	Access						
			W/m2	or Table 6b		or Table 6c		factor						
								Table 6d						
Southeast		5.3900	36.7938	0.6400		0.7000		0.7700					61.5708	(77)
Northwest		10.8100	11.2829	0.6400		0.7000		0.7700					37.8669	(81)
Solar gains	99.4377	181.9570	282.3705	405.8693	505.7204	524.5462	496.3621	418.4315	324.5963	210.1092	121.3940		83.6158	(83)
Total gains	589.1102	686.8619	764.9070	875.4073	951.2433	955.7201	911.1420	832.1666	750.7764	648.3416	584.7764		562.0557	(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, n1,m (see Table 9a)														
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
alpha	75.1045	75.3254	75.5433	76.5836	76.7815	77.7160	77.7160	77.8916	77.3534	76.7815	76.3823	75.9694		
util living area	6.0070	6.0217	6.0362	6.1056	6.1188	6.1811	6.1811	6.1928	6.1569	6.1188	6.0922	6.0646		
	0.9973	0.9926	0.9789	0.9173	0.7659	0.5520	0.4022	0.4583	0.7286	0.9539	0.9930	0.9979		(86)
MIT	19.9770	20.1563	20.4056	20.7337	20.9315	20.9921	20.9990	20.9980	20.9620	20.6875	20.2802	19.9525		(87)
Th 2	20.1466	20.1489	20.1512	20.1617	20.1637	20.1730	20.1730	20.1747	20.1694	20.1637	20.1597	20.1555		(88)
util rest of house	0.9964	0.9903	0.9722	0.8933	0.7142	0.4837	0.3271	0.3771	0.6566	0.9350	0.9903	0.9973		(89)
MIT 2	19.2112	19.3911	19.6378	19.9554	20.1209	20.1696	20.1727	20.1741	20.1502	19.9214	19.5237	19.1940		(90)
Living area fraction	19.3727	19.5525	19.7998	20.1196	20.2919	20.3431	20.3470	20.3479	20.3214	20.0830	19.6832	19.3540		(91)
MIT	19.3727	19.5525	19.7998	20.1196	20.2919	20.3431	20.3470	20.3479	20.3214	20.0830	19.6832	19.3540		(92)
Temperature adjustment												0.0000		(93)
adjusted MIT	19.3727	19.5525	19.7998	20.1196	20.2919	20.3431	20.3470	20.3479	20.3214	20.0830	19.6832	19.3540		(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9953	0.9881	0.9687	0.8919	0.7226	0.4980	0.3429	0.3943	0.6705	0.9328	0.9883	0.9964	(94)
Ext temp.	586.3437	678.7085	740.9969	780.8096	687.3231	475.9336	312.4458	328.1113	503.4001	604.8049	577.9527	560.0256	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	1301.6993	1261.6922	1141.9124	950.2223	725.7997	479.3126	312.7226	328.7441	521.6707	801.0769	1068.5229	1293.8191	(97)
Space heating requirement - total per year (kWh/year)	532.2246	391.7650	298.2811	121.9771	28.6266	0.0000	0.0000	0.0000	0.0000	146.0263	353.2105	545.9423	(98a)
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)
Space heating kWh	532.2246	391.7650	298.2811	121.9771	28.6266	0.0000	0.0000	0.0000	0.0000	146.0263	353.2105	545.9423	(98c)

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Space heating requirement after solar contribution - total per year (kWh/year)
 Space heating per m2

2418.0536
 (98c) / (4) = 25.8892 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	784.5157	617.5975	632.8596	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9544	0.9810	0.9672	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	748.7447	605.8469	612.1294	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1060.6390	1011.2401	921.5513	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction												
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 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.1410	75.4031	57.5525	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												189.0966 (107)
Energy for space heating												25.8892 (99)
Energy for space cooling												2.0246 (108)
Total												27.9138 (109)
Fabric Energy Efficiency (DFEE)												27.9 (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	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b) -
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.1700 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3196 (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	0.4074	0.3995	0.3915	0.3515	0.3435	0.3036	0.3036	0.2956	0.3196	0.3435	0.3595	0.3755 (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	0.5830	0.5798	0.5766	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5646	0.5705 (25)

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3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K						
TER Opaque door			2.1800	1.0000	2.1800			(26)					
TER Opening Type (Uw = 1.20)			16.2000	1.1450	18.5496			(27)					
Heatloss Floor 1			46.7000	0.1300	6.0710			(28a)					
External Wall 1	70.0000	18.3800	51.6200	0.1800	9.2916			(29a)					
External Roof 1	46.7000		46.7000	0.1100	5.1370			(30)					
Total net area of external elements Aum(A, m ²)			163.4000					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		41.2292	(33)					
Party Wall 1			77.0100	0.0000	0.0000			(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E5 Ground floor (normal)				19.5000	0.1600		3.1200						
E6 Intermediate floor within a dwelling				19.5000	0.0000		0.0000						
E16 Corner (normal)				10.2000	0.0900		0.9180						
E18 Party wall between dwellings				10.2000	0.0600		0.6120						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								4.6500 (36)					
Point Thermal bridges								0.0500 (36a)					
Total fabric heat loss							(33) + (36) + (36a) =	45.9292 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	45.8220	45.5687	45.3204	44.1540	43.9358	42.9200	42.9200	42.7319	43.3113	43.9358	44.3773	44.8388	(38)
Average = Sum(39)m / 12 =	91.7513	91.4979	91.2496	90.0833	89.8650	88.8492	88.8492	88.6611	89.2405	89.8650	90.3065	90.7680	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9823	0.9796	0.9770	0.9645	0.9622	0.9513	0.9513	0.9493	0.9555	0.9622	0.9669	0.9718	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6695 (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	0.0000 (42a)
Hot water usage for baths	29.7859	29.3436	28.7206	27.5720	26.7120	25.7583	25.2432	25.8618	26.5353	27.5558	28.7280	29.6852	(42b)
Hot water usage for other uses	41.9679	40.4418	38.9157	37.3896	35.8635	34.3374	34.3374	35.8635	37.3896	38.9157	40.4418	41.9679	(42c)
Average daily hot water use (litres/day)													65.7689 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	71.7539	69.7854	67.6363	64.9616	62.5755	60.0957	59.5806	61.7253	63.9249	66.4715	69.1698	71.6532	(44)
Energy content (annual)	113.6406	99.3735	103.9545	88.9292	84.2386	73.8947	72.0576	76.4288	78.8258	90.2012	98.5451	112.1915	(45)
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													
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	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
WWHRS	96.5945	84.4674	88.3614	75.5899	71.6028	62.8105	61.2489	64.9645	67.0019	76.6710	83.7633	95.3628	(62)
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	(63a)
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	(63b)
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	(63c)
Output from w/h	96.5945	84.4674	88.3614	75.5899	71.6028	62.8105	61.2489	64.9645	67.0019	76.6710	83.7633	95.3628	(64)
Total per year (kWh/year) = Sum(64)m =													928.4389 (64)
Electric shower(s)	55.2397	49.2190	53.7453	51.2885	52.2509	49.8423	51.5037	52.2509	51.2885	53.7453	52.7347	55.2397	(64a)
Heat gains from water heating, kWh/month	37.9585	33.4216	35.5267	31.7196	30.9634	28.1632	28.1882	29.3038	29.5726	32.6041	34.1245	37.6506	(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	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	127.0988	140.7166	127.0988	131.3355	127.0988	131.3355	127.0988	127.0988	131.3355	127.0988	131.3355	127.0988	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1957	247.7401	241.3283	227.6786	210.4482	194.2540	183.4353	180.8910	187.3027	200.9525	218.1829	234.3770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													

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Pumps, fans	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783 (71)
Total internal gains	51.0196	49.7346	47.7509	44.0550	41.6175	39.1156	37.8873	39.3869	41.0731	43.8227	47.3951	50.6057	50.6057 (72)
	486.3560	501.2331	479.2199	466.1109	442.2064	427.7469	411.4634	410.4186	422.7531	434.9159	459.9553	475.1234	475.1234 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Southeast	5.3900	36.7938	0.6300	0.7000	0.7700	60.6088 (77)						
Northwest	10.8100	11.2829	0.6300	0.7000	0.7700	37.2752 (81)						
Solar gains	97.8840	179.1139	277.9585	399.5276	497.8185	516.3501	488.6065	411.8935	319.5244	206.8262	119.4972	82.3093 (83)
Total gains	584.2399	680.3470	757.1784	865.6385	940.0249	944.0970	900.0698	822.3121	742.2775	641.7421	579.4525	557.4327 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	70.6923	70.8881	71.0810	72.0013	72.1761	73.0013	73.0013	73.1562	72.6813	72.1761	71.8233	71.4581
tau	5.7128	5.7259	5.7387	5.8001	5.8117	5.8668	5.8668	5.8771	5.8454	5.8117	5.7882	5.7639
util living area	0.9975	0.9935	0.9822	0.9317	0.7987	0.5897	0.4325	0.4919	0.7638	0.9618	0.9938	0.9981 (86)
MIT	19.8759	20.0558	20.3134	20.6632	20.8991	20.9858	20.9980	20.9960	20.9420	20.6228	20.1934	19.8511 (87)
Th 2	20.0981	20.1003	20.1026	20.1130	20.1150	20.1241	20.1241	20.1258	20.1206	20.1150	20.1110	20.1069 (88)
util rest of house	0.9967	0.9914	0.9763	0.9101	0.7470	0.5144	0.3474	0.4006	0.6899	0.9452	0.9915	0.9975 (89)
MIT 2	19.0714	19.2519	19.5077	19.8490	20.0508	20.1180	20.1236	20.1247	20.0906	19.8197	19.3981	19.0537 (90)
Living area fraction	19.2411	19.4215	19.6776	20.0207	20.2297	20.3011	20.3081	20.3085	20.2702	19.9891	19.5658	19.2219 (92)
MIT	19.2411	19.4215	19.6776	20.0207	20.2297	20.3011	20.3081	20.3085	20.2702	19.9891	19.5658	0.0000
Temperature adjustment	19.2411	19.4215	19.6776	20.0207	20.2297	20.3011	20.3081	20.3085	20.2702	19.9891	19.5658	19.2219 (93)
adjusted MIT	19.2411	19.4215	19.6776	20.0207	20.2297	20.3011	20.3081	20.3085	20.2702	19.9891	19.5658	19.2219 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9956	0.9893	0.9727	0.9075	0.7542	0.5300	0.3654	0.4199	0.7034	0.9422	0.9895	0.9966 (94)
Useful gains	581.6652	673.0777	736.5388	785.5598	708.9642	500.3641	328.8835	345.2789	522.1331	604.6802	573.3661	555.5278 (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	1370.8657	1328.6831	1202.4501	1001.7909	766.5224	506.5342	329.4584	346.5310	550.6316	843.7499	1125.7437	1363.5092 (97)
Space heating kWh	587.1652	440.5668	346.6380	155.6864	42.8233	0.0000	0.0000	0.0000	0.0000	177.8679	397.7119	601.1381 (98a)
Space heating requirement - total per year (kWh/year)												2749.5976
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	587.1652	440.5668	346.6380	155.6864	42.8233	0.0000	0.0000	0.0000	0.0000	177.8679	397.7119	601.1381 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2749.5976
Space heating per m2												(98c) / (4) = 29.4389 (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	835.1825	657.4841	673.8242	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9328	0.9693	0.9500	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	779.0317	637.2666	640.1031	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1050.7690	1001.8615	913.5020	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	195.6509	271.2586	203.4087	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	48.9127	67.8146	50.8522	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												167.5796 (107)
Energy for space heating												29.4389 (99)
Energy for space cooling												1.7942 (108)

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Total
Fabric Energy Efficiency (TFEE)

31.2332 (109)
31.2 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	2.7000 (2b)	126.0900 (1b)
First floor	46.7000 (1c)	2.4000 (2c)	112.0800 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.1700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2125 (21)

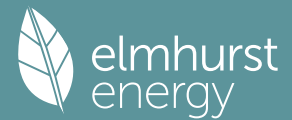
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5209	0.5156	0.5103	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
window 0.8 (Uw = 0.80)			16.2000	0.7752	12.5581		(27)
front door			2.1800	0.8000	1.7440		(26)
Heatloss Floor 1			46.7000	0.1100	5.1370		(28a)
External Wall 1	70.0000	18.3800	51.6200	0.1500	7.7430		(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370		(30)
Total net area of external elements Aum(A, m ²)			163.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.3191		(33)
Party Wall 1			77.0100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							8.1700 (36)
Point Thermal bridges						(36a) =	0.0500 (36a)
Total fabric heat loss						(33) + (36) + (36a) =	40.5391 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.9437	40.5261	40.1086	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981 (38)
Heat transfer coeff	81.4828	81.0653	80.6477	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372 (39)

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Average = Sum(39)m / 12 =												80.1442	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8724	0.8679	0.8635	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	0.8581
													31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6695 (42)	
Hot water usage for mixer showers	68.9778	67.9412	66.4307	63.5405	61.4077	59.0292	57.6772	59.1763	60.8196	63.3734	66.3256	68.7135	(42a)
Hot water usage for baths	29.7859	29.3436	28.7206	27.5720	26.7120	25.7583	25.2432	25.8618	26.5353	27.5558	28.7280	29.6852	(42b)
Hot water usage for other uses	41.9679	40.4418	38.9157	37.3896	35.8635	34.3374	34.3374	35.8635	37.3896	38.9157	40.4418	41.9679	(42c)
Average daily hot water use (litres/day)													129.3641 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667	(44)
Energy conte	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803	(45)
Energy content (annual)												Total = Sum(45)m = 2148.7113	
Distribution loss (46)m = 0.15 x (45)m													
	33.4327	29.4181	30.9084	26.3870	25.0358	21.9717	21.2720	22.4552	23.0734	26.4297	28.9557	32.9670	(46)
Water storage loss:													
Store volume												200.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2200 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.6588 (55)	
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)
If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(62)
WWHS	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)
FGHS	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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(64)
												Total per year (kWh/year) = Sum(64)m = 2663.0693 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)	
Heat gains from water heating, kWh/month	109.0573	96.7763	103.4618	92.3119	90.4441	82.5247	82.1010	84.7239	84.9668	93.5341	98.0060	108.0251	(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	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.7632	26.4354	21.4987	16.2759	12.1664	10.2714	11.0986	14.4264	19.3631	24.5859	28.6954	30.5904	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.9637	369.7613	360.1915	339.8187	314.1017	289.9314	273.7841	269.9865	279.5562	299.9290	325.6461	349.8164	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	(71)
Water heating gains (Table 5)	146.5824	144.0123	139.0615	128.2110	121.5647	114.6177	110.3509	113.8762	118.0094	125.7179	136.1194	145.1950	(72)
Total internal gains	649.3846	647.2843	627.8272	591.3810	554.9082	521.8958	502.3089	505.3645	524.0041	557.3082	597.5362	632.6772	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Southeast	5.3900	36.7938	0.6400	0.7000	0.7700	61.5708 (77)							
Northwest	10.8100	11.2829	0.6400	0.7000	0.7700	37.8669 (81)							
Solar gains	99.4377	181.9570	282.3705	405.8693	505.7204	524.5462	496.3621	418.4315	324.5963	210.1092	121.3940	83.6158	(83)
Total gains	748.8223	829.2413	910.1977	997.2503	1060.6286	1046.4420	998.6710	923.7960	848.6004	767.4174	718.9302	716.2930	(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, n_{li,m} (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	79.6010	80.0110	80.4252	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417
alpha	6.3067	6.3341	6.3617	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161
util living area	0.9895	0.9786	0.9465	0.8510	0.6771	0.4858	0.3515	0.3969	0.6343	0.8967	0.9774	0.9916 (86)
Living	20.2507	20.4028	20.6272	20.8577	20.9705	20.9968	20.9997	20.9993	20.9847	20.8276	20.5062	20.2346
Non living	19.5187	19.6706	19.8886	20.1012	20.1885	20.2048	20.2060	20.2059	20.1988	20.0809	19.7828	19.5155
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.6167	20.4028	20.6272	20.8577	20.9705	20.9968	20.9997	20.9993	20.9847	20.8276	20.5062	20.3417 (87)
Th 2	20.1910	20.1948	20.1987	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061 (88)
util rest of house	0.9864	0.9727	0.9324	0.8184	0.6266	0.4267	0.2882	0.3288	0.5674	0.8649	0.9700	0.9891 (89)
MIT 2	19.8471	19.6706	19.8886	20.1012	20.1885	20.2048	20.2060	20.2059	20.1988	20.0809	19.7828	19.6121 (90)
Living area fraction	20.0094	19.8250	20.0444	20.2608	20.3534	20.3718	20.3734	20.3732	20.3646	20.2384	19.9354	0.2109 (91)
Temperature adjustment												0.0000
adjusted MIT	20.0094	19.8250	20.0444	20.2608	20.3534	20.3718	20.3734	20.3732	20.3646	20.2384	19.9354	19.7660 (92)
												0.0000
												19.7660 (93)

8. Space heating requirement

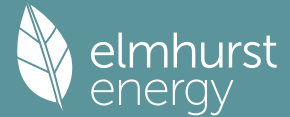
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9856	0.9693	0.9293	0.8209	0.6362	0.4391	0.3016	0.3431	0.5811	0.8663	0.9669	0.9874 (94)
Useful gains	738.0414	803.8122	845.8340	818.5944	674.8065	459.4660	301.1623	316.9936	493.0977	664.8367	695.1371	707.2958 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1280.0459	1209.9000	1092.3215	907.0124	690.8660	460.8058	301.2586	317.2125	500.1455	769.5035	1024.7399	1242.7443 (97)
Space heating kWh	403.2513	272.8910	183.3867	63.6609	11.9483	0.0000	0.0000	0.0000	0.0000	77.8722	237.3141	398.3737 (98a)
Space heating requirement - total per year (kWh/year)												1648.6981
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	403.2513	272.8910	183.3867	63.6609	11.9483	0.0000	0.0000	0.0000	0.0000	77.8722	237.3141	398.3737 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1648.6981
Space heating per m ²										(98c) / (4) =		17.6520 (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 %) 246.9769 (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	403.2513	272.8910	183.3867	63.6609	11.9483	0.0000	0.0000	0.0000	0.0000	77.8722	237.3141	398.3737 (98)
Space heating efficiency (main heating system 1)	246.9769	246.9769	246.9769	246.9769	246.9769	0.0000	0.0000	0.0000	0.0000	246.9769	246.9769	246.9769 (210)
Space heating fuel (main heating system)	163.2749	110.4925	74.2526	25.7761	4.8378	0.0000	0.0000	0.0000	0.0000	31.5301	96.0876	161.3000 (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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655 (64)
Efficiency of water heater (217)m	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298 (216)
Fuel for water heating, kWh/month	157.4264	139.1240	147.4881	128.8545	124.3670	111.4712	109.5486	114.2071	115.8086	129.8552	138.9679	155.5931 (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	3.6307	3.2793	3.6307	3.5136	3.6307	3.5136	3.6307	3.6307	3.5136	3.6307	3.5136	3.6307 (231)
Lighting	26.0516	20.8995	18.8177	13.7867	10.6492	8.7005	9.7146	12.6274	16.4017	21.5199	24.3067	26.7756 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-50.5729	-74.9106	-111.8312	-126.6220	-136.7200	-127.5785	-125.6501	-117.9029	-102.7457	-84.7090	-56.1018	-43.1110 (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)												

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(233b)m	-19.9575	-45.9997	-101.2423	-167.0461	-231.4461	-236.1684	-232.5679	-191.8211	-134.4082	-71.9380	-28.2247	-15.4423	(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												667.5515	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												169.3298	
Water heating fuel used												1572.7118	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471)													
mechanical ventilation fans (SFP = 0.1471)												42.7485	(230a)
Total electricity for the above, kWh/year												42.7485	(231)
Electricity for lighting (calculated in Appendix L)												210.2509	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2634.7180	(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												-141.4553	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	667.5515	16.4900	110.0792 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1572.7118	16.4900	259.3402 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	42.7485	16.4900	7.0492 (249)
Energy for lighting	210.2509	16.4900	34.6704 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1158.4558	16.4900	-191.0294
PV Unit electricity exported	-1476.2622	5.5900	-82.5231
Total			-273.5524 (252)
Total energy cost			137.5866 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3579 (257)
SAP value		94.1987
SAP rating (Section 12)		94 (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	667.5515	0.1574	105.0670 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1572.7118	0.1410	221.7911 (264)
Space and water heating			326.8581 (265)
Pumps, fans and electric keep-hot	42.7485	0.1387	5.9297 (267)
Energy for lighting	210.2509	0.1443	30.3457 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1158.4558	0.1342	-155.5088
PV Unit electricity exported	-1476.2622	0.1237	-182.5775
Total			-338.0863 (269)
Total CO2, kg/year			25.0472 (272)
CO2 emissions per m2			0.2700 (273)
EI value			99.7575
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b)
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.1700 (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)
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												5.0000 (17)
Infiltration rate												0.2500 (18)
Number of sides sheltered												2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.2125 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.6000	4.3000	4.3000	4.0000	4.0000	3.8000	3.8000	3.7000	3.7000	4.0000	3.9000	4.1000 (22)
Adj infilt rate	1.1500	1.0750	1.0750	1.0000	1.0000	0.9500	0.9500	0.9250	0.9250	1.0000	0.9750	1.0250 (22a)
Mechanical extract ventilation - decentralised	0.2444	0.2284	0.2284	0.2125	0.2125	0.2019	0.2019	0.1966	0.1966	0.2125	0.2072	0.2178 (22b)
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	0.5000	0.5000	0.5000	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					
window 0.8 (Uw = 0.80)			16.2000	0.7752	12.5581		(27)					
front door			2.1800	0.8000	1.7440		(26)					
Heatloss Floor 1			46.7000	0.1100	5.1370		(28a)					
External Wall 1	70.0000	18.3800	51.6200	0.1500	7.7430		(29a)					
External Roof 1	46.7000		46.7000	0.1100	5.1370		(30)					
Total net area of external elements Aum(A, m2)			163.4000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.3191		(33)					
Party Wall 1			77.0100	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (User defined value 0.050 * total exposed area)								8.1700 (36)				
Point Thermal bridges								(36a) = 0.0500 (36a)				
Total fabric heat loss								(33) + (36) + (36a) = 40.5391 (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	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981 (38)
Heat transfer coeff	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372 (39)
Average = Sum(39)m / 12 =												79.8372
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548 (40)
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												2.6695 (42)
Hot water usage for mixer showers												68.7135 (42a)
Hot water usage for baths												29.6852 (42b)
Hot water usage for other uses												41.9679 (42c)
Average daily hot water use (litres/day)												129.3641 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667 (44)
Energy content (annual)	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803 (45)
Distribution loss (46) _m = 0.15 x (45) _m												2148.7113
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kwh/day):												1.2200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6588 (55)
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228 (56)
If cylinder contains dedicated solar storage												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655 (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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655 (64)
												2663.0693 (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)
												0.0000 (64a)
Heat gains from water heating, kWh/month	109.0573	96.7763	103.4618	92.3119	90.4441	82.5247	82.1010	84.7239	84.9668	93.5341	98.0060	108.0251 (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	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.7632	26.4354	21.4987	16.2759	12.1664	10.2714	11.0986	14.4264	19.3631	24.5859	28.6954	30.5904 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.9637	369.7613	360.1915	339.8187	314.1017	289.9314	273.7841	269.9865	279.5562	299.9290	325.6461	349.8164 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783 (71)
Water heating gains (Table 5)	146.5824	144.0123	139.0615	128.2110	121.5647	114.6177	110.3509	113.8762	118.0094	125.7179	136.1194	145.1950 (72)
Total internal gains	649.3846	647.2843	627.8272	591.3810	554.9082	521.8958	502.3089	505.3645	524.0041	557.3082	597.5362	632.6772 (73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Southeast		5.3900	45.0642	0.6400	0.7000	0.7700	75.4104 (77)					
Northwest		10.8100	14.6130	0.6400	0.7000	0.7700	49.0431 (81)					
Solar gains	124.4535	194.8646	310.1075	452.4005	530.4082	605.4504	550.6070	484.3075	374.1021	243.4909	151.6637	102.7311 (83)
Total gains	773.8381	842.1489	937.9346	1043.7814	1085.3164	1127.3462	1052.9159	989.6720	898.1062	800.7991	749.1999	735.4084 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil, _m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417
alpha	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161
util living area												

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	0.9797	0.9644	0.9100	0.7653	0.5599	0.3468	0.2350	0.2501	0.4778	0.7965	0.9500	0.9832 (86)
Living	20.4380	20.5519	20.7570	20.9328	20.9914	20.9997	21.0000	21.0000	20.9975	20.9312	20.6819	20.4148
Non living	19.7153	19.8247	20.0144	20.1612	20.2018	20.2060	20.2061	20.2061	20.2052	20.1636	19.9501	19.6931
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.7125	20.5519	20.7570	20.9328	20.9914	20.9997	21.0000	21.0000	20.9975	20.9312	20.6819	20.4966 (87)
Th 2	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061 (88)
util rest of house	0.9737	0.9544	0.8875	0.7222	0.5048	0.2907	0.1749	0.1860	0.4087	0.7445	0.9337	0.9780 (89)
MIT 2	19.9550	19.8247	20.0144	20.1612	20.2018	20.2060	20.2061	20.2061	20.2052	20.1636	19.9501	19.7649 (90)
Living area fraction									fLA = Living area / (4) =			0.2109 (91)
MIT	20.1148	19.9781	20.1711	20.3239	20.3684	20.3734	20.3735	20.3735	20.3724	20.3255	20.1044	19.9192 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1148	19.9781	20.1711	20.3239	20.3684	20.3734	20.3735	20.3735	20.3724	20.3255	20.1044	19.9192 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9729	0.9510	0.8864	0.7289	0.5162	0.3025	0.1876	0.1995	0.4232	0.7528	0.9313	0.9758 (94)
Useful gains	752.8690	800.8886	831.4215	760.8221	560.2079	341.0648	197.4773	197.4755	380.1147	602.8633	697.7134	717.5775 (95)
Ext temp.	5.7000	6.2000	7.8000	10.3000	13.3000	16.1000	17.9000	17.9000	15.6000	12.3000	8.8000	5.9000 (96)
Heat loss rate W	1150.8365	1100.0020	987.6708	800.2816	564.3177	341.1760	197.4808	197.4806	381.0114	640.7343	902.5129	1119.2563 (97)
Space heating kWh	296.0878	201.0042	116.2494	28.4108	3.0578	0.0000	0.0000	0.0000	0.0000	28.1760	147.4557	298.8490 (98a)
Space heating requirement - total per year (kWh/year)												1119.2907
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	296.0878	201.0042	116.2494	28.4108	3.0578	0.0000	0.0000	0.0000	0.0000	28.1760	147.4557	298.8490 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1119.2907
Space heating per m2										(98c) / (4) =		11.9838 (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 %)												247.1004 (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	296.0878	201.0042	116.2494	28.4108	3.0578	0.0000	0.0000	0.0000	0.0000	28.1760	147.4557	298.8490 (98)
Space heating efficiency (main heating system 1)	247.1004	247.1004	247.1004	247.1004	247.1004	0.0000	0.0000	0.0000	0.0000	247.1004	247.1004	247.1004 (210)
Space heating fuel (main heating system)	119.8249	81.3452	47.0454	11.4977	1.2375	0.0000	0.0000	0.0000	0.0000	11.4026	59.6744	120.9424 (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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655 (64)
Efficiency of water heater (217)m	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429 (216)
Fuel for water heating, kWh/month	157.4141	139.1132	147.4766	128.8445	124.3573	111.4625	109.5401	114.1982	115.7996	129.8451	138.9571	155.5810 (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	3.6307	3.2793	3.6307	3.5136	3.6307	3.5136	3.6307	3.6307	3.5136	3.6307	3.5136	3.6307 (231)
Lighting	26.0516	20.8995	18.8177	13.7867	10.6492	8.7005	9.7146	12.6274	16.4017	21.5199	24.3067	26.7756 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-60.6140	-78.2625	-116.8959	-132.0245	-138.6377	-135.4059	-131.0936	-126.1339	-111.0549	-92.3895	-66.1905	-51.1988 (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	-28.8523	-52.3881	-117.3503	-193.2267	-243.8669	-280.3184	-262.4077	-229.4689	-161.6421	-90.2586	-40.4640	-21.7849 (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												452.9701 (211)
Space heating fuel - main system 2												0.0000 (213)

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	169.3429
Water heating fuel used	1572.5895 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471)	
mechanical ventilation fans (SFP = 0.1471)	42.7485 (230a)
Total electricity for the above, kWh/year	42.7485 (231)
Electricity for lighting (calculated in Appendix L)	210.2509 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2961.9306 (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	-683.3716 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	452.9701	18.3900	83.3012 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1572.5895	18.3900	289.1992 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	42.7485	18.3900	7.8614 (249)
Energy for lighting	210.2509	18.3900	38.6651 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1239.9017	18.3900	-228.0179
PV Unit electricity exported	-1722.0289	5.8100	-100.0499
Total			-328.0678 (252)
Total energy cost			90.9592 (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	452.9701	0.1586	71.8274 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1572.5895	0.1410	221.7738 (264)
Space and water heating			293.6012 (265)
Pumps, fans and electric keep-hot	42.7485	0.1387	5.9297 (267)
Energy for lighting	210.2509	0.1443	30.3457 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1239.9017	0.1346	-166.8478
PV Unit electricity exported	-1722.0289	0.1241	-213.7298
Total			-380.5776 (269)
Total CO2, kg/year			-50.7010 (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	452.9701	1.5870	718.8550 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1572.5895	1.5215	2392.6386 (278)
Space and water heating			3111.4936 (279)
Pumps, fans and electric keep-hot	42.7485	1.5128	64.6699 (281)
Energy for lighting	210.2509	1.5338	322.4899 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1239.9017	1.4973	-1856.5295
PV Unit electricity exported	-1722.0289	0.4555	-784.3211
Total			-2640.8505 (283)
Total Primary energy kWh/year			857.8029 (286)

SAP 10 EPC IMPROVEMENTS

Plot 2 DS

Current energy efficiency rating: A 94
Current environmental impact rating: A 100

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N Solar water heating	Recommended
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.0	-£ 63	-49 kg (95.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£63	0.52 kg/m ²	A 96
Total Savings	£63	0.52 kg/m ²	A 100

Potential energy efficiency rating:	A 96
Potential environmental impact rating:	A 100

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£419	£347	£72
Space heating	£91	£106	-£15
Water heating	£289	£202	£87
Lighting	£39	£39	£0
Generated (PV)	-£328	-£319	-£9
Total cost of fuels	£91	£28	£63
Total cost of uses	£91	£28	£63
Delivered energy	-7 kWh/m ²	-12 kWh/m ²	4 kWh/m ²
Carbon dioxide emissions	-0.1 tonnes	-0.1 tonnes	0.0 tonnes
CO2 emissions per m ²	-1 kg/m ²	-1 kg/m ²	1 kg/m ²
Primary energy	9 kWh/m ²	4 kWh/m ²	5 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b) -
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.1700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2125 (21)

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

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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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (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	0.5209	0.5156	0.5103	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					
window 0.8 (Uw = 0.80)			16.2000	0.7752	12.5581		(27)					
front door			2.1800	0.8000	1.7440		(26)					
Heatloss Floor 1			46.7000	0.1100	5.1370		(28a)					
External Wall 1	70.0000	18.3800	51.6200	0.1500	7.7430		(29a)					
External Roof 1	46.7000		46.7000	0.1100	5.1370		(30)					
Total net area of external elements Aum(A, m2)			163.4000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 32.3191		(33)					
Party Wall 1			77.0100	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)							8.1700 (36)					
Point Thermal bridges							0.0500 (36a)					
Total fabric heat loss						(33) + (36) + (36a) =	40.5391 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.9437	Feb 40.5261	Mar 40.1086	Apr 39.2981	May 39.2981	Jun 39.2981	Jul 39.2981	Aug 39.2981	Sep 39.2981	Oct 39.2981	Nov 39.2981	Dec 39.2981 (38)
Heat transfer coeff	81.4828	81.0653	80.6477	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372 (39)
Average = Sum(39)m / 12 =												80.1442
HLP	Jan 0.8724	Feb 0.8679	Mar 0.8635	Apr 0.8548	May 0.8548	Jun 0.8548	Jul 0.8548	Aug 0.8548	Sep 0.8548	Oct 0.8548	Nov 0.8548	Dec 0.8548 (40)
HLP (average)												0.8581
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6695 (42)
Hot water usage for mixer showers												
68.9778	67.9412	66.4307	63.5405	61.4077	59.0292	57.6772	59.1763	60.8196	63.3734	66.3256	68.7135	68.7135 (42a)
Hot water usage for baths												
29.7859	29.3436	28.7206	27.5720	26.7120	25.7583	25.2432	25.8618	26.5353	27.5558	28.7280	29.6852	29.6852 (42b)
Hot water usage for other uses												
41.9679	40.4418	38.9157	37.3896	35.8635	34.3374	34.3374	35.8635	37.3896	38.9157	40.4418	41.9679	41.9679 (42c)
Average daily hot water use (litres/day)												129.3641 (43)
Daily hot water use	Jan 140.7317	Feb 137.7266	Mar 134.0670	Apr 128.5022	May 123.9832	Jun 119.1249	Jul 117.2578	Aug 120.9016	Sep 124.7445	Oct 129.8449	Nov 135.4954	Dec 140.3667 (44)
Energy conte	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803 (45)
Energy content (annual)												Total = Sum(45)m = 2148.7113
Distribution loss (46)m = 0.15 x (45)m												
33.4327	29.4181	30.9084	26.3870	25.0358	21.9717	21.2720	22.4552	23.0734	26.4297	28.9557	32.9670	32.9670 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6588 (55)
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228 (56)
If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (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	266.5697	235.5784	248.3454	211.4355	197.7961	176.1472	172.4714	181.2902	190.6956	218.4877	235.3141	263.4655 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												617.6263 (H24)
Heat delivered to space heating												0.0000 (H29)

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Solar input												617.6263
Solar input	-0.0000	-16.2126	-58.2117	-79.8138	-103.8729	-95.5543	-94.7243	-83.0656	-57.5217	-28.6494	-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	266.5697	219.3658	190.1337	131.6217	93.9232	80.5930	77.7471	98.2246	133.1739	189.8384	235.3141	263.4655 (64)
	Total per year (kWh/year) = Sum(64)m =											1979.9705 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	109.0573	96.7763	102.3452	86.9090	80.2087	72.4393	71.6795	75.0467	80.6445	92.4175	98.0060	108.0251 (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	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.7632	26.4354	21.4987	16.2759	12.1664	10.2714	11.0986	14.4264	19.3631	24.5859	28.6954	30.5904 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.9637	369.7613	360.1915	339.8187	314.1017	289.9314	273.7841	269.9865	279.5562	299.9290	325.6461	349.8164 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783 (71)
Water heating gains (Table 5)	146.5824	144.0123	137.5607	120.7070	107.8074	100.6102	96.3434	100.8693	112.0062	124.2171	136.1194	145.1950 (72)
Total internal gains	649.3846	647.2843	626.3264	583.8770	541.1509	507.8883	488.3014	492.3575	518.0009	555.8074	597.5362	632.6772 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Southeast	5.3900	36.7938	0.6400	0.7000	0.7700	61.5708 (77)						
Northwest	10.8100	11.2829	0.6400	0.7000	0.7700	37.8669 (81)						
Solar gains	99.4377	181.9570	282.3705	405.8693	505.7204	524.5462	496.3621	418.4315	324.5963	210.1092	121.3940	83.6158 (83)
Total gains	748.8223	829.2413	908.6969	989.7463	1046.8713	1032.4345	984.6636	910.7891	842.5972	765.9166	718.9302	716.2930 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	79.6010	80.0110	80.4252	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417 (85)
tau	6.3067	6.3341	6.3617	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161
alpha	0.9895	0.9786	0.9469	0.8544	0.6846	0.4921	0.3564	0.4025	0.6383	0.8974	0.9774	0.9916 (86)
util living area	20.2507	20.4028	20.6259	20.8540	20.9687	20.9965	20.9996	20.9992	20.9842	20.8266	20.5062	20.2346
Living	19.5187	19.6706	19.8874	20.0983	20.1873	20.2047	20.2060	20.2059	20.1985	20.0801	19.7828	19.5155
Non living	0	0	0	0	0	0	0	0	0	0	0	0
24 / 16	3	0	0	0	0	0	0	0	0	0	0	0
24 / 9	28	0	0	0	0	0	0	0	0	0	0	10
16 / 9	20.6167	20.4028	20.6259	20.8540	20.9687	20.9965	20.9996	20.9992	20.9842	20.8266	20.5062	20.3417 (87)
MIT	20.1910	20.1948	20.1987	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061 (88)
util rest of house	0.9864	0.9727	0.9329	0.8222	0.6339	0.4324	0.2923	0.3334	0.5712	0.8657	0.9700	0.9891 (89)
MIT 2	19.8471	19.6706	19.8874	20.0983	20.1873	20.2047	20.2060	20.2059	20.1985	20.0801	19.7828	19.6121 (90)
Living area fraction	20.0094	19.8250	20.0431	20.2577	20.3521	20.3717	20.3734	20.3732	20.3642	20.2376	19.9354	0.2109 (91)
MIT	20.0094	19.8250	20.0431	20.2577	20.3521	20.3717	20.3734	20.3732	20.3642	20.2376	19.9354	19.7660 (92)
Temperature adjustment	20.0094	19.8250	20.0431	20.2577	20.3521	20.3717	20.3734	20.3732	20.3642	20.2376	19.9354	0.0000
adjusted MIT	20.0094	19.8250	20.0431	20.2577	20.3521	20.3717	20.3734	20.3732	20.3642	20.2376	19.9354	19.7660 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9856	0.9693	0.9297	0.8245	0.6435	0.4449	0.3058	0.3480	0.5849	0.8671	0.9669	0.9874 (94)
Useful gains	738.0414	803.8122	844.8358	816.0149	673.6674	459.3497	301.1529	316.9724	492.8128	664.1526	695.1371	707.2958 (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	1280.0459	1209.9000	1092.2227	906.7673	690.7618	460.7949	301.2576	317.2104	500.1192	769.4376	1024.7399	1242.7443 (97)
Space heating kWh	403.2513	272.8910	184.0558	65.3417	12.7183	0.0000	0.0000	0.0000	0.0000	78.3321	237.3141	398.3737 (98a)
Space heating requirement - total per year (kWh/year)												1652.2778
Solar heating kWh												

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Solar heating contribution - total per year (kWh/year)	-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)
Space heating kWh	403.2513	272.8910	184.0558	65.3417	12.7183	0.0000	0.0000	0.0000	0.0000	78.3321	237.3141	398.3737	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1652.2778	
Space heating per m2										(98c) / (4) =		17.6903	(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 %)													246.9769 (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	403.2513	272.8910	184.0558	65.3417	12.7183	0.0000	0.0000	0.0000	0.0000	78.3321	237.3141	398.3737	(98)
Space heating efficiency (main heating system 1)	246.9769	246.9769	246.9769	246.9769	246.9769	0.0000	0.0000	0.0000	0.0000	246.9769	246.9769	246.9769	(210)
Space heating fuel (main heating system)	163.2749	110.4925	74.5235	26.4566	5.1496	0.0000	0.0000	0.0000	0.0000	31.7164	96.0876	161.3000	(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	266.5697	219.3658	190.1337	131.6217	93.9232	80.5930	77.7471	98.2246	133.1739	189.8384	235.3141	263.4655	(64)
Efficiency of water heater (217)m	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	169.3298	(216)
Fuel for water heating, kWh/month	157.4264	129.5495	112.2860	77.7310	55.4676	47.5953	45.9146	58.0078	78.6476	112.1116	138.9679	155.5931	(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	10.4252	9.4163	10.4252	10.0889	10.4252	10.0889	10.4252	10.0889	10.4252	10.0889	10.4252	10.0889	(231)
Lighting	26.0516	20.8995	18.8177	13.7867	10.6492	8.7005	9.7146	12.6274	16.4017	21.5199	24.3067	26.7756	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-50.6634	-74.7932	-109.8129	-120.8004	-124.9644	-115.4084	-113.5721	-109.0291	-98.7693	-84.0292	-56.2498	-43.1837	(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	-19.8669	-46.1172	-103.2607	-172.8678	-243.2016	-248.3385	-244.6460	-200.6949	-138.3846	-72.6178	-28.0767	-15.3696	(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													669.0010 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													169.3298
Water heating fuel used													1169.2985 (219)
Space cooling fuel													0.0000 (221)

Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471)													
mechanical ventilation fans (SFP = 0.1471)													42.7485 (230a)
pump for solar water heating													80.0000 (230g)
Total electricity for the above, kWh/year													122.7485 (231)
Electricity for lighting (calculated in Appendix L)													210.2509 (232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-2634.7180 (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													-463.4191 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	669.0010	16.4900	110.3183	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1169.2985	16.4900	192.8173	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)

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Pumps, fans and electric keep-hot	42.7485	16.4900	7.0492 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	210.2509	16.4900	34.6704 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1101.2758	16.4900	-181.6004
PV Unit electricity exported	-1533.4422	5.5900	-85.7194
Total			-267.3198 (252)
Total energy cost			90.7274 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600 (256)
Energy cost factor (ECF) =		$[(255) \times (256)] / [(4) + 45.0] =$	0.2360 (257)
SAP value			96.1745
SAP rating (Section 12)			96 (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	669.0010	0.1574	105.2723 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1169.2985	0.1458	170.4983 (264)
Space and water heating			275.7706 (265)
Pumps, fans and electric keep-hot	122.7485	0.1387	17.0267 (267)
Energy for lighting	210.2509	0.1443	30.3457 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1101.2758	0.1348	-148.4734
PV Unit electricity exported	-1533.4422	0.1233	-189.0608
Total			-337.5343 (269)
Total CO2, kg/year			-14.3913 (272)
CO2 emissions per m2			-0.1500 (273)
EI value			100.1393
EI rating			100 (274)
EI band			A

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b) -
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 238.1700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2500 (18)

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Number of sides sheltered

2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.3000	4.3000	4.0000	4.0000	3.8000	3.8000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0750	1.0750	1.0000	1.0000	0.9500	0.9500	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.2444	0.2284	0.2284	0.2125	0.2125	0.2019	0.2019	0.1966	0.1966	0.2125	0.2072	0.2178	(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	0.5000	0.5000	0.5000	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	
window 0.8 (Uw = 0.80)			16.2000	0.7752	12.5581			(27)
front door			2.1800	0.8000	1.7440			(26)
Heatloss Floor 1			46.7000	0.1100	5.1370			(28a)
External Wall 1	70.0000	18.3800	51.6200	0.1500	7.7430			(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370			(30)
Total net area of external elements Aum(A, m2)			163.4000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 32.3191			(33)
Party Wall 1			77.0100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)								8.1700 (36)
Point Thermal bridges								(36a) = 0.0500 (36a)
Total fabric heat loss								(33) + (36) + (36a) = 40.5391 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	(38)
Average = Sum(39)m / 12 =	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	79.8372	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	(40)
HLP (average)													0.8548
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy													2.6695 (42)
Hot water usage for mixer showers	68.9778	67.9412	66.4307	63.5405	61.4077	59.0292	57.6772	59.1763	60.8196	63.3734	66.3256	68.7135	(42a)
Hot water usage for baths	29.7859	29.3436	28.7206	27.5720	26.7120	25.7583	25.2432	25.8618	26.5353	27.5558	28.7280	29.6852	(42b)
Hot water usage for other uses	41.9679	40.4418	38.9157	37.3896	35.8635	34.3374	34.3374	35.8635	37.3896	38.9157	40.4418	41.9679	(42c)
Average daily hot water use (litres/day)													129.3641 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667	(44)
Energy content (annual)	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2148.7113
Distribution loss	33.4327	29.4181	30.9084	26.3870	25.0358	21.9717	21.2720	22.4552	23.0734	26.4297	28.9557	32.9670	(46)

Water storage loss:													200.0000 (47)
Store volume													1.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.6588 (55)
Enter (49) or (54) in (55)													
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)
If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(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	266.5697	235.5784	248.3454	211.4355	197.7961	176.1472	172.4714	181.2902	190.6956	218.4877	235.3141	263.4655	(62)
WVHRS	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)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)

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Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												736.6642 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												736.6642
Solar input	-4.1428	-21.6730	-68.3738	-92.1403	-109.9351	-111.6333	-106.0583	-99.1315	-71.8191	-41.9364	-9.8207	-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 (63d)	
Output from w/h	262.4270	213.9054	179.9717	119.2952	87.8610	64.5140	66.4131	82.1587	118.8765	176.5513	225.4934	263.4655 (64)
	Total per year (kWh/year) = Sum(64)m =											1860.9327 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	109.0573	96.7763	102.3452	86.9090	80.2087	72.4393	71.6795	75.0467	80.6445	92.4175	98.0060	108.0251 (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	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675	160.1675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.7632	26.4354	21.4987	16.2759	12.1664	10.2714	11.0986	14.4264	19.3631	24.5859	28.6954	30.5904 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.9637	369.7613	360.1915	339.8187	314.1017	289.9314	273.7841	269.9865	279.5562	299.9290	325.6461	349.8164 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862	53.6862 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783 (71)
Water heating gains (Table 5)	146.5824	144.0123	137.5607	120.7070	107.8074	100.6102	96.3434	100.8693	112.0062	124.2171	136.1194	145.1950 (72)
Total internal gains	649.3846	647.2843	626.3264	583.8770	541.1509	507.8883	488.3014	492.3575	518.0009	555.8074	597.5362	632.6772 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Southeast	5.3900	45.0642	0.6400	0.7000	0.7700	0.7700	75.4104 (77)					
Northwest	10.8100	14.6130	0.6400	0.7000	0.7700	0.7700	49.0431 (81)					
Solar gains	124.4535	194.8646	310.1075	452.4005	530.4082	605.4504	550.6070	484.3075	374.1021	243.4909	151.6637	102.7311 (83)
Total gains	773.8381	842.1489	936.4338	1036.2774	1071.5591	1113.3387	1038.9085	976.6650	892.1030	799.2983	749.1999	735.4084 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417	81.2417
alpha	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161	6.4161
util living area	0.9797	0.9644	0.9105	0.7693	0.5667	0.3511	0.2382	0.2534	0.4809	0.7975	0.9500	0.9832 (86)
Living	20.4380	20.5519	20.7560	20.9308	20.9909	20.9996	21.0000	21.0000	20.9974	20.9307	20.6819	20.4148
Non living	19.7153	19.8247	20.0135	20.1597	20.2015	20.2060	20.2061	20.2061	20.2052	20.1633	19.9501	19.6931
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.7125	20.5519	20.7560	20.9308	20.9909	20.9996	21.0000	21.0000	20.9974	20.9307	20.6819	20.4966 (87)
Th 2	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061 (88)
util rest of house	0.9737	0.9544	0.8882	0.7263	0.5110	0.2944	0.1772	0.1885	0.4114	0.7455	0.9337	0.9780 (89)
MIT 2	19.9550	19.8247	20.0135	20.1597	20.2015	20.2060	20.2061	20.2061	20.2052	20.1633	19.9501	19.7649 (90)
Living area fraction	fLA = Living area / (4) =											0.2109 (91)
MIT	20.1148	19.9781	20.1701	20.3224	20.3680	20.3734	20.3735	20.3735	20.3723	20.3251	20.1044	19.9192 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1148	19.9781	20.1701	20.3224	20.3680	20.3734	20.3735	20.3735	20.3723	20.3251	20.1044	19.9192 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9729	0.9510	0.8870	0.7329	0.5225	0.3063	0.1901	0.2022	0.4260	0.7538	0.9313	0.9758 (94)

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Useful gains	752.8690	800.8886	830.6483	759.4828	559.8881	341.0552	197.4770	197.4750	380.0762	602.5458	697.7134	717.5775	(95)
Ext temp.	5.7000	6.2000	7.8000	10.3000	13.3000	16.1000	17.9000	17.9000	15.6000	12.3000	8.8000	5.9000	(96)
Heat loss rate W	1150.8365	1100.0020	987.5957	800.1574	564.2885	341.1750	197.4808	197.4805	381.0077	640.7046	902.5129	1119.2563	(97)
Space heating kWh	296.0878	201.0042	116.7689	29.2857	3.2739	0.0000	0.0000	0.0000	0.0000	28.3901	147.4557	298.8490	(98a)
Space heating requirement - total per year (kWh/year)												1121.1154	
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	296.0878	201.0042	116.7689	29.2857	3.2739	0.0000	0.0000	0.0000	0.0000	28.3901	147.4557	298.8490	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1121.1154	
Space heating per m2											(98c) / (4) =	12.0034	(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 %)	247.1004	(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	296.0878	201.0042	116.7689	29.2857	3.2739	0.0000	0.0000	0.0000	0.0000	28.3901	147.4557	298.8490	(98)
Space heating efficiency (main heating system 1)	247.1004	247.1004	247.1004	247.1004	247.1004	0.0000	0.0000	0.0000	0.0000	247.1004	247.1004	247.1004	(210)
Space heating fuel (main heating system)	119.8249	81.3452	47.2557	11.8518	1.3249	0.0000	0.0000	0.0000	0.0000	11.4893	59.6744	120.9424	(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	262.4270	213.9054	179.9717	119.2952	87.8610	64.5140	66.4131	82.1587	118.8765	176.5513	225.4934	263.4655	(64)
Efficiency of water heater (217)m	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	169.3429	(216)
Fuel for water heating, kWh/month	154.9678	126.3149	106.2764	70.4459	51.8835	38.0966	39.2181	48.5162	70.1987	104.2567	133.1579	155.5810	(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	10.4252	9.4163	10.4252	10.0889	10.4252	10.0889	10.4252	10.0889	10.4252	10.0889	10.4252	10.0889	(231)
Lighting	26.0516	20.8995	18.8177	13.7867	10.6492	8.7005	9.7146	12.6274	16.4017	21.5199	24.3067	26.7756	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-60.7014	-77.9923	-113.9572	-124.0478	-125.4879	-119.1107	-116.1993	-113.8439	-105.0940	-90.8722	-66.2166	-51.3056	(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	-28.7649	-52.6583	-120.2890	-201.2035	-257.0166	-296.6135	-277.3020	-241.7588	-167.6031	-91.7760	-40.4379	-21.6780	(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												453.7085	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												169.3429	
Water heating fuel used												1098.9137	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
(MEV)Decentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471)		
mechanical ventilation fans (SFP = 0.1471)		42.7485 (230a)
pump for solar water heating		80.0000 (230g)
Total electricity for the above, kWh/year		122.7485 (231)
Electricity for lighting (calculated in Appendix L)		210.2509 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		-2961.9306 (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		-1076.3090 (238)

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10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	453.7085	18.3900	83.4370 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1098.9137	18.3900	202.0902 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	42.7485	18.3900	7.8614 (249)
Pump for solar water heating	80.0000	18.3900	14.7120 (249)
Energy for lighting	210.2509	18.3900	38.6651 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1164.8289	18.3900	-214.2120
PV Unit electricity exported	-1797.1017	5.8100	-104.4116
Total			-318.6237 (252)
Total energy cost			28.1422 (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	453.7085	0.1585	71.9335 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1098.9137	0.1467	161.2211 (264)
Space and water heating			233.1546 (265)
Pumps, fans and electric keep-hot	122.7485	0.1387	17.0267 (267)
Energy for lighting	210.2509	0.1443	30.3457 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1164.8289	0.1353	-157.5953
PV Unit electricity exported	-1797.1017	0.1237	-222.2752
Total			-379.8706 (269)
Total CO2, kg/year			-99.3435 (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	453.7085	1.5869	719.9868 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1098.9137	1.5427	1695.3324 (278)
Space and water heating			2415.3193 (279)
Pumps, fans and electric keep-hot	122.7485	1.5128	185.6939 (281)
Energy for lighting	210.2509	1.5338	322.4899 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1164.8289	1.5001	-1747.3176
PV Unit electricity exported	-1797.1017	0.4539	-815.6337
Total			-2562.9513 (283)
Total Primary energy kWh/year			360.5517 (286)

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Property Reference	all plots		Issued on Date	30/06/2023	
Assessment Reference	Plot 3 DS	Prop Type Ref			
Property	Plot 1 , Bryanston Road , Southampton, Hampshire , SO19				
SAP Rating	93 A	DER	0.69	TER	10.41
Environmental	99 A	% DER < TER			93.37
CO ₂ Emissions (t/year)	-0.03	DFEE	32.19	TREE	35.64
Compliance Check	See BREL	% DFEE < TREE			9.65
% DPER < TPER	63.94	DPER	19.53	TPER	54.15
Assessor Details	Dr. Rachel Mitchell			Assessor ID	L772-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b)
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.1700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.2500 (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) =	0.2313 (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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5448	0.5391	0.5333	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5102	0.5217 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
window 0.8 (Uw = 0.80)			19.0800	0.7752	14.7907		(27)
front door			2.1800	0.8000	1.7440		(26)
Heatloss Floor 1			46.7000	0.1100	5.1370		(28a)

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External Wall 1	98.5000	21.2600	77.2400	0.1500	11.5860	(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370	(30)
Total net area of external elements Aum(A, m2)			191.9000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.3947	(33)
Party Wall 1			48.0000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)						9.5950 (36)
Point Thermal bridges						(36a) = 0.0500 (36a)
Total fabric heat loss						(33) + (36) + (36a) = 48.0397 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	42.8226	42.3682	41.9138	39.6419	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	40.0963	41.0051	(38)
Average = Sum(39)m / 12 =	90.8623	90.4079	89.9535	87.6816	87.3377	87.3377	87.3377	87.3377	87.3377	87.3377	88.1360	89.0448	(39)
													88.3427

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9728	0.9680	0.9631	0.9388	0.9351	0.9351	0.9351	0.9351	0.9351	0.9351	0.9436	0.9534	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6695 (42)
Hot water usage for mixer showers	68.9778	67.9412	66.4307	63.5405	61.4077	59.0292	57.6772	59.1763	60.8196	63.3734	66.3256	68.7135	(42a)
Hot water usage for baths	29.7859	29.3436	28.7206	27.5720	26.7120	25.7583	25.2432	25.8618	26.5353	27.5558	28.7280	29.6852	(42b)
Hot water usage for other uses	41.9679	40.4418	38.9157	37.3896	35.8635	34.3374	34.3374	35.8635	37.3896	38.9157	40.4418	41.9679	(42c)
Average daily hot water use (litres/day)													129.3641 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667	(44)
Energy content (annual)	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803	(45)
Distribution loss (46)m = 0.15 x (45)m	33.4327	29.4181	30.9084	26.3870	25.0358	21.9717	21.2720	22.4552	23.0734	26.4297	28.9557	32.9670	(46)
Water storage loss:													200.0000 (47)

Store volume													1.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.6588 (55)
Enter (49) or (54) in (55)													
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)

If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(64)
Total per year (kWh/year) = Sum(64)m =													2663.0693 (64)

12Total per year (kWh/year)													
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

Heat gains from water heating, kWh/month	109.0573	96.7763	103.4618	92.3119	90.4441	82.5247	82.1010	84.7239	84.9668	93.5341	98.0060	108.0251	(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	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.4564	140.0053	126.4564	130.6716	126.4564	130.6716	126.4564	126.4564	130.6716	126.4564	130.6716	126.4564	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1957	247.7401	241.3283	227.6786	210.4482	194.2540	183.4353	180.8910	187.3027	200.9525	218.1829	234.3770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	(71)
Water heating gains (Table 5)	146.5824	144.0123	139.0615	128.2110	121.5647	114.6177	110.3509	113.8762	118.0094	125.7179	136.1194	145.1950	(72)
Total internal gains	581.2763	594.7995	569.8881	549.6030	521.5111	502.5852	483.2845	484.2654	499.0256	516.1686	548.0158	569.0703	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
Northeast				2.8800	11.2829	0.6400		0.7000		0.7700	10.0885 (75)	
Southeast				5.3900	36.7938	0.6400		0.7000		0.7700	61.5708 (77)	
Northwest				10.8100	11.2829	0.6400		0.7000		0.7700	37.8669 (81)	
Solar gains	109.5262	202.4924	319.3688	466.6311	587.3962	611.6212	577.8190	483.3699	369.6792	235.2051	134.0879	91.8546 (83)
Total gains	690.8025	797.2919	889.2569	1016.2341	1108.9073	1114.2063	1061.1035	967.6353	868.7048	751.3737	682.1037	660.9249 (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	71.3840	71.7427	72.1051	73.9735	74.2647	74.2647	74.2647	74.2647	74.2647	74.2647	73.5921	72.8410
alpha	5.7589	5.7828	5.8070	5.9316	5.9510	5.9510	5.9510	5.9510	5.9510	5.9510	5.9061	5.8561
util living area	0.9941	0.9858	0.9629	0.8735	0.6978	0.4975	0.3616	0.4139	0.6675	0.9237	0.9858	0.9953 (86)
Living	20.0148	20.2052	20.4676	20.7932	20.9540	20.9945	20.9993	20.9985	20.9728	20.7441	20.3409	20.0023
Non living	19.2157	19.4068	19.6648	19.9803	20.1102	20.1355	20.1376	20.1374	20.1247	19.9472	19.5588	19.2166
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.4960	20.2052	20.4676	20.7932	20.9540	20.9945	20.9993	20.9985	20.9728	20.7441	20.3409	20.1419 (87)
Th 2	20.1060	20.1101	20.1142	20.1347	20.1378	20.1378	20.1378	20.1378	20.1378	20.1378	20.1306	20.1224 (88)
util rest of house	0.9923	0.9816	0.9518	0.8421	0.6438	0.4324	0.2911	0.3370	0.5944	0.8963	0.9808	0.9939 (89)
MIT 2	19.6506	19.4068	19.6648	19.9803	20.1102	20.1355	20.1376	20.1374	20.1247	19.9472	19.5588	19.3433 (90)
Living area fraction	fLA = Living area / (4) =											0.1606 (91)
MIT	19.7864	19.5350	19.7937	20.1108	20.2457	20.2734	20.2760	20.2757	20.2609	20.0752	19.6844	19.4715 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.7864	19.5350	19.7937	20.1108	20.2457	20.2734	20.2760	20.2757	20.2609	20.0752	19.6844	19.4715 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9915	0.9781	0.9470	0.8411	0.6508	0.4427	0.3024	0.3494	0.6053	0.8940	0.9774	0.9924 (94)
Useful gains	684.9100	779.7951	842.1662	854.7730	721.6583	493.2828	320.8707	338.0672	525.7987	671.7427	666.6962	655.9216 (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	1407.1259	1323.1179	1195.8189	982.9844	746.3647	495.5054	321.0529	338.4921	538.0783	827.5428	1109.1361	1359.8507 (97)
Space heating kWh	537.3286	365.1129	263.1176	92.3122	18.3816	0.0000	0.0000	0.0000	0.0000	115.9153	318.5567	523.7233 (98a)
Space heating requirement - total per year (kWh/year)												2234.4482
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	537.3286	365.1129	263.1176	92.3122	18.3816	0.0000	0.0000	0.0000	0.0000	115.9153	318.5567	523.7233 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2234.4482
Space heating per m2												(98c) / (4) = 23.9234 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												243.3223 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	537.3286	365.1129	263.1176	92.3122	18.3816	0.0000	0.0000	0.0000	0.0000	115.9153	318.5567	523.7233 (98)
Space heating efficiency (main heating system 1)	243.3223	243.3223	243.3223	243.3223	243.3223	0.0000	0.0000	0.0000	0.0000	243.3223	243.3223	243.3223 (210)
Space heating fuel (main heating system)	220.8300	150.0532	108.1354	37.9382	7.5544	0.0000	0.0000	0.0000	0.0000	47.6386	130.9196	215.2385 (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

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Efficiency of water heater (217)m	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655 (64)
Fuel for water heating, kWh/month	168.4389	168.4389	168.4389	168.4389	168.4389	168.4389	168.4389	168.4389	168.4389	168.4389	168.4389	168.4389 (216)
Space cooling fuel requirement (221)m	158.2590	139.8599	148.2681	129.5360	125.0248	112.0608	110.1280	114.8111	116.4211	130.5420	139.7029	156.4161 (219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Lighting	3.6307	3.2793	3.6307	3.5136	3.6307	3.5136	3.6307	3.6307	3.5136	3.6307	3.5136	3.6307 (231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	25.2607	20.2651	18.2465	13.3681	10.3259	8.4364	9.4197	12.2440	15.9038	20.8666	23.5688	25.9628 (232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-51.3020	-76.2004	-114.1136	-128.1564	-137.2521	-127.6420	-125.7056	-117.9397	-102.7599	-85.6911	-56.8590	-43.6607 (233a)
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	-19.2283	-44.7099	-98.9599	-165.5118	-230.9139	-236.1049	-232.5124	-191.7843	-134.3940	-70.9559	-27.4674	-14.8926 (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												918.3079 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												168.4389
Water heating fuel used												1581.0298 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471)												
mechanical ventilation fans (SFP = 0.1471)												42.7485 (230a)
Total electricity for the above, kWh/year												42.7485 (231)
Electricity for lighting (calculated in Appendix L)												203.8684 (232)

Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2634.7180 (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												111.2366 (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	918.3079	0.1571	144.3024 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1581.0298	0.1410	222.9641 (264)
Space and water heating			367.2666 (265)
Pumps, fans and electric keep-hot	42.7485	0.1387	5.9297 (267)
Energy for lighting	203.8684	0.1443	29.4245 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1167.2826	0.1344	-156.8300
PV Unit electricity exported	-1467.4354	0.1234	-181.0981
Total			-337.9282 (269)
Total CO2, kg/year			64.6927 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.6900 (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	918.3079	1.5817	1452.5033 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1581.0298	1.5215	2405.4802 (278)
Space and water heating			3857.9834 (279)
Pumps, fans and electric keep-hot	42.7485	1.5128	64.6699 (281)
Energy for lighting	203.8684	1.5338	312.7002 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1167.2826	1.4966	-1746.8989
PV Unit electricity exported	-1467.4354	0.4529	-664.6107
Total			-2411.5096 (283)
Total Primary energy kWh/year			1823.8440 (286)
Dwelling Primary energy Rate (DPER)			19.5300 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b) -
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.1700 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3760 (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) =	0.3478 (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	0.4434	0.4347	0.4260	0.3825	0.3738	0.3304	0.3304	0.3217	0.3478	0.3738	0.3912	0.4086 (22b)
Effective ac	0.5983	0.5945	0.5907	0.5732	0.5699	0.5546	0.5546	0.5517	0.5605	0.5699	0.5765	0.5835 (25)

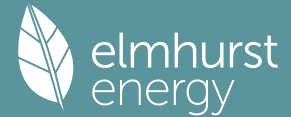
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1800	1.0000	2.1800		(26)
TER Opening Type (Uw = 1.20)			19.0800	1.1450	21.8473		(27)
Heatloss Floor 1			46.7000	0.1300	6.0710		(28a)
External Wall 1	98.5000	21.2600	77.2400	0.1800	13.9032		(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370		(30)
Total net area of external elements Aum(A, m ²)			191.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1385		(33)
Party Wall 1			48.0000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	
List of Thermal Bridges	250.0000 (35)
K1 Element	
E5 Ground floor (normal)	Length 19.5000 Psi-value 0.1600 Total 3.1200
E6 Intermediate floor within a dwelling	19.5000 0.0000 0.0000
E16 Corner (normal)	10.2000 0.0900 0.9180
E18 Party wall between dwellings	10.2000 0.0600 0.6120
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	
Point Thermal bridges	(36a) = 0.0500 (36a)
Total fabric heat loss	(33) + (36) + (36a) = 53.8385 (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	47.0241	46.7241	46.4300	45.0488	44.7904	43.5873	43.5873	43.3646	44.0507	44.7904	45.3132	45.8597 (38)
Heat transfer coeff	100.8627	100.5626	100.2686	98.8873	98.6289	97.4259	97.4259	97.2031	97.8893	98.6289	99.1517	99.6983 (39)
Average = Sum(39)m / 12 =												98.8861
HLP	1.0799	1.0767	1.0735	1.0588	1.0560	1.0431	1.0431	1.0407	1.0481	1.0560	1.0616	1.0674 (40)
HLP (average)												1.0587

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Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.6695 (42)
Hot water usage for mixer showers												68.7135 (42a)
Hot water usage for baths												29.6852 (42b)
Hot water usage for other uses												41.9679 (42c)
Average daily hot water use (litres/day)												129.3641 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667 (44)
Energy content (annual)	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2148.7113
Water storage loss:												200.0000 (47)
Store volume												1.6525 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8924 (55)
Enter (49) or (54) in (55)												
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage												27.6637 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
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	273.8106	242.1186	256.9821	225.1964	217.8313	195.7612	192.7392	200.6275	203.1058	227.1244	242.3214	270.7064 (62)
WWHRS	-31.5338	-27.8887	-29.2035	-24.1816	-22.5364	-19.2846	-18.0762	-19.2222	-19.9526	-23.5219	-26.6474	-30.9498 (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	242.2768	214.2298	227.7786	201.0147	195.2949	176.4767	174.6630	181.4053	183.1532	203.6025	215.6740	239.7566 (64)
												Total per year (kWh/year) = Sum(64)m = 2455.3261 (64)
12Total per year (kWh/year)												2455 (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	114.8500	102.0084	109.2545	97.9177	96.2368	88.1306	87.8937	90.5166	90.5726	99.3268	103.6118	113.8178 (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	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	124.2876	137.6041	124.2876	128.4305	124.2876	128.4305	124.2876	124.2876	128.4305	124.2876	128.4305	124.2876 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1957	247.7401	241.3283	227.6786	210.4482	194.2540	183.4353	180.8910	187.3027	200.9525	218.1829	234.3770 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473 (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)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783 (71)
Water heating gains (Table 5)	154.3682	151.7982	146.8474	135.9968	129.3506	122.4035	118.1367	121.6621	125.7953	133.5037	143.9053	152.9809 (72)
Total internal gains	589.8934	603.1842	578.5052	558.1478	530.1282	508.1299	488.9015	489.8825	504.5704	524.7857	556.5605	577.6874 (73)
6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	2.8800	11.2829	0.6300	0.7000	0.7700	9.9309 (75)						
Southeast	5.3900	36.7938	0.6300	0.7000	0.7700	60.6088 (77)						
Northwest	10.8100	11.2829	0.6300	0.7000	0.7700	37.2752 (81)						
Solar gains	107.8148	199.3285	314.3787	459.3400	578.2181	602.0646	568.7906	475.8173	363.9030	231.5300	131.9928	90.4193 (83)
Total gains	697.7082	802.5127	892.8839	1017.4878	1108.3463	1110.1945	1057.6921	965.6998	868.4733	756.3157	688.5533	668.1067 (84)
7. Mean internal temperature (heating season)												

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.3064	64.4982	64.6874	65.5909	65.7628	66.5748	66.5748	66.7274	66.2597	65.7628	65.4160	65.0574
alpha	5.2871	5.2999	5.3125	5.3727	5.3842	5.4383	5.4383	5.4485	5.4173	5.3842	5.3611	5.3372
util living area	0.9944	0.9876	0.9697	0.9027	0.7541	0.5507	0.4035	0.4592	0.7224	0.9406	0.9877	0.9955 (86)
MIT	19.8484	20.0386	20.3155	20.6755	20.9049	20.9858	20.9978	20.9957	20.9438	20.6329	20.1857	19.8233 (87)
Th 2	20.0173	20.0199	20.0225	20.0347	20.0369	20.0476	20.0476	20.0495	20.0435	20.0369	20.0323	20.0275 (88)
util rest of house	0.9927	0.9837	0.9600	0.8744	0.6968	0.4735	0.3171	0.3664	0.6426	0.9165	0.9832	0.9941 (89)
MIT 2	18.6856	18.9287	19.2777	19.7180	19.9621	20.0400	20.0469	20.0481	20.0079	19.6809	19.1263	18.6612 (90)
Living area fraction	18.8723	19.1070	19.4444	19.8718	20.1135	20.1919	20.1996	20.2003	20.1582	19.8338	19.2964	0.1606 (91)
MIT	18.8723	19.1070	19.4444	19.8718	20.1135	20.1919	20.1996	20.2003	20.1582	19.8338	19.2964	18.8478 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8723	19.1070	19.4444	19.8718	20.1135	20.1919	20.1996	20.2003	20.1582	19.8338	19.2964	18.8478 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9897	0.9788	0.9528	0.8688	0.7017	0.4855	0.3310	0.3813	0.6528	0.9102	0.9784	0.9916 (94)
Useful gains	690.5089	785.5188	850.7107	884.0342	777.7078	538.9551	350.1156	368.1832	566.9632	688.4181	673.6603	662.4866 (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	1469.8017	1428.6906	1297.9123	1084.9728	829.8151	544.7936	350.6951	369.3997	593.0296	910.7212	1209.2958	1460.3611 (97)
Space heating kWh	579.7938	432.2115	332.7180	144.6758	38.7678	0.0000	0.0000	0.0000	0.0000	165.3936	385.6576	593.6186 (98a)
Space heating requirement - total per year (kWh/year)												2672.8367
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	579.7938	432.2115	332.7180	144.6758	38.7678	0.0000	0.0000	0.0000	0.0000	165.3936	385.6576	593.6186 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2672.8367
Space heating per m2										(98c) / (4) =		28.6171 (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 %)												92.3000 (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	579.7938	432.2115	332.7180	144.6758	38.7678	0.0000	0.0000	0.0000	0.0000	165.3936	385.6576	593.6186 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	628.1623	468.2681	360.4746	156.7452	42.0020	0.0000	0.0000	0.0000	0.0000	179.1913	417.8305	643.1404 (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	242.2768	214.2298	227.7786	201.0147	195.2949	176.4767	174.6630	181.4053	183.1532	203.6025	215.6740	239.7566 (64)
Efficiency of water heater (217)m	85.9434	85.6006	84.9084	83.3348	81.1625	79.8000	79.8000	79.8000	79.8000	83.5977	85.3476	79.8000 (216)
Fuel for water heating, kWh/month	281.9029	250.2667	268.2640	241.2134	240.6221	221.1487	218.8760	227.3249	229.5153	243.5504	252.7006	278.7566 (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	25.8245	20.7174	18.6537	13.6665	10.5564	8.6247	9.6299	12.5173	16.2587	21.3324	24.0948	26.5423 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-42.9824	-60.2392	-86.0817	-96.1944	-103.2143	-96.1278	-94.8985	-89.8090	-80.7938	-68.5566	-47.1099	-37.1995 (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	-25.3956	-53.2906	-105.6868	-158.4154	-209.1781	-210.0996	-207.6656	-175.9972	-129.1967	-76.1516	-33.8845	-20.0958 (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												

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Space heating fuel - main system 1	2895.8144 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2954.1416 (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)	208.4186 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2308.2645 (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	3836.1101 (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	2895.8144	0.2100	608.1210 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2954.1416	0.2100	620.3697 (264)
Space and water heating			1228.4908 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	208.4186	0.1443	30.0812 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-903.2071	0.1347	-121.6803
PV Unit electricity exported	-1405.0574	0.1260	-176.9689
Total			-298.6492 (269)
Total CO2, kg/year			971.8520 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.4100 (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	2895.8144	1.1300	3272.2703 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2954.1416	1.1300	3338.1800 (278)
Space and water heating			6610.4503 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	208.4186	1.5338	319.6794 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-903.2071	1.4979	-1352.9238
PV Unit electricity exported	-1405.0574	0.4623	-649.6007
Total			-2002.5245 (283)
Total Primary energy kWh/year			5057.7059 (286)
Target Primary Energy Rate (TPER)			54.1500 (287)

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Property Reference	all plots		Issued on Date	30/06/2023	
Assessment Reference	Plot 4 DS	Prop Type Ref			
Property	Plot 1, Bryanston Road, Southampton, Hampshire, SO19				
SAP Rating	92 A	DER	1.06	TER	11.17
Environmental	99 A	% DER < TER			90.51
CO ₂ Emissions (t/year)	0.01	DFEE	31.60	TFEE	35.41
Compliance Check	See BREL	% DFEE < TFEE			10.75
% DPER < TPER	61.63	DPER	22.34	TPER	58.22
Assessor Details	Dr. Rachel Mitchell			Assessor ID	L772-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.7000 (2b)	= 106.6500 (1b)
First floor	39.5000 (1c)	x 2.4000 (2c)	= 94.8000 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.4500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	Air changes per hour	0.0000 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			5.0000 (17)
Infiltration rate			0.2500 (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) =	0.2313 (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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5448	0.5391	0.5333	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5102	0.5217 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
window 0.8 (Uw = 0.80)			16.0700	0.7752	12.4574		(27)
front door			2.1800	0.8000	1.7440		(26)
Heatloss Floor 1			39.5000	0.1100	4.3450		(28a)

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External Wall 1	91.8000	18.2500	73.5500	0.1500	11.0325								(29a)
External Roof 1	39.5000		39.5000	0.1100	4.3450								(30)
Total net area of external elements Aum(A, m2)			170.8000										(31)
Fabric heat loss, W/K = Sum (A x U)													(32)
Party Wall 1			49.5000	0.0000	0.0000								(33)
													(34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)													8.5400 (36)
Point Thermal bridges													(36a) = 0.0500 (36a)
Total fabric heat loss													(33) + (36) + (36a) = 42.5139 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	36.2204	35.8361	35.4517	33.5301	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392	33.9144	34.6831	(38)
Average = Sum(39)m / 12 =	78.7343	78.3499	77.9656	76.0440	75.7531	75.7531	75.7531	75.7531	75.7531	75.7531	76.4283	77.1969	(39)
	31	28	31	30	31	30	31	31	30	31	30	31	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9966	0.9918	0.9869	0.9626	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9674	0.9772	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4436 (42)
Hot water usage for mixer showers	65.1911	64.2114	62.7838	60.0523	58.0365	55.7886	54.5108	55.9276	57.4807	59.8943	62.6845	64.9413	(42a)
Hot water usage for baths	28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623	(42b)
Hot water usage for other uses	39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550	(42c)
Average daily hot water use (litres/day)													122.2605 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587	(44)
Energy content (annual)	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114	(45)
Distribution loss (46)m = 0.15 x (45)m	31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567	(46)

Water storage loss:													200.0000 (47)
Store volume													1.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.6588 (55)
Enter (49) or (54) in (55)													

Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)
If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966	(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	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966	(64)
Total per year (kWh/year) = Sum(64)m =													2545.0788 (64)

12Total per year (kWh/year)													2545 (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	104.9877	93.1954	99.6996	89.1001	87.3968	79.8504	79.5118	81.9906	82.1582	90.3169	94.4814	104.0122	(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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.1668	124.1847	112.1668	115.9057	112.1668	115.9057	112.1668	112.1668	115.9057	112.1668	115.9057	112.1668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	141.1125	138.6837	134.0049	123.7501	117.4688	110.9033	106.8707	110.2024	114.1086	121.3937	131.2241	139.8013	(72)
Total internal gains	530.2714	542.1157	519.7358	501.1210	475.8280	458.6471	441.2861	442.3625	455.6908	471.3361	500.1781	519.3707	(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			
Northeast				2.0300	11.2829	0.6400	0.7000	0.7700	7.1110 (75)			
Southeast				4.4200	36.7938	0.6400	0.7000	0.7700	50.4904 (77)			
Southwest				3.3800	36.7938	0.6400	0.7000	0.7700	38.6103 (79)			
Northwest				6.2400	11.2829	0.6400	0.7000	0.7700	21.8584 (81)			
Solar gains	118.0700	210.7394	313.9018	431.7803	522.7329	536.1529	509.7507	439.2663	354.3091	239.8033	143.1730	99.9094 (83)
Total gains	648.3414	752.8551	833.6376	932.9012	998.5609	994.8000	951.0368	881.6289	810.0000	711.1393	643.3511	619.2801 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	69.6788	70.0206	70.3658	72.1439	72.4209	72.4209	72.4209	72.4209	72.4209	72.4209	71.7812	71.0664
alpha	5.6453	5.6680	5.6911	5.8096	5.8281	5.8281	5.8281	5.8281	5.8281	5.8281	5.7854	5.7378
util living area	0.9906	0.9777	0.9467	0.8472	0.6755	0.4835	0.3500	0.3942	0.6265	0.8935	0.9776	0.9924 (86)
Living	20.0610	20.2659	20.5227	20.8177	20.9579	20.9947	20.9993	20.9987	20.9786	20.7857	20.3917	20.0441
Non living	19.2450	19.4490	19.6985	19.9811	20.0928	20.1155	20.1176	20.1174	20.1077	19.9633	19.5908	19.2415
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5197	20.2659	20.5227	20.8177	20.9579	20.9947	20.9993	20.9987	20.9786	20.7857	20.3917	20.1778 (87)
Th 2	20.0861	20.0902	20.0943	20.1146	20.1177	20.1177	20.1177	20.1177	20.1177	20.1177	20.1105	20.1024 (88)
util rest of house	0.9877	0.9712	0.9319	0.8123	0.6209	0.4186	0.2801	0.3192	0.5540	0.8594	0.9700	0.9901 (89)
MIT 2	19.6559	19.4490	19.6985	19.9811	20.0928	20.1155	20.1176	20.1174	20.1077	19.9633	19.5908	19.3620 (90)
Living area fraction	19.8439	19.6268	19.8779	20.1633	20.2812	20.3069	20.3095	20.3093	20.2973	20.1423	19.7651	0.2177 (91)
MIT	19.8439	19.6268	19.8779	20.1633	20.2812	20.3069	20.3095	20.3093	20.2973	20.1423	19.7651	19.5396 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8439	19.6268	19.8779	20.1633	20.2812	20.3069	20.3095	20.3093	20.2973	20.1423	19.7651	19.5396 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9868	0.9672	0.9278	0.8144	0.6313	0.4327	0.2953	0.3355	0.5692	0.8604	0.9663	0.9883 (94)
Useful gains	639.7730	728.1611	773.4456	759.7099	630.4133	430.4122	280.8467	295.7971	461.0458	611.8852	621.6947	612.0250 (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	1223.8398	1153.8457	1043.0180	856.5026	650.0508	432.3189	281.0092	296.1381	469.4662	722.8600	967.9751	1184.1684 (97)
Space heating kWh	434.5457	286.0600	200.5619	69.6907	14.6103	0.0000	0.0000	0.0000	0.0000	82.5652	249.3219	425.6747 (98a)
Space heating requirement - total per year (kWh/year)												1763.0304
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	434.5457	286.0600	200.5619	69.6907	14.6103	0.0000	0.0000	0.0000	0.0000	82.5652	249.3219	425.6747 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1763.0304
Space heating per m2												(98c) / (4) = 22.3168 (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 %) 248.4693 (206)

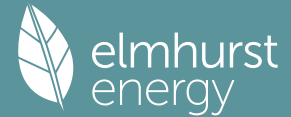
Efficiency of main space heating system 2 (in %) 0.0000 (207)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	434.5457	286.0600	200.5619	69.6907	14.6103	0.0000	0.0000	0.0000	0.0000	82.5652	249.3219	425.6747 (98)
Space heating efficiency (main heating system 1)	248.4693	248.4693	248.4693	248.4693	248.4693	0.0000	0.0000	0.0000	0.0000	248.4693	248.4693	248.4693 (210)
Space heating fuel (main heating system)	174.8891	115.1289	80.7190	28.0480	5.8801	0.0000	0.0000	0.0000	0.0000	33.2295	100.3432	171.3189 (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

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Water heating requirement	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966 (64)
Efficiency of water heater (217)m	169.4881	169.4881	169.4881	169.4881	169.4881	169.4881	169.4881	169.4881	169.4881	169.4881	169.4881	169.4881 (216)
Fuel for water heating, kWh/month	150.0580	132.6400	140.6744	123.0349	118.8435	106.6215	104.8517	109.2502	110.7166	124.0251	132.5838	148.3270 (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	3.0709	2.7737	3.0709	2.9719	3.0709	2.9719	3.0709	3.0709	2.9719	3.0709	2.9719	3.0709 (231)
Lighting	22.4063	17.9751	16.1846	11.8575	9.1591	7.4831	8.3552	10.8605	14.1067	18.5087	20.9055	23.0290 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-41.6121	-62.1950	-93.9897	-107.3870	-116.8006	-109.2196	-107.5828	-100.4259	-86.7590	-70.7336	-46.3087	-35.3848 (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	-14.8122	-34.5333	-76.4691	-127.5475	-177.7322	-181.7780	-178.9917	-147.3533	-102.9641	-54.5840	-21.1524	-11.4579 (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												709.5567 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												169.4881
Water heating fuel used												1501.6267 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471)												
mechanical ventilation fans (SFP = 0.1471)												36.1577 (230a)
Total electricity for the above, kWh/year												36.1577 (231)
Electricity for lighting (calculated in Appendix L)												180.8313 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2107.7744 (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												320.3981 (238)

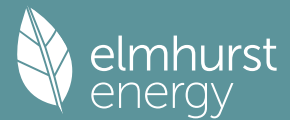
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	709.5567	0.1574	111.6606 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1501.6267	0.1410	211.7278 (264)
Space and water heating			323.3884 (265)
Pumps, fans and electric keep-hot	36.1577	0.1387	5.0155 (267)
Energy for lighting	180.8313	0.1443	26.0995 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-978.3988	0.1340	-131.1489
PV Unit electricity exported	-1129.3756	0.1234	-139.4190
Total			-270.5678 (269)
Total CO2, kg/year			83.9356 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.0600 (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	709.5567	1.5825	1122.9047 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1501.6267	1.5214	2284.5268 (278)
Space and water heating			3407.4315 (279)
Pumps, fans and electric keep-hot	36.1577	1.5128	54.6994 (281)
Energy for lighting	180.8313	1.5338	277.3651 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-978.3988	1.4954	-1463.0819
PV Unit electricity exported	-1129.3756	0.4530	-511.6548
Total			-1974.7367 (283)
Total Primary energy kWh/year			1764.7593 (286)
Dwelling Primary energy Rate (DPER)			22.3400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.7000 (2b)	= 106.6500 (1b)
First floor	39.5000 (1c)	x 2.4000 (2c)	= 94.8000 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.4500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	30.0000 / (5) = 0.1489 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3989 (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) = 0.3690 (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	0.4705	0.4613	0.4520	0.4059	0.3967	0.3506	0.3506	0.3413	0.3690	0.3967	0.4151	0.4336 (22b)
Effective ac	0.6107	0.6064	0.6022	0.5824	0.5787	0.5614	0.5614	0.5583	0.5681	0.5787	0.5862	0.5940 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
TER Opaque door			2.1800	1.0000	2.1800		(26)					
TER Opening Type (U _w = 1.20)			16.0700	1.1450	18.4008		(27)					
Heatloss Floor 1			39.5000	0.1300	5.1350		(28a)					
External Wall 1	91.8000	18.2500	73.5500	0.1800	13.2390		(29a)					
External Roof 1	39.5000		39.5000	0.1100	4.3450		(30)					
Total net area of external elements A _{um} (A, m ²)			170.8000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 43.2998		(33)					
Party Wall 1			49.5000	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							250.0000 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E5 Ground floor (normal)				19.5000	0.1600	3.1200						
E6 Intermediate floor within a dwelling				19.5000	0.0000	0.0000						
E16 Corner (normal)				10.2000	0.0900	0.9180						
E18 Party wall between dwellings				10.2000	0.0600	0.6120						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6500 (36)					
Point Thermal bridges							(36a) = 0.0500 (36a)					
Total fabric heat loss							(33) + (36) + (36a) = 47.9998 (37)					
Ventilation heat loss calculated monthly (38) _m = 0.33 x (25) _m x (5)												
(38) _m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.5967	40.3110	40.0310	38.7156	38.4695	37.3239	37.3239	37.1117	37.7652	38.4695	38.9674	39.4879 (38)
Average = Sum(39) _m / 12 =	88.5965	88.3108	88.0307	86.7154	86.4693	85.3237	85.3237	85.1115	85.7649	86.4693	86.9671	87.4876 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1215	1.1179	1.1143	1.0977	1.0945	1.0800	1.0800	1.0774	1.0856	1.0945	1.1008	1.1074 (40)

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HLP (average)													1.0976
Days in mont	31	28	31	30	31	30	31	31	30	31	30		31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4436 (42)
Hot water usage for mixer showers													64.9413 (42a)
Hot water usage for baths													28.0623 (42b)
Hot water usage for other uses													39.6550 (42c)
Average daily hot water use (litres/day)													122.2605 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587	(44)
Energy content (annual)	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114	(45)
Energy content (annual)												Total = Sum(45)m = 2030.7208	
Distribution loss (46)m = 0.15 x (45)m													31.5968
Water storage loss:													200.0000 (47)
Store volume													1.6525 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.8924 (55)
Enter (49) or (54) in (55)													0.8924 (55)
Total storage loss													27.6637 (56)
If cylinder contains dedicated solar storage													27.6637 (57)
Primary loss													23.2624 (59)
Combi loss													0.0000 (61)
Total heat required for water heating calculated for each month													261.5713 (62)
WWHRS													-29.8026 (63a)
PV diverter													-0.0000 (63b)
Solar input													0.0000 (63c)
FGHRS													0.0000 (63d)
Output from w/h													231.7687 (64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2353.4207 (64)
Electric shower(s)													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													110.7804 (65)

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

Metabolic gains (Table 5), Watts													122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													110.2096 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													162.5944 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													35.2181 (69)
Pumps, fans													3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)													-97.7445 (71)
Water heating gains (Table 5)													148.8984 (72)
Total internal gains													539.1000 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast	2.0300	11.2829	0.6300	0.7000	0.7700	6.9999 (75)						
Southeast	4.4200	36.7938	0.6300	0.7000	0.7700	49.7015 (77)						
Southwest	3.3800	36.7938	0.6300	0.7000	0.7700	38.0070 (79)						
Northwest	6.2400	11.2829	0.6300	0.7000	0.7700	21.5169 (81)						
Solar gains	116.2252	207.4466	308.9971	425.0337	514.5652	527.7755	501.7858	432.4028	348.7730	236.0563	140.9359	98.3484 (83)
Total gains	655.3252	758.1812	837.5615	934.9180	999.2218	992.1860	948.9006	880.5939	810.2272	716.2210	649.8774	626.5477 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.9225	62.1228	62.3204	63.2657	63.4458	64.2977	64.2977	64.4579	63.9668	63.4458	63.0826	62.7073
alpha	5.1282	5.1415	5.1547	5.2177	5.2297	5.2865	5.2865	5.2972	5.2645	5.2297	5.2055	5.1805
util living area	0.9914	0.9812	0.9576	0.8834	0.7367	0.5396	0.3939	0.4412	0.6866	0.9183	0.9813	0.9930 (86)
MIT	19.8680	20.0747	20.3521	20.6940	20.9068	20.9853	20.9977	20.9959	20.9513	20.6689	20.2181	19.8409 (87)
Th 2	19.9833	19.9863	19.9892	20.0027	20.0053	20.0172	20.0172	20.0194	20.0126	20.0053	20.0001	19.9948 (88)
util rest of house	0.9887	0.9755	0.9448	0.8512	0.6775	0.4614	0.3068	0.3489	0.6049	0.8877	0.9746	0.9909 (89)
MIT 2	18.6854	18.9482	19.2949	19.7093	19.9329	20.0094	20.0165	20.0180	19.9826	19.6932	19.1419	18.6593 (90)
Living area fraction									fLA = Living area / (4) =			0.2177 (91)
MIT	18.9429	19.1935	19.5251	19.9237	20.1449	20.2219	20.2301	20.2309	20.1935	19.9056	19.3762	18.9166 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9429	19.1935	19.5251	19.9237	20.1449	20.2219	20.2301	20.2309	20.1935	19.9056	19.3762	18.9166 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9849	0.9696	0.9376	0.8483	0.6863	0.4780	0.3258	0.3691	0.6207	0.8841	0.9690	0.9876 (94)
Useful gains	645.4018	735.1506	785.2714	793.1317	685.8031	474.3107	309.1717	324.9892	502.9022	633.2085	629.7628	618.7489 (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	1297.3058	1262.2689	1146.6105	955.9215	730.2262	479.6803	309.7331	326.0549	522.6115	804.6476	1067.6242	1287.5172 (97)
Space heating kWh	485.0165	354.2235	268.8363	117.2087	33.0508	0.0000	0.0000	0.0000	0.0000	127.5507	315.2601	497.5636 (98a)
Space heating requirement - total per year (kWh/year)												2198.7103
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	485.0165	354.2235	268.8363	117.2087	33.0508	0.0000	0.0000	0.0000	0.0000	127.5507	315.2601	497.5636 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2198.7103
Space heating per m2										(98c) / (4) =		27.8318 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	485.0165	354.2235	268.8363	117.2087	33.0508	0.0000	0.0000	0.0000	0.0000	127.5507	315.2601	497.5636 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	525.4784	383.7741	291.2636	126.9866	35.8080	0.0000	0.0000	0.0000	0.0000	138.1915	341.5603	539.0722 (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	231.7687	204.9915	218.0671	192.6827	187.3672	169.4922	167.8682	174.2401	175.8017	195.2181	206.5365	229.3867 (64)
Efficiency of water heater (217)m	85.6756	85.2745	84.5303	82.9810	81.0315	79.8000	79.8000	79.8000	79.8000	83.1295	85.0053	79.8000 (216)
Fuel for water heating, kWh/month	270.5188	240.3900	257.9751	232.2011	231.2277	212.3963	210.3612	218.3459	220.3028	234.8363	242.9691	267.5114 (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	22.8994	18.3707	16.5408	12.1185	9.3607	7.6478	8.5391	11.0995	14.4171	18.9160	21.3656	23.5358 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-36.8265	-51.8549	-74.4535	-83.6235	-90.1025	-84.0757	-83.0262	-78.4033	-70.2500	-59.2357	-40.4592	-31.8453 (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	-21.0093	-44.1714	-87.7489	-131.7317	-174.1267	-174.9389	-172.8899	-146.4220	-107.3651	-63.1620	-28.0479	-16.6165 (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)												

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(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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													2382.1346	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													79.8000	
Water heating fuel used													2839.0357	(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)													184.8110	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1952.3865	(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													3539.5949	(238)

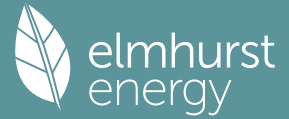
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2382.1346	0.2100	500.2483	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2839.0357	0.2100	596.1975	(264)
Space and water heating			1096.4458	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	184.8110	0.1443	26.6739	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-784.1562	0.1346	-105.5554	
PV Unit electricity exported	-1168.2303	0.1259	-147.0904	
Total			-252.6458	(269)
Total CO2, kg/year			882.4031	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1700	(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	2382.1346	1.1300	2691.8122	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2839.0357	1.1300	3208.1103	(278)
Space and water heating			5899.9225	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	184.8110	1.5338	283.4693	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-784.1562	1.4975	-1174.2722	
PV Unit electricity exported	-1168.2303	0.4622	-539.9237	
Total			-1714.1959	(283)
Total Primary energy kWh/year			4599.2968	(286)
Target Primary Energy Rate (TPER)			58.2200	(287)

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Property Reference	all plots		Issued on Date	30/06/2023	
Assessment Reference	Plot 5 DS	Prop Type Ref			
Property	Plot 1 , Bryanston Road , Southampton, Hampshire , SO19				
SAP Rating	94 A	DER	0.62	TER	9.77
Environmental	100 A	% DER < TER	93.65		
CO ₂ Emissions (t/year)	-0.02	DFEE	24.72	TREE	28.53
Compliance Check	See BREL	% DFEE < TREE	13.35		
% DPER < TPER	64.56	DPER	17.98	TPER	50.73
Assessor Details	Dr. Rachel Mitchell			Assessor ID	L772-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.7000 (2b)	= 106.6500 (1b) -
First floor	39.5000 (1c)	x 2.4000 (2c)	= 94.8000 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.4500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	Air changes per hour	0.0000 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			5.0000 (17)
Infiltration rate			0.2500 (18)
Number of sides sheltered			2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5209	0.5156	0.5103	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value KJ/m ² K	A x K kJ/K
window 0.8 (Uw = 0.80)			12.6900	0.7752	9.8372		(27)
front door			2.1800	0.8000	1.7440		(26)
Heatloss Floor 1			39.5000	0.1100	4.3450		(28a)

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External Wall 1	41.8000	14.8700	26.9300	0.1500	4.0395	(29a)
External Roof 1	39.5000		39.5000	0.1100	4.3450	(30)
Total net area of external elements Aum(A, m2)			120.8000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.3107	(33)
Party Wall 1			99.0000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)						6.0400 (36)
Point Thermal bridges						(36a) = 0.0500 (36a)
Total fabric heat loss						(33) + (36) + (36a) = 30.4007 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	34.6311	34.2780	33.9248	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392	
Average = Sum(39)m / 12 =	65.0319	64.6787	64.3255	63.6400	63.6400	63.6400	63.6400	63.6400	63.6400	63.6400	63.6400	63.6400	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.8232	0.8187	0.8142	0.8056	0.8056	0.8056	0.8056	0.8056	0.8056	0.8056	0.8056	0.8056	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4436 (42)
Hot water usage for mixer showers	65.1911	64.2114	62.7838	60.0523	58.0365	55.7886	54.5108	55.9276	57.4807	59.8943	62.6845	64.9413	(42a)
Hot water usage for baths	28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623	(42b)
Hot water usage for other uses	39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550	(42c)
Average daily hot water use (litres/day)													122.2605 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587	(44)
Energy content (annual)	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2030.7208
Water storage loss:	31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567	(46)

Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2200 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.6588 (55)

Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)
If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966	(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	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966	(64)
Total per year (kWh/year) = Sum(64)m =													2545.0788 (64)

12Total per year (kWh/year)													2545 (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	104.9877	93.1954	99.6996	89.1001	87.3968	79.8504	79.5118	81.9906	82.1582	90.3169	94.4814	104.0122	(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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.5033	130.0930	117.5033	121.4201	117.5033	121.4201	117.5033	117.5033	121.4201	117.5033	121.4201	117.5033	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	141.1125	138.6837	134.0049	123.7501	117.4688	110.9033	106.8707	110.2024	114.1086	121.3937	131.2241	139.8013	(72)
Total internal gains	535.6079	548.0240	525.0723	506.6353	481.1645	464.1615	446.6226	447.6990	461.2052	476.6726	505.6925	524.7072	(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			
Northeast				2.0300	11.2829	0.6400	0.7000	0.7700	7.1110 (75)			
Southeast				4.4200	36.7938	0.6400	0.7000	0.7700	50.4904 (77)			
Northwest				6.2400	11.2829	0.6400	0.7000	0.7700	21.8584 (81)			
Solar gains	79.4597	144.9718	223.9157	320.2831	397.8468	412.1699	390.2179	329.7223	256.8732	167.1161	96.9268	66.8671 (83)
Total gains	615.0676	692.9958	748.9880	826.9185	879.0113	876.3314	836.8405	777.4213	718.0784	643.7886	602.6193	591.5743 (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	84.3604	84.8210	85.2867	86.2054	86.2054	86.2054	86.2054	86.2054	86.2054	86.2054	86.2054	86.2054	
alpha	6.6240	6.6547	6.6858	6.7470	6.7470	6.7470	6.7470	6.7470	6.7470	6.7470	6.7470	6.7470	
util living area	0.9898	0.9767	0.9442	0.8379	0.6573	0.4634	0.3345	0.3762	0.6027	0.8826	0.9748	0.9917 (86)	
Living	20.3115	20.4737	20.6741	20.8882	20.9796	20.9982	20.9998	20.9996	20.9909	20.8645	20.5698	20.3015	
Non living	19.6141	19.7758	19.9702	20.1668	20.2364	20.2478	20.2485	20.2484	20.2442	20.1512	19.8806	19.6172	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.6478	20.4737	20.6741	20.8882	20.9796	20.9982	20.9998	20.9996	20.9909	20.8645	20.5698	20.3992 (87)	
Th 2	20.2333	20.2371	20.2410	20.2485	20.2485	20.2485	20.2485	20.2485	20.2485	20.2485	20.2485	20.2485 (88)	
util rest of house	0.9869	0.9704	0.9299	0.8051	0.6094	0.4096	0.2774	0.3150	0.5408	0.8494	0.9668	0.9893 (89)	
MIT 2	19.9165	19.7758	19.9702	20.1668	20.2364	20.2478	20.2485	20.2484	20.2442	20.1512	19.8806	19.7055 (90)	
Living area fraction	fLA = Living area / (4) =											0.1899 (91)	
MIT	20.0554	19.9083	20.1038	20.3037	20.3775	20.3902	20.3911	20.3910	20.3860	20.2867	20.0114	19.8372 (92)	
Temperature adjustment												0.0000	
adjusted MIT	20.0554	19.9083	20.1038	20.3037	20.3775	20.3902	20.3911	20.3910	20.3860	20.2867	20.0114	19.8372 (93)	

8. Space heating requirement

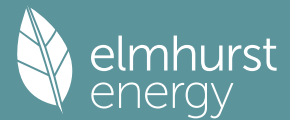
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9861	0.9671	0.9270	0.8077	0.6178	0.4198	0.2883	0.3266	0.5523	0.8513	0.9638	0.9876 (94)
Useful gains	606.5263	670.2196	694.3150	667.8745	543.0681	367.8723	241.2285	253.8999	396.5794	548.0348	580.8144	584.2658 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1024.6012	970.7155	875.0736	725.7342	552.2385	368.4910	241.2674	253.9901	400.0379	616.4583	821.6840	995.1497 (97)
Space heating kWh	311.0477	201.9333	134.4844	41.6590	6.8228	0.0000	0.0000	0.0000	0.0000	50.9070	173.4261	305.6976 (98a)
Space heating requirement - total per year (kWh/year)												1225.9779
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	311.0477	201.9333	134.4844	41.6590	6.8228	0.0000	0.0000	0.0000	0.0000	50.9070	173.4261	305.6976 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1225.9779
Space heating per m2												(98c) / (4) = 15.5187 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												253.3213 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	311.0477	201.9333	134.4844	41.6590	6.8228	0.0000	0.0000	0.0000	0.0000	50.9070	173.4261	305.6976 (98)
Space heating efficiency (main heating system 1)	253.3213	253.3213	253.3213	253.3213	253.3213	0.0000	0.0000	0.0000	0.0000	253.3213	253.3213	253.3213 (210)
Space heating fuel (main heating system)	122.7879	79.7143	53.0885	16.4451	2.6933	0.0000	0.0000	0.0000	0.0000	20.0958	68.4609	120.6759 (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

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Efficiency of water heater (217)m	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966 (64)
Fuel for water heating, kWh/month	170.0461	170.0461	170.0461	170.0461	170.0461	170.0461	170.0461	170.0461	170.0461	170.0461	170.0461	170.0461 (216)
Space cooling fuel requirement (221)m	149.5656	132.2048	140.2129	122.6312	118.4535	106.2717	104.5077	108.8918	110.3534	123.6182	132.1487	147.8403 (219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Lighting	3.0709	2.7737	3.0709	2.9719	3.0709	2.9719	3.0709	3.0709	2.9719	3.0709	2.9719	3.0709 (231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	23.4723	18.8303	16.9546	12.4217	9.5949	7.8391	8.7528	11.3772	14.7778	19.3893	21.9002	24.1246 (232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-41.0310	-61.1759	-92.3594	-106.1374	-116.3190	-109.2206	-107.5919	-100.4489	-86.7920	-70.0563	-45.7036	-34.9312 (233a)
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	-15.3933	-35.5524	-78.0994	-128.7971	-178.2138	-181.7769	-178.9825	-147.3303	-102.9311	-55.2613	-21.7576	-11.9115 (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												483.9617 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0461
Water heating fuel used												1496.6996 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471)												
mechanical ventilation fans (SFP = 0.1471)												36.1577 (230a)
Total electricity for the above, kWh/year												36.1577 (231)
Electricity for lighting (calculated in Appendix L)												189.4346 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2107.7744 (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												98.4792 (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	483.9617	0.1577	76.3392 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1496.6996	0.1410	211.0331 (264)
Space and water heating			287.3723 (265)
Pumps, fans and electric keep-hot	36.1577	0.1387	5.0155 (267)
Energy for lighting	189.4346	0.1443	27.3413 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-971.7671	0.1339	-130.1497
PV Unit electricity exported	-1136.0073	0.1237	-140.5435
Total			-270.6932 (269)
Total CO2, kg/year			49.0359 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.6200 (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	483.9617	1.5839	766.5502 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1496.6996	1.5214	2277.0308 (278)
Space and water heating			3043.5809 (279)
Pumps, fans and electric keep-hot	36.1577	1.5128	54.6994 (281)
Energy for lighting	189.4346	1.5338	290.5611 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-971.7671	1.4950	-1452.7487
PV Unit electricity exported	-1136.0073	0.4540	-515.7965
Total			-1968.5453 (283)
Total Primary energy kWh/year			1420.2962 (286)
Dwelling Primary energy Rate (DPER)			17.9800 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.7000 (2b)	= 106.6500 (1b) -
First floor	39.5000 (1c)	x 2.4000 (2c)	= 94.8000 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.4500 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	30.0000 / (5) = 0.1489 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3989 (18)	
Number of sides sheltered	2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3391 (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	0.4323	0.4239	0.4154	0.3730	0.3645	0.3221	0.3221	0.3137	0.3391	0.3645	0.3815	0.3984 (22b)
Effective ac	0.5935	0.5898	0.5863	0.5696	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5728	0.5794 (25)

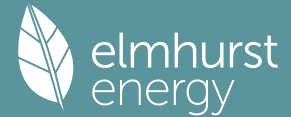
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1800	1.0000	2.1800		(26)
TER Opening Type (Uw = 1.20)			12.6900	1.1450	14.5305		(27)
Heatloss Floor 1			39.5000	0.1300	5.1350		(28a)
External Wall 1	41.8000	14.8700	26.9300	0.1800	4.8474		(29a)
External Roof 1	39.5000		39.5000	0.1100	4.3450		(30)
Total net area of external elements Aum(A, m ²)			120.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0379		(33)
Party Wall 1			99.0000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	
List of Thermal Bridges	250.0000 (35)
K1 Element	
E5 Ground floor (normal)	Length 19.5000 Psi-value 0.1600 Total 3.1200
E6 Intermediate floor within a dwelling	19.5000 0.0000 0.0000
E16 Corner (normal)	10.2000 0.0900 0.9180
E18 Party wall between dwellings	10.2000 0.0600 0.6120
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6500 (36)
Point Thermal bridges	(36a) = 0.0500 (36a)
Total fabric heat loss	(33) + (36) + (36a) = 35.7379 (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	39.4520	39.2107	38.9743	37.8636	37.6558	36.6884	36.6884	36.5092	37.0610	37.6558	38.0761	38.5156 (38)
Heat transfer coeff	75.1899	74.9487	74.7122	73.6015	73.3937	72.4263	72.4263	72.2472	72.7989	73.3937	73.8141	74.2536 (39)
Average = Sum(39)m / 12 =												73.6005
HLP	0.9518	0.9487	0.9457	0.9317	0.9290	0.9168	0.9168	0.9145	0.9215	0.9290	0.9344	0.9399 (40)
HLP (average)												0.9317

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Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.4436 (42)
Hot water usage for mixer showers												64.9413 (42a)
Hot water usage for baths												28.0623 (42b)
Hot water usage for other uses												39.6550 (42c)
Average daily hot water use (litres/day)												122.2605 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587 (44)
Energy content (annual)	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114 (45)
Distribution loss (46)m = 0.15 x (45)m												2030.7208
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
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	261.5713	231.3492	245.6673	215.5368	208.6664	187.7181	184.9521	192.4070	194.6589	217.4487	231.7211	258.6375 (62)
WWHRS	-29.8026	-26.3577	-27.6003	-22.8541	-21.2992	-18.2259	-17.0839	-18.1670	-18.8572	-22.2306	-25.1845	-29.2507 (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	231.7687	204.9915	218.0671	192.6827	187.3672	169.4922	167.8682	174.2401	175.8017	195.2181	206.5365	229.3867 (64)
												2353.4207 (64)
12Total per year (kWh/year)												
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	110.7804	98.4275	105.4923	94.7059	93.1895	85.4562	85.3045	87.7833	87.7640	96.1096	100.0872	109.8049 (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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	114.2776	126.5216	114.2776	118.0868	114.2776	118.0868	114.2776	114.2776	118.0868	114.2776	118.0868	114.2776 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	148.8984	146.4696	141.7908	131.5360	125.2547	118.6892	114.6566	117.9883	121.8945	129.1796	139.0100	147.5872 (72)
Total internal gains	543.1680	555.2385	532.6324	514.0879	488.7247	468.6141	451.1827	452.2591	465.6578	484.2327	513.1451	532.2673 (73)
6. Solar gains												
[Jan]												
		Area		Solar flux		g		FF		Access		Gains
		m2		Table 6a		Specific data		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast		2.0300		11.2829		0.6300		0.7000		0.7700		6.9999 (75)
Southeast		4.4200		36.7938		0.6300		0.7000		0.7700		49.7015 (77)
Northwest		6.2400		11.2829		0.6300		0.7000		0.7700		21.5169 (81)
Solar gains	78.2182	142.7066	220.4170	315.2787	391.6305	405.7298	384.1207	324.5704	252.8596	164.5049	95.4123	65.8223 (83)
Total gains	621.3862	697.9451	753.0494	829.3666	880.3551	874.3439	835.3035	776.8295	718.5174	648.7376	608.5574	598.0896 (84)
7. Mean internal temperature (heating season)												

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	72.9634	73.1983	73.4299	74.5380	74.7491	75.7475	75.7475	75.9353	75.3598	74.7491	74.3234	73.8835
alpha	5.8642	5.8799	5.8953	5.9692	5.9833	6.0498	6.0498	6.0624	6.0240	5.9833	5.9549	5.9256
util living area	0.9918	0.9827	0.9611	0.8851	0.7296	0.5247	0.3808	0.4264	0.6726	0.9164	0.9814	0.9933 (86)
MIT	20.0999	20.2665	20.4932	20.7789	20.9431	20.9933	20.9992	20.9984	20.9731	20.7614	20.3944	20.0781 (87)
Th 2	20.1237	20.1263	20.1288	20.1407	20.1429	20.1533	20.1533	20.1552	20.1493	20.1429	20.1384	20.1337 (88)
util rest of house	0.9893	0.9777	0.9497	0.8555	0.6760	0.4577	0.3079	0.3489	0.6001	0.8874	0.9750	0.9912 (89)
MIT 2	19.0849	19.2970	19.5808	19.9270	20.0983	20.1496	20.1530	20.1546	20.1325	19.9167	19.4695	19.0650 (90)
Living area fraction	19.2776	19.4811	19.7540	20.0887	20.2587	20.3098	20.3137	20.3148	20.2921	20.0771	19.6451	0.1899 (91)
MIT	19.2776	19.4811	19.7540	20.0887	20.2587	20.3098	20.3137	20.3148	20.2921	20.0771	19.6451	19.2574 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2776	19.4811	19.7540	20.0887	20.2587	20.3098	20.3137	20.3148	20.2921	20.0771	19.6451	19.2574 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9861	0.9729	0.9438	0.8535	0.6836	0.4703	0.3218	0.3636	0.6127	0.8849	0.9702	0.9884 (94)
Useful gains	612.7192	679.0185	710.7427	707.8294	601.7769	411.1789	268.7745	282.4426	440.2514	574.0448	590.4521	591.1706 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1126.1679	1092.8311	990.2375	823.5078	628.1565	413.5415	268.9667	282.8364	450.7778	695.5593	926.0037	1118.0642 (97)
Space heating kWh	382.0058	278.0820	207.9441	83.2885	19.6265	0.0000	0.0000	0.0000	0.0000	90.4068	241.5972	392.0088 (98a)
Space heating requirement - total per year (kWh/year)												1694.9597
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	382.0058	278.0820	207.9441	83.2885	19.6265	0.0000	0.0000	0.0000	0.0000	90.4068	241.5972	392.0088 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1694.9597
Space heating per m2										(98c) / (4) =		21.4552 (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 %)												92.3000 (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	382.0058	278.0820	207.9441	83.2885	19.6265	0.0000	0.0000	0.0000	0.0000	90.4068	241.5972	392.0088 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	413.8741	301.2807	225.2916	90.2367	21.2638	0.0000	0.0000	0.0000	0.0000	97.9489	261.7521	424.7116 (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	231.7687	204.9915	218.0671	192.6827	187.3672	169.4922	167.8682	174.2401	175.8017	195.2181	206.5365	229.3867 (64)
Efficiency of water heater (217)m	85.1727	84.7442	83.9533	82.3179	80.5743	79.8000	79.8000	79.8000	79.8000	82.4448	84.4123	79.8000 (216)
Fuel for water heating, kWh/month	272.1162	241.8943	259.7481	234.0713	232.5397	212.3963	210.3612	218.3459	220.3028	236.7864	244.6758	269.0730 (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	7.3041	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	23.7446	19.0488	17.1513	12.5658	9.7062	7.9300	8.8543	11.5092	14.9493	19.6143	22.1543	24.4046 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-36.8513	-51.8972	-74.5183	-83.6949	-90.1733	-84.1386	-83.0965	-78.4840	-70.3316	-59.2991	-40.4931	-31.8665 (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	-20.9845	-44.1291	-87.6842	-131.6603	-174.0558	-174.8760	-172.8196	-146.3413	-107.2835	-63.0986	-28.0140	-16.5953 (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												

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Space heating fuel - main system 1	1836.3593 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2852.3110 (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)	191.6327 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1952.3865 (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	3013.9166 (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	1836.3593	0.2100	385.6355 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2852.3110	0.2100	598.9853 (264)
Space and water heating			984.6208 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	191.6327	0.1443	27.6585 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-784.8444	0.1346	-105.6472
PV Unit electricity exported	-1167.5420	0.1259	-146.9979
Total			-252.6451 (269)
Total CO2, kg/year			771.5635 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.7700 (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	1836.3593	1.1300	2075.0861 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2852.3110	1.1300	3223.1114 (278)
Space and water heating			5298.1975 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	191.6327	1.5338	293.9326 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-784.8444	1.4975	-1175.2998
PV Unit electricity exported	-1167.5420	0.4622	-539.5836
Total			-1714.8834 (283)
Total Primary energy kWh/year			4007.3475 (286)
Target Primary Energy Rate (TPER)			50.7300 (287)

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Property Reference	all plots		Issued on Date	30/06/2023	
Assessment Reference	Plot 6 DS	Prop Type Ref			
Property	Plot 1, Bryanston Road, Southampton, Hampshire, SO19				
SAP Rating	92 A	DER	1.09	TER	11.26
Environmental	99 A	% DER < TER			90.32
CO ₂ Emissions (t/year)	0.01	DFEE	32.08	TFEE	35.74
Compliance Check	See BREL	% DFEE < TFEE			10.24
% DPER < TPER	61.50	DPER	22.61	TPER	58.73
Assessor Details	Dr. Rachel Mitchell			Assessor ID	L772-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.7000 (2b)	= 106.6500 (1b)
First floor	39.5000 (1c)	x 2.4000 (2c)	= 94.8000 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.4500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	Air changes per hour	0.0000 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			5.0000 (17)
Infiltration rate			0.2500 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5209	0.5156	0.5103	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
window 0.8 (Uw = 0.80)			15.1200	0.7752	11.7209		(27)
front door			2.1800	0.8000	1.7440		(26)
Heatloss Floor 1			39.5000	0.1100	4.3450		(28a)

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External Wall 1	91.8000	17.3000	74.5000	0.1500	11.1750	(29a)
External Roof 1	39.5000		39.5000	0.1100	4.3450	(30)
Total net area of external elements Aum(A, m2)			170.8000			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.3299	(33)
Party Wall 1			49.5000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)						8.5400 (36)
Point Thermal bridges						(36a) = 0.0500 (36a)
Total fabric heat loss					(33) + (36) + (36a) =	41.9199 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	34.6311	34.2780	33.9248	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392	33.2392 (38)
Average = Sum(39)m / 12 =	76.5511	76.1979	75.8447	75.1592	75.1592	75.1592	75.1592	75.1592	75.1592	75.1592	75.1592	75.1592 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9690	0.9645	0.9601	0.9514	0.9514	0.9514	0.9514	0.9514	0.9514	0.9514	0.9514	0.9514 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4436 (42)
Hot water usage for mixer showers	65.1911	64.2114	62.7838	60.0523	58.0365	55.7886	54.5108	55.9276	57.4807	59.8943	62.6845	64.9413 (42a)
Hot water usage for baths	28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623 (42b)
Hot water usage for other uses	39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550 (42c)
Average daily hot water use (litres/day)												122.2605 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587 (44)
Energy content (annual)	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2030.7208
Distribution loss	31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567 (46)

Water storage loss:												200.0000 (47)
Store volume												1.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.6588 (55)
Enter (49) or (54) in (55)												

Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228 (56)
If cylinder contains dedicated solar storage												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966 (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	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966 (64)
Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2545.0788 (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	104.9877	93.1954	99.6996	89.1001	87.3968	79.8504	79.5118	81.9906	82.1582	90.3169	94.4814	104.0122 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	113.3713	125.5183	113.3713	117.1504	113.3713	117.1504	113.3713	113.3713	117.1504	113.3713	117.1504	113.3713 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483 (68)
Pumps, fans	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Total internal gains	141.1125	138.6837	134.0049	123.7501	117.4688	110.9033	106.8707	110.2024	114.1086	121.3937	131.2241	139.8013 (72)
	531.4759	543.4493	520.9403	502.3656	477.0325	459.8918	442.4906	443.5670	456.9355	472.5406	501.4228	520.5752 (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			
Northeast				4.4600	11.2829	0.6400	0.7000	0.7700	15.6231 (75)			
Southeast				4.4200	36.7938	0.6400	0.7000	0.7700	50.4904 (77)			
Northwest				6.2400	11.2829	0.6400	0.7000	0.7700	21.8584 (81)			
Solar gains	87.9719	162.2985	255.1330	371.5509	466.7608	485.6395	458.9471	384.5140	294.9120	188.2907	107.6373	73.8185 (83)
Total gains	619.4478	705.7478	776.0733	873.9165	943.7933	945.5312	901.4378	828.0811	751.8475	660.8313	609.0601	594.3937 (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	71.6660	71.9982	72.3334	72.9932	72.9932	72.9932	72.9932	72.9932	72.9932	72.9932	72.9932	72.9932	
alpha	5.7777	5.7999	5.8222	5.8662	5.8662	5.8662	5.8662	5.8662	5.8662	5.8662	5.8662	5.8662	
util living area	0.9921	0.9824	0.9574	0.8708	0.7028	0.5039	0.3662	0.4161	0.6635	0.9156	0.9820	0.9936 (86)	
Living	20.0685	20.2508	20.4986	20.7911	20.9498	20.9936	20.9992	20.9983	20.9722	20.7514	20.3712	20.0538	
Non living	19.2713	19.4536	19.6961	19.9685	20.0939	20.1214	20.1238	20.1236	20.1107	19.9408	19.5826	19.2689	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.5235	20.2508	20.4986	20.7911	20.9498	20.9936	20.9992	20.9983	20.9722	20.7514	20.3712	20.1862 (87)	
Th 2	20.1092	20.1130	20.1167	20.1240	20.1240	20.1240	20.1240	20.1240	20.1240	20.1240	20.1240	20.1240 (88)	
util rest of house	0.9897	0.9772	0.9451	0.8388	0.6482	0.4371	0.2937	0.3376	0.5896	0.8862	0.9757	0.9916 (89)	
MIT 2	19.6806	19.4536	19.6961	19.9685	20.0939	20.1214	20.1238	20.1236	20.1107	19.9408	19.5826	19.3885 (90)	
Living area fraction	fLA = Living area / (4) =											0.1899 (91)	
MIT	19.8406	19.6050	19.8484	20.1247	20.2564	20.2870	20.2900	20.2897	20.2743	20.0947	19.7323	19.5400 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.8406	19.6050	19.8484	20.1247	20.2564	20.2870	20.2900	20.2897	20.2743	20.0947	19.7323	19.5400 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9888	0.9735	0.9407	0.8389	0.6567	0.4497	0.3075	0.3525	0.6028	0.8851	0.9722	0.9900 (94)
Useful gains	612.5238	687.0497	730.0279	733.1061	619.8349	425.1997	277.1502	291.9239	453.1815	584.8736	592.1078	588.4228 (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	1189.6531	1120.4884	1012.4096	843.6361	643.0918	427.4320	277.3410	292.3452	464.0530	713.6122	949.4338	1152.9390 (97)
Space heating kWh	429.3842	291.2708	210.0920	79.5816	17.3031	0.0000	0.0000	0.0000	0.0000	95.7815	257.2747	420.0000 (98a)
Space heating requirement - total per year (kWh/year)												1800.6880
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	429.3842	291.2708	210.0920	79.5816	17.3031	0.0000	0.0000	0.0000	0.0000	95.7815	257.2747	420.0000 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1800.6880
Space heating per m2												(98c) / (4) = 22.7935 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												249.0040 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	429.3842	291.2708	210.0920	79.5816	17.3031	0.0000	0.0000	0.0000	0.0000	95.7815	257.2747	420.0000 (98)
Space heating efficiency (main heating system 1)	249.0040	249.0040	249.0040	249.0040	249.0040	0.0000	0.0000	0.0000	0.0000	249.0040	249.0040	249.0040 (210)
Space heating fuel (main heating system)	172.4407	116.9744	84.3729	31.9600	6.9489	0.0000	0.0000	0.0000	0.0000	38.4659	103.3215	168.6720 (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

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Efficiency of water heater (217)m	254.3304	224.8090	238.4264	208.5295	201.4255	180.7108	177.7112	185.1662	187.6516	210.2078	224.7138	251.3966 (64)
Fuel for water heating, kWh/month	169.5445	169.5445	169.5445	169.5445	169.5445	169.5445	169.5445	169.5445	169.5445	169.5445	169.5445	169.5445 (216)
Space cooling fuel requirement (221)m	150.0081	132.5959	140.6277	122.9940	118.8040	106.5861	104.8169	109.2139	110.6799	123.9839	132.5397	148.2777 (219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Lighting	3.0709	2.7737	3.0709	2.9719	3.0709	2.9719	3.0709	3.0709	2.9719	3.0709	2.9719	3.0709 (231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	22.6469	18.1682	16.3584	11.9849	9.2575	7.5634	8.4450	10.9771	14.2581	18.7075	21.1300	23.2763 (232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-41.5880	-62.2503	-94.2068	-107.8143	-116.9725	-109.2273	-107.5922	-100.4376	-86.7713	-71.0141	-46.3669	-35.3638 (233a)
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	-14.8362	-34.4779	-76.2520	-127.1202	-177.5603	-181.7703	-178.9823	-147.3417	-102.9518	-54.3035	-21.0943	-11.4789 (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												723.1563 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												169.5445
Water heating fuel used												1501.1277 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471) mechanical ventilation fans (SFP = 0.1471)												36.1577 (230a)
Total electricity for the above, kWh/year												36.1577 (231)
Electricity for lighting (calculated in Appendix L)												182.7732 (232)

Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2107.7744 (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												335.4405 (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	723.1563	0.1570	113.5468 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1501.1277	0.1410	211.6574 (264)
Space and water heating			325.2042 (265)
Pumps, fans and electric keep-hot	36.1577	0.1387	5.0155 (267)
Energy for lighting	182.7732	0.1443	26.3798 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-979.6051	0.1341	-131.3191
PV Unit electricity exported	-1128.1693	0.1234	-139.2391
Total			-270.5582 (269)
Total CO2, kg/year			86.0413 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.0900 (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	723.1563	1.5813	1143.4962 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1501.1277	1.5214	2283.7676 (278)
Space and water heating			3427.2638 (279)
Pumps, fans and electric keep-hot	36.1577	1.5128	54.6994 (281)
Energy for lighting	182.7732	1.5338	280.3436 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-979.6051	1.4954	-1464.9189
PV Unit electricity exported	-1128.1693	0.4529	-510.9888
Total			-1975.9077 (283)
Total Primary energy kWh/year			1786.3990 (286)
Dwelling Primary energy Rate (DPER)			22.6100 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.7000 (2b)	= 106.6500 (1b) -
First floor	39.5000 (1c)	x 2.4000 (2c)	= 94.8000 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.4500 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	30.0000 / (5) = 0.1489 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3989 (18)	
Number of sides sheltered	2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3391 (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	0.4323	0.4239	0.4154	0.3730	0.3645	0.3221	0.3221	0.3137	0.3391	0.3645	0.3815	0.3984 (22b)
Effective ac	0.5935	0.5898	0.5863	0.5696	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5728	0.5794 (25)

3. Heat losses and heat loss parameter

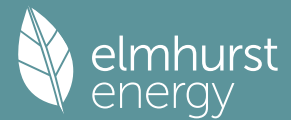
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1800	1.0000	2.1800		(26)
TER Opening Type (Uw = 1.20)			15.1200	1.1450	17.3130		(27)
Heatloss Floor 1			39.5000	0.1300	5.1350		(28a)
External Wall 1	91.8000	17.3000	74.5000	0.1800	13.4100		(29a)
External Roof 1	39.5000		39.5000	0.1100	4.3450		(30)
Total net area of external elements Aum(A, m ²)			170.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.3830		(33)
Party Wall 1			49.5000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
List of Thermal Bridges	
K1 Element	
E5 Ground floor (normal)	Length 19.5000 Psi-value 0.1600 Total 3.1200
E6 Intermediate floor within a dwelling	19.5000 0.0000 0.0000
E16 Corner (normal)	10.2000 0.0900 0.9180
E18 Party wall between dwellings	10.2000 0.0600 0.6120
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6500 (36)
Point Thermal bridges	(36a) = 0.0500 (36a)
Total fabric heat loss	(33) + (36) + (36a) = 47.0830 (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	39.4520	39.2107	38.9743	37.8636	37.6558	36.6884	36.6884	36.5092	37.0610	37.6558	38.0761	38.5156 (38)
Heat transfer coeff	86.5349	86.2937	86.0572	84.9465	84.7387	83.7713	83.7713	83.5922	84.1440	84.7387	85.1591	85.5986 (39)
Average = Sum(39)m / 12 =												84.9455

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0954	1.0923	1.0893	1.0753	1.0726	1.0604	1.0604	1.0581	1.0651	1.0726	1.0780	1.0835 (40)
												1.0753

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Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.4436 (42)
Hot water usage for mixer showers												64.9413 (42a)
Hot water usage for baths												28.0623 (42b)
Hot water usage for other uses												39.6550 (42c)
Average daily hot water use (litres/day)												122.2605 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587 (44)
Energy content (annual)	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114 (45)
Distribution loss (46)m = 0.15 x (45)m												2030.7208
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
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	261.5713	231.3492	245.6673	215.5368	208.6664	187.7181	184.9521	192.4070	194.6589	217.4487	231.7211	258.6375 (62)
WWHRS	-29.8026	-26.3577	-27.6003	-22.8541	-21.2992	-18.2259	-17.0839	-18.1670	-18.8572	-22.2306	-25.1845	-29.2507 (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	231.7687	204.9915	218.0671	192.6827	187.3672	169.4922	167.8682	174.2401	175.8017	195.2181	206.5365	229.3867 (64)
12Total per year (kWh/year)												2353.4207 (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	110.7804	98.4275	105.4923	94.7059	93.1895	85.4562	85.3045	87.7833	87.7640	96.1096	100.0872	109.8049 (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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.9671	122.8564	110.9671	114.6660	110.9671	114.6660	110.9671	110.9671	114.6660	110.9671	114.6660	110.9671 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	148.8984	146.4696	141.7908	131.5360	125.2547	118.6892	114.6566	117.9883	121.8945	129.1796	139.0100	147.5872 (72)
Total internal gains	539.8575	551.5733	529.3220	510.6671	485.4142	465.1933	447.8723	448.9487	462.2370	480.9222	509.7243	528.9569 (73)
6. Solar gains												
[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	4.4600	11.2829	0.6300	0.7000	0.7700	15.3790 (75)						
Southeast	4.4200	36.7938	0.6300	0.7000	0.7700	49.7015 (77)						
Northwest	6.2400	11.2829	0.6300	0.7000	0.7700	21.5169 (81)						
Solar gains	86.5973	159.7626	251.1465	365.7454	459.4676	478.0513	451.7761	378.5060	290.3040	185.3487	105.9555	72.6651 (83)
Total gains	626.4549	711.3360	780.4685	876.4125	944.8818	943.2446	899.6484	827.4547	752.5410	666.2709	615.6797	601.6220 (84)
7. Mean internal temperature (heating season)												

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	63.3976	63.5749	63.7496	64.5831	64.7415	65.4891	65.4891	65.6295	65.1991	64.7415	64.4219	64.0911
alpha	5.2265	5.2383	5.2500	5.3055	5.3161	5.3659	5.3659	5.3753	5.3466	5.3161	5.2948	5.2727
util living area	0.9928	0.9851	0.9663	0.9002	0.7567	0.5562	0.4077	0.4606	0.7170	0.9335	0.9847	0.9941 (86)
MIT	19.8718	20.0557	20.3227	20.6714	20.8994	20.9842	20.9975	20.9953	20.9434	20.6431	20.2060	19.8462 (87)
Th 2	20.0046	20.0071	20.0096	20.0211	20.0232	20.0333	20.0333	20.0352	20.0294	20.0232	20.0189	20.0143 (88)
util rest of house	0.9905	0.9805	0.9558	0.8712	0.6990	0.4775	0.3192	0.3662	0.6362	0.9072	0.9791	0.9922 (89)
MIT 2	18.7058	18.9405	19.2760	19.7013	19.9440	20.0249	20.0325	20.0336	19.9938	19.6804	19.1414	18.6805 (90)
Living area fraction									fLA = Living area / (4) =			0.1899 (91)
MIT	18.9272	19.1522	19.4747	19.8855	20.1254	20.2070	20.2158	20.2162	20.1741	19.8632	19.3435	18.9019 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9272	19.1522	19.4747	19.8855	20.1254	20.2070	20.2158	20.2162	20.1741	19.8632	19.3435	18.9019 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9870	0.9752	0.9486	0.8666	0.7054	0.4920	0.3360	0.3841	0.6490	0.9019	0.9739	0.9892 (94)
Useful gains	618.3412	693.7203	740.3462	759.4835	666.5499	464.0458	302.3131	317.8360	488.4305	600.9241	599.5987	595.1475 (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	1265.7656	1229.8773	1116.5692	933.1789	713.9601	469.7073	302.8973	319.0061	511.0971	784.9537	1042.6471	1258.4603 (97)
Space heating kWh	481.6837	360.2975	279.9099	125.0607	35.2731	0.0000	0.0000	0.0000	0.0000	136.9181	318.9948	493.5047 (98a)
Space heating requirement - total per year (kWh/year)												2231.6426
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	481.6837	360.2975	279.9099	125.0607	35.2731	0.0000	0.0000	0.0000	0.0000	136.9181	318.9948	493.5047 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2231.6426
Space heating per m2										(98c) / (4) =		28.2486 (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 %)												92.3000 (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	481.6837	360.2975	279.9099	125.0607	35.2731	0.0000	0.0000	0.0000	0.0000	136.9181	318.9948	493.5047 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	521.8675	390.3549	303.2610	135.4937	38.2157	0.0000	0.0000	0.0000	0.0000	148.3403	345.6065	534.6747 (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	231.7687	204.9915	218.0671	192.6827	187.3672	169.4922	167.8682	174.2401	175.8017	195.2181	206.5365	229.3867 (64)
Efficiency of water heater (217)m	85.6615	85.3109	84.6208	83.1156	81.1023	79.8000	79.8000	79.8000	79.8000	83.2795	85.0311	79.8000 (216)
Fuel for water heating, kWh/month	270.5632	240.2875	257.6993	231.8250	231.0258	212.3963	210.3612	218.3459	220.3028	234.4133	242.8953	267.5630 (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	23.0568	18.4970	16.6545	12.2018	9.4250	7.7003	8.5978	11.1758	14.5162	19.0461	21.5125	23.6976 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-36.8311	-51.8628	-74.4656	-83.6368	-90.1157	-84.0874	-83.0393	-78.4183	-70.2652	-59.2476	-40.4655	-31.8492 (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	-21.0047	-44.1635	-87.7369	-131.7184	-174.1135	-174.9272	-172.8768	-146.4070	-107.3498	-63.1502	-28.0415	-16.6125 (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												

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Space heating fuel - main system 1	2417.8143 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2837.6787 (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)	186.0814 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1952.3865 (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	3575.1880 (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	2417.8143	0.2100	507.7410 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2837.6787	0.2100	595.9125 (264)
Space and water heating			1103.6535 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	186.0814	0.1443	26.8573 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-784.2845	0.1346	-105.5725
PV Unit electricity exported	-1168.1020	0.1259	-147.0732
Total			-252.6457 (269)
Total CO2, kg/year			889.7944 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.2600 (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	2417.8143	1.1300	2732.1302 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2837.6787	1.1300	3206.5770 (278)
Space and water heating			5938.7072 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	186.0814	1.5338	285.4178 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-784.2845	1.4975	-1174.4637
PV Unit electricity exported	-1168.1020	0.4622	-539.8603
Total			-1714.3240 (283)
Total Primary energy kWh/year			4639.9018 (286)
Target Primary Energy Rate (TPER)			58.7300 (287)

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Property Reference	all plots		Issued on Date	30/06/2023	
Assessment Reference	Plot 7 DS	Prop Type Ref			
Property	Plot 1, Bryanston Road, Southampton, Hampshire, SO19				
SAP Rating	93 A	DER	0.58	TER	10.10
Environmental	100 A	% DER < TER	94.26		
CO ₂ Emissions (t/year)	-0.04	DFEE	30.77	TREE	34.15
Compliance Check	See BREL	% DFEE < TREE	9.90		
% DPER < TPER	64.64	DPER	18.46	TPER	52.51
Assessor Details	Dr. Rachel Mitchell			Assessor ID	L772-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b)
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.1700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.2500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5209	0.5156	0.5103	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value KJ/m ² K	A x K kJ/K
window 0.8 (Uw = 0.80)			18.6300	0.7752	14.4419		(27)
front door			2.1800	0.8000	1.7440		(26)
Heatloss Floor 1			46.7000	0.1100	5.1370		(28a)

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External Wall 1	98.5000	20.8100	77.6900	0.1500	11.6535		(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370		(30)
Total net area of external elements Aum(A, m2)			191.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1134		(33)
Party Wall 1			48.0000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							9.5950 (36)
Point Thermal bridges							(36a) = 0.0500 (36a)
Total fabric heat loss						(33) + (36) + (36a) =	47.7584 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	40.9437	40.5261	40.1086	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	
Average = Sum(39)m / 12 =	88.7020	88.2845	87.8669	87.0564	87.0564	87.0564	87.0564	87.0564	87.0564	87.0564	87.0564	87.0564	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.9497	0.9452	0.9408	0.9321	0.9321	0.9321	0.9321	0.9321	0.9321	0.9321	0.9321	0.9321	0.9354
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6695 (42)
Hot water usage for mixer showers	68.9778	67.9412	66.4307	63.5405	61.4077	59.0292	57.6772	59.1763	60.8196	63.3734	66.3256	68.7135	(42a)
Hot water usage for baths	29.7859	29.3436	28.7206	27.5720	26.7120	25.7583	25.2432	25.8618	26.5353	27.5558	28.7280	29.6852	(42b)
Hot water usage for other uses	41.9679	40.4418	38.9157	37.3896	35.8635	34.3374	34.3374	35.8635	37.3896	38.9157	40.4418	41.9679	(42c)
Average daily hot water use (litres/day)	33.4327	29.4181	30.9084	26.3870	25.0358	21.9717	21.2720	22.4552	23.0734	26.4297	28.9557	32.9670	(43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667	(44)
Energy content (annual)	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803	(45)
Distribution loss (46)m = 0.15 x (45)m	33.4327	29.4181	30.9084	26.3870	25.0358	21.9717	21.2720	22.4552	23.0734	26.4297	28.9557	32.9670	(46)

Water storage loss:													200.0000 (47)
Store volume													1.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.6588 (55)
Enter (49) or (54) in (55)													
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)

If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(62)
WWHS	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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(64)
Total per year (kWh/year) = Sum(64)m =													2663.0693 (64)

12Total per year (kWh/year)													
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

Heat gains from water heating, kWh/month	109.0573	96.7763	103.4618	92.3119	90.4441	82.5247	82.1010	84.7239	84.9668	93.5341	98.0060	108.0251	(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	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.9621	140.5651	126.9621	131.1941	126.9621	131.1941	126.9621	126.9621	131.1941	126.9621	131.1941	126.9621	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1957	247.7401	241.3283	227.6786	210.4482	194.2540	183.4353	180.8910	187.3027	200.9525	218.1829	234.3770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	(71)
Water heating gains (Table 5)	146.5824	144.0123	139.0615	128.2110	121.5647	114.6177	110.3509	113.8762	118.0094	125.7179	136.1194	145.1950	(72)
Total internal gains	581.7820	595.3593	570.3938	550.1255	522.0168	503.1077	483.7901	484.7711	499.5481	516.6743	548.5383	569.5760	(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
Southeast				5.3900	36.7938	0.6400	0.7000	0.7700				61.5708 (77)
Southwest				2.4300	36.7938	0.6400	0.7000	0.7700				27.7583 (79)
Northwest				10.8100	11.2829	0.6400	0.7000	0.7700				37.8669 (81)
Solar gains	127.1960	229.2396	347.0647	486.0285	595.5054	613.6818	582.2984	497.1866	394.6463	262.3666	154.6420	107.3711 (83)
Total gains	708.9779	824.5990	917.4585	1036.1540	1117.5221	1116.7895	1066.0885	981.9577	894.1944	779.0408	703.1803	676.9471 (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	73.1225	73.4683	73.8174	74.5047	74.5047	74.5047	74.5047	74.5047	74.5047	74.5047	74.5047	74.5047
alpha	5.8748	5.8979	5.9212	5.9670	5.9670	5.9670	5.9670	5.9670	5.9670	5.9670	5.9670	5.9670
util living area	0.9931	0.9827	0.9553	0.8634	0.6919	0.4949	0.3588	0.4067	0.6499	0.9123	0.9832	0.9946 (86)
Living	20.0742	20.2715	20.5256	20.8103	20.9564	20.9947	20.9993	20.9987	20.9766	20.7673	20.3800	20.0567
Non living	19.2902	19.4874	19.7357	19.9997	20.1143	20.1381	20.1402	20.1400	20.1291	19.9692	19.6049	19.2851
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5264	20.2715	20.5256	20.8103	20.9564	20.9947	20.9993	20.9987	20.9766	20.7673	20.3800	20.1886 (87)
Th 2	20.1255	20.1292	20.1330	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403 (88)
util rest of house	0.9910	0.9776	0.9427	0.8309	0.6380	0.4302	0.2890	0.3313	0.5776	0.8824	0.9774	0.9929 (89)
MIT 2	19.6982	19.4874	19.7357	19.9997	20.1143	20.1381	20.1402	20.1400	20.1291	19.9692	19.6049	19.4047 (90)
Living area fraction	fLA = Living area / (4) =											0.2109 (91)
MIT	19.8729	19.6528	19.9023	20.1707	20.2919	20.3188	20.3214	20.3211	20.3079	20.1376	19.7684	19.5701 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8729	19.6528	19.9023	20.1707	20.2919	20.3188	20.3214	20.3211	20.3079	20.1376	19.7684	19.5701 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9902	0.9741	0.9387	0.8321	0.6478	0.4438	0.3037	0.3472	0.5922	0.8823	0.9742	0.9915 (94)
Useful gains	702.0496	803.2728	861.2478	862.1909	723.9814	495.6254	323.7850	340.9475	529.5140	687.3243	685.0131	671.1610 (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	1381.3452	1302.4401	1177.6166	981.1843	747.9799	497.8576	323.9698	341.3547	540.4365	830.3077	1102.8653	1338.0624 (97)
Space heating kWh	505.3960	335.4404	235.3784	85.6752	17.8549	0.0000	0.0000	0.0000	0.0000	106.3797	300.8536	496.1747 (98a)
Space heating requirement - total per year (kWh/year)												2083.1527
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	505.3960	335.4404	235.3784	85.6752	17.8549	0.0000	0.0000	0.0000	0.0000	106.3797	300.8536	496.1747 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2083.1527
Space heating per m2												(98c) / (4) = 22.3036 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												243.7715 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	505.3960	335.4404	235.3784	85.6752	17.8549	0.0000	0.0000	0.0000	0.0000	106.3797	300.8536	496.1747 (98)
Space heating efficiency (main heating system 1)	243.7715	243.7715	243.7715	243.7715	243.7715	0.0000	0.0000	0.0000	0.0000	243.7715	243.7715	243.7715 (210)
Space heating fuel (main heating system)	207.3236	137.6044	96.5570	35.1457	7.3244	0.0000	0.0000	0.0000	0.0000	43.6391	123.4162	203.5409 (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

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Efficiency of water heater (217)m	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655 (64)
Fuel for water heating, kWh/month	168.5795	168.5795	168.5795	168.5795	168.5795	168.5795	168.5795	168.5795	168.5795	168.5795	168.5795	168.5795 (216)
Space cooling fuel requirement (221)m	158.1270	139.7432	148.1445	129.4280	124.9205	111.9673	110.0361	114.7154	116.3240	130.4331	139.5864	156.2856 (219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Lighting	3.6307	3.2793	3.6307	3.5136	3.6307	3.5136	3.6307	3.6307	3.5136	3.6307	3.5136	3.6307 (231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	25.3617	20.3461	18.3194	13.4216	10.3672	8.4701	9.4573	12.2930	15.9674	20.9501	23.6631	26.0666 (232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-51.1381	-75.8069	-113.3539	-127.8089	-137.2012	-127.6304	-125.6950	-117.9319	-102.7557	-85.4503	-56.7008	-43.5464 (233a)
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	-19.3923	-45.1035	-99.7196	-165.8592	-230.9648	-236.1165	-232.5230	-191.7921	-134.3981	-71.1967	-27.6256	-15.0069 (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												854.5513 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												168.5795
Water heating fuel used												1579.7113 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471) mechanical ventilation fans (SFP = 0.1471)												42.7485 (230a)
Total electricity for the above, kWh/year												42.7485 (231)
Electricity for lighting (calculated in Appendix L)												204.6836 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2634.7180 (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												46.9768 (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	854.5513	0.1572	134.3243 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1579.7113	0.1410	222.7782 (264)
Space and water heating			357.1025 (265)
Pumps, fans and electric keep-hot	42.7485	0.1387	5.9297 (267)
Energy for lighting	204.6836	0.1443	29.5422 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1165.0196	0.1343	-156.4885
PV Unit electricity exported	-1469.6984	0.1235	-181.4836
Total			-337.9721 (269)
Total CO2, kg/year			54.6023 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.5800 (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	854.5513	1.5819	1351.7972 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1579.7113	1.5215	2403.4742 (278)
Space and water heating			3755.2713 (279)
Pumps, fans and electric keep-hot	42.7485	1.5128	64.6699 (281)
Energy for lighting	204.6836	1.5338	313.9506 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1165.0196	1.4964	-1743.3701
PV Unit electricity exported	-1469.6984	0.4532	-666.0301
Total			-2409.4002 (283)
Total Primary energy kWh/year			1724.4917 (286)
Dwelling Primary energy Rate (DPER)			18.4600 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b) -
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	238.1700 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	30.0000 / (5) = 0.1260 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3760 (18)	
Number of sides sheltered	2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3196 (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	0.4074	0.3995	0.3915	0.3515	0.3435	0.3036	0.3036	0.2956	0.3196	0.3435	0.3595	0.3755 (22b)
Effective ac	0.5830	0.5798	0.5766	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5646	0.5705 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1800	1.0000	2.1800		(26)
TER Opening Type (Uw = 1.20)			18.6300	1.1450	21.3321		(27)
Heatloss Floor 1			46.7000	0.1300	6.0710		(28a)
External Wall 1	98.5000	20.8100	77.6900	0.1800	13.9842		(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370		(30)
Total net area of external elements Aum(A, m ²)			191.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.7043		(33)
Party Wall 1			48.0000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	
List of Thermal Bridges	250.0000 (35)
K1 Element	
E5 Ground floor (normal)	Length 19.5000 Psi-value 0.1600 Total 3.1200
E6 Intermediate floor within a dwelling	19.5000 0.0000 0.0000
E16 Corner (normal)	10.2000 0.0900 0.9180
E18 Party wall between dwellings	10.2000 0.0600 0.6120
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6500 (36)
Point Thermal bridges	(36a) = 0.0500 (36a)
Total fabric heat loss	(33) + (36) + (36a) = 53.4043 (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	45.8220	45.5687	45.3204	44.1540	43.9358	42.9200	42.9200	42.7319	43.3113	43.9358	44.3773	44.8388 (38)
Heat transfer coeff	99.2263	98.9730	98.7247	97.5583	97.3401	96.3242	96.3242	96.1361	96.7155	97.3401	97.7815	98.2431 (39)
Average = Sum(39)m / 12 =												97.5573

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0624	1.0597	1.0570	1.0445	1.0422	1.0313	1.0313	1.0293	1.0355	1.0422	1.0469	1.0519 (40)
HLP (average)												1.0445

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Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.6695 (42)
Hot water usage for mixer showers												68.7135 (42a)
Hot water usage for baths												29.6852 (42b)
Hot water usage for other uses												41.9679 (42c)
Average daily hot water use (litres/day)												129.3641 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667 (44)
Energy content (annual)	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2148.7113
Water storage loss:												33.4327
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss												27.6637 (56)
If cylinder contains dedicated solar storage												27.6637 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												273.8106
WWHRS												-31.5338 (62)
PV diverter												-0.0000 (63a)
Solar input												0.0000 (63b)
FGHRS												0.0000 (63c)
Output from w/h												242.2768 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2455.3261 (64)
Electric shower(s)												0.0000 (64a)
Heat gains from water heating, kWh/month												114.8500 (64a)
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	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												124.5793 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												245.1957 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												36.3473 (69)
Pumps, fans												3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												-106.7783 (71)
Water heating gains (Table 5)												154.3682 (72)
Total internal gains												590.1851 (73)
6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Southeast	5.3900	36.7938	0.6300	0.7000	0.7700	60.6088 (77)						
Southwest	2.4300	36.7938	0.6300	0.7000	0.7700	27.3246 (79)						
Northwest	10.8100	11.2829	0.6300	0.7000	0.7700	37.2752 (81)						
Solar gains	125.2085	225.6577	341.6418	478.4343	586.2006	604.0931	573.2000	489.4180	388.4800	258.2671	152.2257	105.6934 (83)
Total gains	715.3937	829.1650	920.4387	1036.8836	1116.6205	1112.5245	1062.3933	979.5923	893.3518	783.3445	709.0877	683.6726 (84)
7. Mean internal temperature (heating season)												

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.3669	65.5342	65.6990	66.4845	66.6335	67.3362	67.3362	67.4680	67.0638	66.6335	66.3327	66.0211
alpha	5.3578	5.3689	5.3799	5.4323	5.4422	5.4891	5.4891	5.4979	5.4709	5.4422	5.4222	5.4014
util living area	0.9937	0.9854	0.9647	0.8937	0.7446	0.5442	0.3974	0.4483	0.7018	0.9307	0.9857	0.9950 (86)
MIT	19.8964	20.0940	20.3654	20.7030	20.9136	20.9871	20.9981	20.9964	20.9527	20.6684	20.2278	19.8662 (87)
Th 2	20.0317	20.0339	20.0361	20.0464	20.0483	20.0573	20.0573	20.0590	20.0539	20.0483	20.0444	20.0403 (88)
util rest of house	0.9917	0.9809	0.9539	0.8639	0.6874	0.4684	0.3131	0.3583	0.6226	0.9039	0.9805	0.9934 (89)
MIT 2	18.7572	19.0089	19.3494	19.7586	19.9806	20.0505	20.0567	20.0578	20.0243	19.7304	19.1882	18.7251 (90)
Living area fraction	18.9975	19.2378	19.5637	19.9578	20.1774	20.2480	20.2553	20.2557	20.2201	19.9283	19.4075	18.9658 (92)
MIT	18.9975	19.2378	19.5637	19.9578	20.1774	20.2480	20.2553	20.2557	20.2201	19.9283	19.4075	18.9658 (93)
Temperature adjustment												0.0000
adjusted MIT	18.9975	19.2378	19.5637	19.9578	20.1774	20.2480	20.2553	20.2557	20.2201	19.9283	19.4075	18.9658 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9887	0.9760	0.9472	0.8608	0.6956	0.4840	0.3309	0.3773	0.6373	0.8999	0.9759	0.9908 (94)
Useful gains	707.2827	809.2610	871.8683	892.5089	776.7639	538.5085	351.5433	369.5727	569.3258	704.9074	691.9686	677.4079 (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	1458.3761	1419.0534	1289.7078	1078.7813	825.1933	544.0408	352.0921	370.6766	591.9092	908.0134	1203.4457	1450.6385 (97)
Space heating kWh	558.8135	409.7805	310.8726	134.1161	36.0314	0.0000	0.0000	0.0000	0.0000	151.1108	368.2635	575.2836 (98a)
Space heating requirement - total per year (kWh/year)												2544.2721
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	558.8135	409.7805	310.8726	134.1161	36.0314	0.0000	0.0000	0.0000	0.0000	151.1108	368.2635	575.2836 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2544.2721
Space heating per m2										(98c) / (4) =		27.2406 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	558.8135	409.7805	310.8726	134.1161	36.0314	0.0000	0.0000	0.0000	0.0000	151.1108	368.2635	575.2836 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	605.4317	443.9658	336.8067	145.3046	39.0373	0.0000	0.0000	0.0000	0.0000	163.7170	398.9854	623.2759 (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	242.2768	214.2298	227.7786	201.0147	195.2949	176.4767	174.6630	181.4053	183.1532	203.6025	215.6740	239.7566 (64)
Efficiency of water heater (217)m	85.8710	85.4899	84.7577	83.1735	81.0800	79.8000	79.8000	79.8000	79.8000	83.4010	85.2489	79.8000 (216)
Fuel for water heating, kWh/month	282.1404	250.5908	268.7408	241.6812	240.8670	221.1487	218.8760	227.3249	229.5153	244.1249	252.9932	278.9537 (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	25.8851	20.7660	18.6975	13.6986	10.5812	8.6449	9.6525	12.5467	16.2969	21.3824	24.1514	26.6046 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-42.9843	-60.2425	-86.0866	-96.1999	-103.2196	-96.1326	-94.9038	-89.8151	-80.8000	-68.5615	-47.1125	-37.2011 (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	-25.3937	-53.2873	-105.6818	-158.4099	-209.1728	-210.0948	-207.6603	-175.9911	-129.1905	-76.1467	-33.8819	-20.0942 (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												

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Space heating fuel - main system 1	2756.5244 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2956.9568 (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)	208.9078 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2308.2645 (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	3700.1246 (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	2756.5244	0.2100	578.8701 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2956.9568	0.2100	620.9609 (264)
Space and water heating			1199.8311 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	208.9078	0.1443	30.1519 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-903.2596	0.1347	-121.6873
PV Unit electricity exported	-1405.0049	0.1260	-176.9618
Total			-298.6492 (269)
Total CO2, kg/year			943.2630 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1000 (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	2756.5244	1.1300	3114.8726 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2956.9568	1.1300	3341.3612 (278)
Space and water heating			6456.2338 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	208.9078	1.5338	320.4298 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-903.2596	1.4979	-1353.0021
PV Unit electricity exported	-1405.0049	0.4623	-649.5748
Total			-2002.5769 (283)
Total Primary energy kWh/year			4904.1875 (286)
Target Primary Energy Rate (TPER)			52.5100 (287)

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Property Reference	all plots		Issued on Date	30/06/2023	
Assessment Reference	Plot 8 DS	Prop Type Ref			
Property	Plot 1 , Bryanston Road , Southampton, Hampshire , SO19				
SAP Rating	93 A	DER	0.70	TER	10.44
Environmental	99 A	% DER < TER			93.30
CO ₂ Emissions (t/year)	-0.03	DFEE	32.30	TREE	35.71
Compliance Check	See BREL	% DFEE < TREE			9.53
% DPER < TPER	63.93	DPER	19.60	TPER	54.34
Assessor Details	Dr. Rachel Mitchell			Assessor ID	L772-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b)
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.1700 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.2500 (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) =	0.2313 (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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5448	0.5391	0.5333	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5102	0.5217 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
window 0.8 (Uw = 0.80)			18.6300	0.7752	14.4419		(27)
front door			2.1800	0.8000	1.7440		(26)
Heatloss Floor 1			46.7000	0.1100	5.1370		(28a)

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External Wall 1	98.5000	20.8100	77.6900	0.1500	11.6535								(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370								(30)
Total net area of external elements Aum(A, m2)			191.9000										(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1134								(33)
Party Wall 1			48.0000	0.0000	0.0000								(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)													9.5950 (36)
Point Thermal bridges												(36a) =	0.0500 (36a)
Total fabric heat loss												(33) + (36) + (36a) =	47.7584 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	42.8226	42.3682	41.9138	39.6419	39.2981	39.2981	39.2981	39.2981	39.2981	39.2981	40.0963	41.0051	(38)
Average = Sum(39)m / 12 =	90.5810	90.1266	89.6722	87.4003	87.0564	87.0564	87.0564	87.0564	87.0564	87.0564	87.8547	88.7634	(39)
													88.0614

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9698	0.9650	0.9601	0.9358	0.9321	0.9321	0.9321	0.9321	0.9321	0.9321	0.9406	0.9504	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6695 (42)
Hot water usage for mixer showers	68.9778	67.9412	66.4307	63.5405	61.4077	59.0292	57.6772	59.1763	60.8196	63.3734	66.3256	68.7135	(42a)
Hot water usage for baths	29.7859	29.3436	28.7206	27.5720	26.7120	25.7583	25.2432	25.8618	26.5353	27.5558	28.7280	29.6852	(42b)
Hot water usage for other uses	41.9679	40.4418	38.9157	37.3896	35.8635	34.3374	34.3374	35.8635	37.3896	38.9157	40.4418	41.9679	(42c)
Average daily hot water use (litres/day)													129.3641 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667	(44)
Energy content (annual)	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803	(45)
Distribution loss (46)m = 0.15 x (45)m	33.4327	29.4181	30.9084	26.3870	25.0358	21.9717	21.2720	22.4552	23.0734	26.4297	28.9557	32.9670	(46)
Water storage loss:													200.0000 (47)

Store volume													1.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.6588 (55)
Enter (49) or (54) in (55)													
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)

If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(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	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655	(64)
Total per year (kWh/year) = Sum(64)m =													2663.0693 (64)

12Total per year (kWh/year)													2663 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	109.0573	96.7763	103.4618	92.3119	90.4441	82.5247	82.1010	84.7239	84.9668	93.5341	98.0060	108.0251	(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	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.9621	140.5651	126.9621	131.1941	126.9621	131.1941	126.9621	126.9621	131.1941	126.9621	131.1941	126.9621	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1957	247.7401	241.3283	227.6786	210.4482	194.2540	183.4353	180.8910	187.3027	200.9525	218.1829	234.3770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	36.3473	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	-106.7783	(71)
Water heating gains (Table 5)	146.5824	144.0123	139.0615	128.2110	121.5647	114.6177	110.3509	113.8762	118.0094	125.7179	136.1194	145.1950	(72)
Total internal gains	581.7820	595.3593	570.3938	550.1255	522.0168	503.1077	483.7901	484.7711	499.5481	516.6743	548.5383	569.5760	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast					2.4300	11.2829	0.6400		0.7000		0.7700	8.5122 (75)
Southeast					5.3900	36.7938	0.6400		0.7000		0.7700	61.5708 (77)
Northwest					10.8100	11.2829	0.6400		0.7000		0.7700	37.8669 (81)
Solar gains	107.9499	199.2837	313.5878	457.1371	574.6343	598.0157	565.0914	473.2233	362.6350	231.2838	132.1045	90.5672 (83)
Total gains	689.7318	794.6431	883.9816	1007.2626	1096.6511	1101.1234	1048.8815	957.9944	862.1831	747.9581	680.6427	660.1432 (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	71.6057	71.9667	72.3314	74.2116	74.5047	74.5047	74.5047	74.5047	74.5047	74.5047	73.8277	73.0719	
alpha	5.7737	5.7978	5.8221	5.9474	5.9670	5.9670	5.9670	5.9670	5.9670	5.9670	5.9218	5.8715	
util living area	0.9941	0.9860	0.9635	0.8761	0.7023	0.5017	0.3646	0.4167	0.6701	0.9244	0.9859	0.9953 (86)	
Living	20.0186	20.2071	20.4668	20.7908	20.9529	20.9943	20.9993	20.9985	20.9726	20.7443	20.3435	20.0065	
Non living	19.2215	19.4108	19.6663	19.9808	20.1120	20.1380	20.1401	20.1399	20.1271	19.9497	19.5634	19.2228	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4980	20.2071	20.4668	20.7908	20.9529	20.9943	20.9993	20.9985	20.9726	20.7443	20.3435	20.1455 (87)	
Th 2	20.1086	20.1126	20.1167	20.1372	20.1403	20.1403	20.1403	20.1403	20.1403	20.1403	20.1331	20.1249 (88)	
util rest of house	0.9923	0.9818	0.9527	0.8450	0.6484	0.4362	0.2937	0.3395	0.5970	0.8972	0.9808	0.9939 (89)	
MIT 2	19.6548	19.4108	19.6663	19.9808	20.1120	20.1380	20.1401	20.1399	20.1271	19.9497	19.5634	19.3490 (90)	
Living area fraction	fLA = Living area / (4) =											0.2109 (91)	
MIT	19.8326	19.5787	19.8351	20.1516	20.2894	20.3186	20.3214	20.3210	20.3054	20.1173	19.7280	19.5170 (92)	
Temperature adjustment	0.0000												
adjusted MIT	19.8326	19.5787	19.8351	20.1516	20.2894	20.3186	20.3214	20.3210	20.3054	20.1173	19.7280	19.5170 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9916	0.9785	0.9485	0.8456	0.6581	0.4499	0.3087	0.3558	0.6116	0.8964	0.9778	0.9926 (94)
Useful gains	683.9509	777.5878	838.4944	851.7396	721.7418	495.4379	323.7655	340.8821	527.3271	670.4614	665.5565	655.2257 (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	1406.9594	1322.9452	1195.7903	983.3967	747.7597	497.8390	323.9677	341.3477	540.2203	828.5442	1109.4266	1359.5849 (97)
Space heating kWh	537.9183	366.4802	265.8282	94.7931	19.3573	0.0000	0.0000	0.0000	0.0000	117.6136	319.5865	524.0432 (98a)
Space heating requirement - total per year (kWh/year)												2245.6204
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	537.9183	366.4802	265.8282	94.7931	19.3573	0.0000	0.0000	0.0000	0.0000	117.6136	319.5865	524.0432 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2245.6204
Space heating per m2												(98c) / (4) = 24.0430 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)	243.4502 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	537.9183	366.4802	265.8282	94.7931	19.3573	0.0000	0.0000	0.0000	0.0000	117.6136	319.5865	524.0432 (98)
Space heating efficiency (main heating system 1)	243.4502	243.4502	243.4502	243.4502	243.4502	0.0000	0.0000	0.0000	0.0000	243.4502	243.4502	243.4502 (210)
Space heating fuel (main heating system)	220.9562	150.5360	109.1920	38.9374	7.9513	0.0000	0.0000	0.0000	0.0000	48.3112	131.2739	215.2569 (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

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Efficiency of water heater (217)m	266.5697	235.5784	249.7412	218.1891	210.5904	188.7539	185.4984	193.3866	196.0985	219.8835	235.3141	263.4655 (64)
Fuel for water heating, kWh/month	168.4789	168.4789	168.4789	168.4789	168.4789	168.4789	168.4789	168.4789	168.4789	168.4789	168.4789	168.4789 (216)
Space cooling fuel requirement (221)m	158.2214	139.8266	148.2329	129.5052	124.9951	112.0341	110.1018	114.7839	116.3935	130.5110	139.6697	156.3789 (219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Lighting	3.6307	3.2793	3.6307	3.5136	3.6307	3.5136	3.6307	3.6307	3.5136	3.6307	3.5136	3.6307 (231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	25.3617	20.3461	18.3194	13.4216	10.3672	8.4701	9.4573	12.2930	15.9674	20.9501	23.6631	26.0666 (232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-51.3043	-76.2169	-114.1841	-128.2805	-137.3231	-127.6434	-125.7078	-117.9433	-102.7643	-85.7342	-56.8677	-43.6615 (233a)
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	-19.2261	-44.6935	-98.8894	-165.3877	-230.8429	-236.1035	-232.5102	-191.7807	-134.3895	-70.9128	-27.4588	-14.8918 (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												922.4147 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												168.4789
Water heating fuel used												1580.6540 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.2665, total flow = 29.0000, SFP = 0.1471) mechanical ventilation fans (SFP = 0.1471)												42.7485 (230a)
Total electricity for the above, kWh/year												42.7485 (231)
Electricity for lighting (calculated in Appendix L)												204.6836 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2634.7180 (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												115.7829 (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	922.4147	0.1571	144.9051 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1580.6540	0.1410	222.9111 (264)
Space and water heating			367.8163 (265)
Pumps, fans and electric keep-hot	42.7485	0.1387	5.9297 (267)
Energy for lighting	204.6836	0.1443	29.5422 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1167.6312	0.1344	-156.8796
PV Unit electricity exported	-1467.0868	0.1234	-181.0453
Total			-337.9249 (269)
Total CO2, kg/year			65.3633 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.7000 (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	922.4147	1.5815	1458.8431 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1580.6540	1.5215	2404.9084 (278)
Space and water heating			3863.7515 (279)
Pumps, fans and electric keep-hot	42.7485	1.5128	64.6699 (281)
Energy for lighting	204.6836	1.5338	313.9506 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1167.6312	1.4966	-1747.4310
PV Unit electricity exported	-1467.0868	0.4529	-664.4155
Total			-2411.8465 (283)
Total Primary energy kWh/year			1830.5255 (286)
Dwelling Primary energy Rate (DPER)			19.6000 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7000 (1b)	x 2.7000 (2b)	= 126.0900 (1b) -
First floor	46.7000 (1c)	x 2.4000 (2c)	= 112.0800 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 238.1700 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) =	0.1260 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3760 (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) =	0.3478 (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	0.4434	0.4347	0.4260	0.3825	0.3738	0.3304	0.3304	0.3217	0.3478	0.3738	0.3912	0.4086 (22b)
Effective ac	0.5983	0.5945	0.5907	0.5732	0.5699	0.5546	0.5546	0.5517	0.5605	0.5699	0.5765	0.5835 (25)

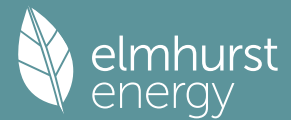
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1800	1.0000	2.1800		(26)
TER Opening Type (Uw = 1.20)			18.6300	1.1450	21.3321		(27)
Heatloss Floor 1			46.7000	0.1300	6.0710		(28a)
External Wall 1	98.5000	20.8100	77.6900	0.1800	13.9842		(29a)
External Roof 1	46.7000		46.7000	0.1100	5.1370		(30)
Total net area of external elements Aum(A, m ²)			191.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.7043		(33)
Party Wall 1			48.0000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	
List of Thermal Bridges	250.0000 (35)
K1 Element	
E5 Ground floor (normal)	Length 19.5000 Psi-value 0.1600 Total 3.1200
E6 Intermediate floor within a dwelling	19.5000 0.0000 0.0000
E16 Corner (normal)	10.2000 0.0900 0.9180
E18 Party wall between dwellings	10.2000 0.0600 0.6120
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6500 (36)
Point Thermal bridges	(36a) = 0.0500 (36a)
Total fabric heat loss	(33) + (36) + (36a) = 53.4043 (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	47.0241	46.7241	46.4300	45.0488	44.7904	43.5873	43.5873	43.3646	44.0507	44.7904	45.3132	45.8597 (38)
Heat transfer coeff	100.4284	100.1284	99.8343	98.4531	98.1946	96.9916	96.9916	96.7688	97.4550	98.1946	98.7174	99.2640 (39)
Average = Sum(39)m / 12 =												98.4518
HLP	1.0753	1.0720	1.0689	1.0541	1.0513	1.0385	1.0385	1.0361	1.0434	1.0513	1.0569	1.0628 (40)
HLP (average)												1.0541

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Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.6695 (42)
Hot water usage for mixer showers												68.7135 (42a)
Hot water usage for baths												29.6852 (42b)
Hot water usage for other uses												41.9679 (42c)
Average daily hot water use (litres/day)												129.3641 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	140.7317	137.7266	134.0670	128.5022	123.9832	119.1249	117.2578	120.9016	124.7445	129.8449	135.4954	140.3667 (44)
Energy content (annual)	222.8845	196.1208	206.0560	175.9131	166.9052	146.4779	141.8132	149.7014	153.8225	176.1983	193.0381	219.7803 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2148.7113
Water storage loss:												33.4327
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss												27.6637 (56)
If cylinder contains dedicated solar storage												27.6637 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												273.8106
WWHRS												-31.5338 (62)
PV diverter												-0.0000 (63a)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h												242.2768
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2455.3261 (64)
Electric shower(s)												0.0000 (64a)
Heat gains from water heating, kWh/month												114.8500
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	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729	133.4729 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												124.5793 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												245.1957 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												36.3473 (69)
Pumps, fans												3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												-106.7783 (71)
Water heating gains (Table 5)												154.3682 (72)
Total internal gains												590.1851 (73)
6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	2.4300	11.2829	0.6300	0.7000	0.7700	8.3792 (75)						
Southeast	5.3900	36.7938	0.6300	0.7000	0.7700	60.6088 (77)						
Northwest	10.8100	11.2829	0.6300	0.7000	0.7700	37.2752 (81)						
Solar gains	106.2631	196.1699	308.6880	449.9943	565.6557	588.6717	556.2618	465.8292	356.9688	227.6700	130.0403	89.1521 (83)
Total gains	696.4483	799.6772	887.4850	1008.4436	1096.0756	1097.1031	1045.4551	956.0034	861.8407	752.7475	686.9024	667.1313 (84)
7. Mean internal temperature (heating season)												

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.5844	64.7780	64.9688	65.8802	66.0536	66.8729	66.8729	67.0269	66.5549	66.0536	65.7038	65.3420
alpha	5.3056	5.3185	5.3313	5.3920	5.4036	5.4582	5.4582	5.4685	5.4370	5.4036	5.3803	5.3561
util living area	0.9945	0.9877	0.9702	0.9046	0.7580	0.5545	0.4064	0.4618	0.7245	0.9411	0.9878	0.9956 (86)
MIT	19.8544	20.0428	20.3167	20.6741	20.9037	20.9855	20.9978	20.9957	20.9437	20.6344	20.1901	19.8297 (87)
Th 2	20.0211	20.0237	20.0263	20.0385	20.0408	20.0514	20.0514	20.0534	20.0473	20.0408	20.0362	20.0313 (88)
util rest of house	0.9927	0.9839	0.9607	0.8766	0.7009	0.4773	0.3198	0.3688	0.6449	0.9172	0.9832	0.9941 (89)
MIT 2	18.6960	18.9369	19.2822	19.7199	19.9647	20.0437	20.0507	20.0519	20.0116	19.6859	19.1348	18.6721 (90)
Living area fraction									fLA = Living area / (4) =			0.2109 (91)
MIT	18.9403	19.1701	19.5004	19.9211	20.1627	20.2423	20.2505	20.2510	20.2082	19.8859	19.3574	18.9163 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9403	19.1701	19.5004	19.9211	20.1627	20.2423	20.2505	20.2510	20.2082	19.8859	19.3574	18.9163 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9899	0.9794	0.9542	0.8727	0.7087	0.4931	0.3381	0.3884	0.6592	0.9124	0.9789	0.9918 (94)
Useful gains	689.4291	783.1845	846.8315	880.0893	776.7666	541.0303	353.4299	371.3365	568.1452	686.8316	672.3950	661.6468 (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	1470.3063	1428.8443	1297.8832	1085.0635	830.9960	547.2592	354.0658	372.6558	595.2720	911.8288	1210.0210	1460.7954 (97)
Space heating kWh	580.9726	433.8834	335.5825	147.5814	40.3467	0.0000	0.0000	0.0000	0.0000	167.3979	387.0907	594.5666 (98a)
Space heating requirement - total per year (kWh/year)												2687.4219
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	580.9726	433.8834	335.5825	147.5814	40.3467	0.0000	0.0000	0.0000	0.0000	167.3979	387.0907	594.5666 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2687.4219
Space heating per m2										(98c) / (4) =		28.7733 (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 %)												92.3000 (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	580.9726	433.8834	335.5825	147.5814	40.3467	0.0000	0.0000	0.0000	0.0000	167.3979	387.0907	594.5666 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	629.4395	470.0795	363.5780	159.8932	43.7126	0.0000	0.0000	0.0000	0.0000	181.3628	419.3833	644.1675 (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	242.2768	214.2298	227.7786	201.0147	195.2949	176.4767	174.6630	181.4053	183.1532	203.6025	215.6740	239.7566 (64)
Efficiency of water heater (217)m	85.9473	85.6086	84.9273	83.3776	81.2093	79.8000	79.8000	79.8000	79.8000	83.6242	85.3555	79.8000 (216)
Fuel for water heating, kWh/month	281.8899	250.2435	268.2042	241.0897	240.4835	221.1487	218.8760	227.3249	229.5153	243.4733	252.6772	278.7466 (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	25.8851	20.7660	18.6975	13.6986	10.5812	8.6449	9.6525	12.5467	16.2969	21.3824	24.1514	26.6046 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-42.9843	-60.2425	-86.0866	-96.1999	-103.2196	-96.1326	-94.9038	-89.8151	-80.8000	-68.5615	-47.1125	-37.2011 (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	-25.3937	-53.2873	-105.6818	-158.4099	-209.1728	-210.0948	-207.6603	-175.9911	-129.1905	-76.1467	-33.8819	-20.0942 (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												

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Space heating fuel - main system 1	2911.6164 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2953.6727 (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)	208.9078 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2308.2645 (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	3851.9324 (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	2911.6164	0.2100	611.4394 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2953.6727	0.2100	620.2713 (264)
Space and water heating			1231.7107 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	208.9078	0.1443	30.1519 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-903.2596	0.1347	-121.6873
PV Unit electricity exported	-1405.0049	0.1260	-176.9618
Total			-298.6492 (269)
Total CO2, kg/year			975.1427 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.4400 (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	2911.6164	1.1300	3290.1265 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2953.6727	1.1300	3337.6502 (278)
Space and water heating			6627.7767 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	208.9078	1.5338	320.4298 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-903.2596	1.4979	-1353.0021
PV Unit electricity exported	-1405.0049	0.4623	-649.5748
Total			-2002.5769 (283)
Total Primary energy kWh/year			5075.7304 (286)
Target Primary Energy Rate (TPER)			54.3400 (287)