ENERGY REPORT

building certification | compliance | testing

Energy Statement

for planning

37 Latham Road, Twickenham, TW1 1BN

J02997

9th May 2024

Issue:1

Registry of Amendments

Revision	Date	Amendment Details	Prepared by
1	09/05/24	Initial issue	T Pope

About Energy Report Limited

A specialist building energy and sustainability consultancy offering expertise and experience to our clients within the construction and building sectors. Offering a full inclusive service from design to completion for any energy efficiency or sustainability issue.

Contents

1.0 EXECUTIVE SUMMARY

This Energy Statement has been prepared by Energy Report Ltd on behalf of the client in support of a full planning application for the proposed 1 new end of terrace house to the side of 37 Latham Road, London, N11 within the London borough of Richmond upon Thames ('LBR')

The report has been developed to address the energy performance policy requirements of the London Plan (2021) and LBR Local Plan. The report will highlight the proposed strategy to meet the planning requirements of 35% reduction in CO2 through the application of the energy hierarchy.

The scheme is a residential development of 1 house. All parts of development will be assessed in accordance with Part L1 2021 of the Building Regulations using approved SAP software.

The proposed strategy has been developed in line with the energy hierarchy methodology used to demonstrate the effects of the proposed energy efficiency measures is the 4 stage Energy hierarchy detailed in the London Plan 2021:

1. Be Lean: Use Less Energy
   In the first instance an optimised building fabric is proposed to reduce the energy demand of the scheme via a 'fabric first' approach. The remaining energy demands are to be met by energy efficient building services systems.

2. Be Clean: Supply Energy Efficiently
   Utilise local energy sources

3. Be Green: Use Renewable Energy
   Use of highly solar photovoltaic panels coupled with direct electric heating.

4. Be Seen: Energy Monitoring Post Construction
   Extensive metering of all energy uses will be in place

Extensive SAP energy performance calculations undertaken for the proposed development demonstrate that implementing these measures will reduce the CO_2 emissions associated with the scheme.

In accordance with the GLA's guidance on energy assessments, all CO_2 calculations have been carried out using SAP 10 carbon conversion factors:

Electricity – 0.233KgCO_2kWh
Gas - 0.210KgCO_2kWh

Summary of CO_2 emission reduction for the Proposed Development using SAP 10 carbon factors

Scenario	Regulated CO2 Emissions (T/yr) Domestic	Saving achieved on CO2 Emissions
Baseline Emissions	9.77	
Be Lean Emissions	9.77	
Be Clean Emissions	9.77	-
Be Green Emissions	6.12	37.4%

Table 1 - summary of emission reduction SAP 10

The Part L calculations demonstrating compliance Part L using the SAP 2021 carbon emission factors are included in Appendix 1.

2.0 DEVELOPMENT DESCRIPTION

Application for full planning permission for development of the site to provide 1 house

3.0 PLANNING POLICES AND PROJECT REQUIREMENTS

The relevant planning policy energy related documents for the site are:

- The London Plan 2021 (adopted March 2021) which is the overarching Spatial Development Strategy for the entirety of Greater London.

London Plan Policy SI 2 ('Minimising Greenhouse Gas Emissions') Development proposals should make the fullest contribution minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- BE LEAN: Use Less Energy
- BE CLEAN: supply energy efficiently
- BE GREEN: use renewable energy
- BE SEEN: Energy Monitoring Post Construction

This development is considered a minor development of between 1 and 9 units

4.0 ENERGY STRATEGY AND APPROACH

The methodology used to determine the CO2 emissions is in accordance with the London Plan's 4 step Energy Hierarchy. The Energy hierarchy has four priorities, seeking to reduce energy use before meeting remaining demand by the leanest means possible.

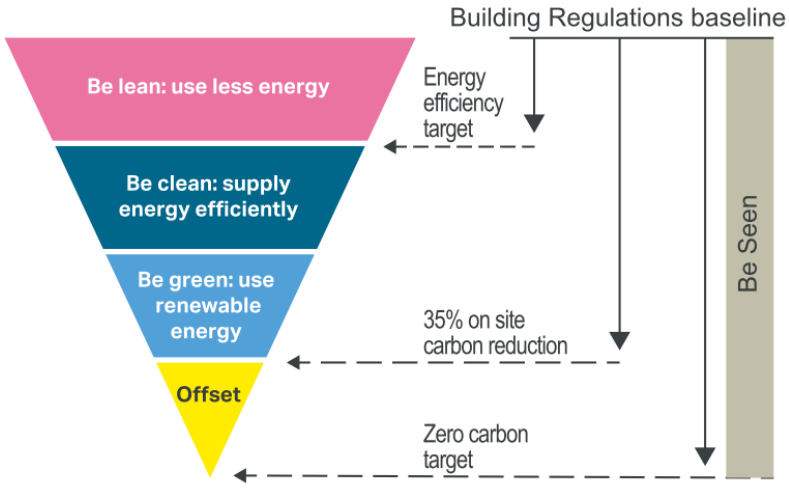

Figure 2 – Be Lean, Be Clean, Be Green

Be Lean – The first step is to reduce the requirement for energy by enhancing the thermal performance of the building envelope, utilising efficient and controllable equipment & lighting

Be Clean – to supply energy cleanly with less inherent wastage through generation & transmission; this involves investigating the feasibility of providing energy via heat networks, district heating and combined heat and power

Be Green – involves investigations into renewable and zero carbon technologies

Be Seen – Monitor and report energy savings

5.0 CALCULATION METHOD - Baseline

The baseline energy and carbon dioxide emissions are calculated using the Standard assessment procedure (SAP).

SAP replicates a version of the building which is the same size, shape and fitted with the same services but has a standard set of performance criteria applied.

This is then used to generate the 'Target Emission Rate'.(TER) which is the baseline allowable standard to meet Building Regulations Part L compliance..

The proposed house has been assessed using approved software (SAP 10) and a summary of the baseline TER's are provided in the table below. Please refer to Appendix 1 for a full schedule of the calculation results.

Baseline CO_2 calculations

Block	TER (kgCO2/m²/year)	Floor Area m²	Annual Emissions CO_2 (Tonnes/year)
House	9.77	115	1.12

Table 3 – baseline CO_2 emissions

6.0 CALCULATION METHOD – Be Lean

A fabric first approach has been taken, aiming to achieve very high efficiency standards thus reducing the requirement for energy.

The following efficiency improvements have been incorporated into the scheme:

- Thermal performance: improved U-values as detailed in table 4 below.
- Low leakage/infiltration: design air permeability levels of 5.0 m³/h/m²@50pa

Be Lean Thermal properties.

Building Element	Proposed Development ($W/m^2 K$)	Part L limits ($W/m^2 K$)
Walls	0.16	0.26
Ground Floor	0.12	0.18
Roof	0.11/0.14	0.16
Window	1.0	1.6
Door	1.0	1.6
Design Air Permeability	5.0	8.0

Table 4 – proposed thermal properties

The Building Emission Rate (BER) has been calculated for each block of the development using the values above and returns the following results:

CALCULATION METHOD – Be Clean

The London Plan policy SI 2 requires developers to investigate the feasibility of connecting to a heat network/ district heating system or consider onsite combined heat and power (CHP).

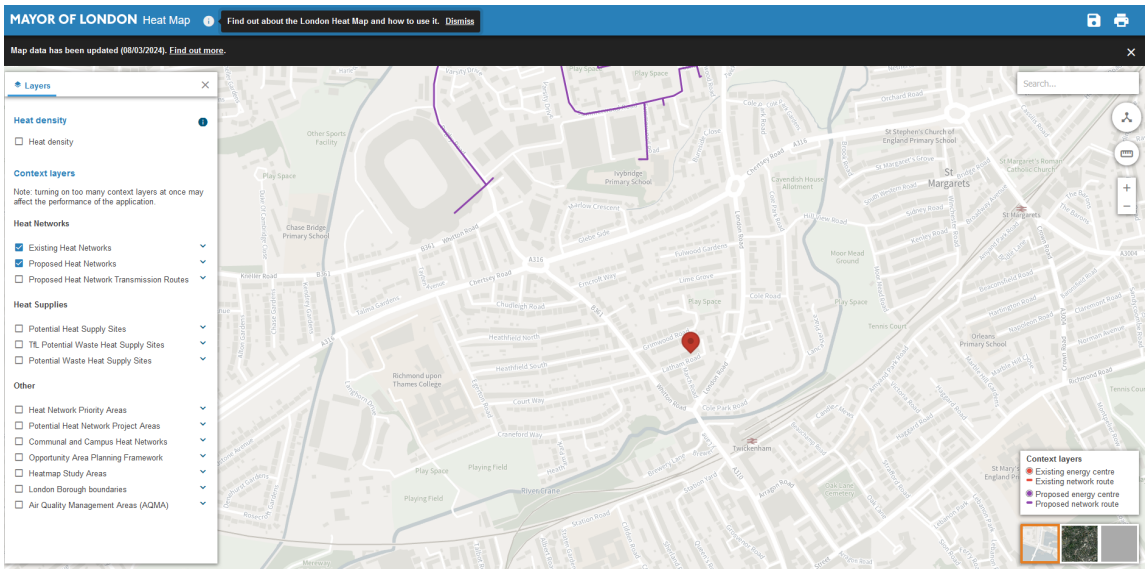

Figure 3 – Extract of the London Plan Heat Map

The above extract from the London Heat map identifies there are proposed heat networks that are within 1km of the site.

Though there is a proposed heat network within the vicinity of the proposed development, the planned route of the heat network is in the opposite direction of the development in question and over 300m away, it is therefore considered unlikely and technically and cost prohibitive to connect to this heat network.

8.0 CALCULATION METHOD – Be Green

The London Plan requires that all minor developments meet 35% reduction in CO2 beyond Part L Building Regulations.

The proposed solution is the use of Solar Photovoltaic panels

Solar Photovoltaic

- PVs, collect the sun's energy into electricity this can be stored via a battery or directly transferred electricity system.
- Solar PV systems are good for individual dwellings or small developments.

Other discounted renewable options

Wind power

- Wind turbines are suited for installation in exposed areas or possibly atop taller buildings.
- As a relatively low urban development, wind power is considered unsuitable for this project.

Air source heat pump

- This option uses a packaged heat pump with multiple compressors and integrated hydraulic module located externally. Users connect to the system using heat interface units (as per the boilers) but incoming temperatures are lower.

Solar Thermal (Hot Water)

- Like PVs, solar thermal systems collect the sun's energy but use it to heat water. This can be stored or transferred directly into the heating system.
- Solar thermal systems are good for individual dwellings or small developments, but the erratic operation and inconsistent temperatures achieved do not make them viable for larger schemes such as this.
- On this basis, solar thermal is discounted for this development.

On site Combined Heat and Power (CHP)

- Using SAP methodology, CHP provides significant carbon reductions due to the large difference between gas and electricity carbon factors (and gas is converted to electricity in this case)
- High temperature system which, provides good flexibility for tenant connections
- Easy to integrate to the district heating network

- Provides electricity as well as heat

The following table sets CO2 calculation reduction under the Be Green requirements

In accordance with the requirements of the GLA, these are reported as below using SAP 10 factors.

Be Green CO_2 calculations

Block	BER (kgCO2/m^2/year)	Floor Area m^2	Annual Emissions CO_2 (Tonnes/year)
House	6.12	115	0.70

Table 3 – Green CO_2 emissions

9.0 Be Seen - Energy Monitoring

London Plan Policy SI2 requests all developments to 'be seen', to monitor, verify and report on energy performance.

The GLA requires all major development proposals to report on their modelled and measured operational energy performance. This will improve transparency on energy usage on sites, reduce the performance gap between modelled and measured energy use, and provide the applicant, building managers and occupants clarity on the performance of the building, equipment and renewable energy technologies.

During the planning process, the responsibility for data submission via the planning stage webform and ensuring accurate estimates as the design develops lies with the Applicant. The Applicant will be expected to ensure that all affected parties (for example, developer, building owner, landlord or occupier) are aware of their responsibilities at subsequent reporting stages. This should be appropriately secured through a legal agreement (Section 106 Agreement) between the Local Planning Authority and the applicant specifically for the as-built and in-use reporting stages. The responsibilities for reporting should be clearly set out in this agreement.

10.0 CONCLUSION

The Energy Statement outlines how the proposed development at 37 Latham Road will meet the energy requirements as specified by the London Plan and LBR Local Plan policies.

This Energy Statement has been prepared following the principles of the London Plan Energy Hierarchy: Be Lean, Be Clean, Be Green and Be Seen. In addition to the Energy Hierarchy, the Energy Statement also takes into consideration adopted London Plan (2021). and the requirements of Richmond upon Thames Council

Be Green: The Proposed Development achieves a reduction in CO_2 emissions by 37% as a result of the use of Solar PV panel. This meets the requirement outlined in Richmond upon Thames Council local Plan policy.

Appendix 1- SAP Summaries

Full SAP Calculation Printout

Property Reference	J02997 37 Latham Road	**Issued on Date**	09/05/2024
Assessment Reference	As Designed Gas Boiler/Solar	**Prop Type Ref**	End Terrace House
Property	37, Latham Road, Twickenham, TW1 1BN		

SAP Rating	93 A	**DER**	6.12	**TER**	9.77
Environmental	95 A	**% DER < TER**			37.36
CO_2 Emissions (t/year)	0.45	**DFEE**	35.69	**TFEE**	39.65
Compliance Check	See BREL	**% DFEE < TFEE**			9.98
% DPER < TPER	27.88	**DPER**	36.81	**TPER**	51.04

Assessor Details	Mr. Stephen Harrison	**Assessor ID**	W557-0001
Client	3 Form Consulting, 3 Form Consulting		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5600 (1b)	x	2.5000 (2b)	=	166.4000	(1b) - (3b)
First floor	49.2100 (1c)	x	2.7000 (2c)	=	132.8670	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	115.7700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	299.2670	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0668	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3168	(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) =	0.2931	(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	0.3737	0.3663	0.3590	0.3224	0.3150	0.2784	0.2784	0.2711	0.2931	0.3150	0.3297	0.3444	(22b)
Effective ac	0.5698	0.5671	0.5644	0.5520	0.5496	0.5388	0.5388	0.5367	0.5429	0.5496	0.5544	0.5593	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.00)			11.3600	0.9615	10.9231			(27)
Opening Type 2			1.8900	1.0000	1.8900			(26)
Opening Type 4 (Uw = 1.40)			8.4000	1.3258	11.1364			(27)
Opening			0.9600	0.9615	0.9231			(27a)
Opening			0.9600	0.9615	0.9231			(27a)
Heatloss Floor 1			66.5600	0.1200	7.9872	110.0000	7321.6000	(28a)
External Wall 1	113.6770	21.6500	92.0270	0.1600	14.7243	60.0000	5521.6200	(29a)
External Roof 1	49.6300		49.6300	0.1100	5.4593	9.0000	446.6700	(30)
External Roof 2	3.7900		3.7900	0.1400	0.5306	9.0000	34.1100	(30)
External Roof 3	13.1400	1.9200	11.2200	0.1400	1.5708	9.0000	100.9800	(30)
Total net area of external elements Aum(A, m2)			246.7970					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.0678			(33)
Party Wall 1			70.9100	0.0000	0.0000	180.0000	12763.8000	(32)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	26188.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.2139 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	13.1900	0.0260	0.3429

E3 Sill	12.2900	0.0220	0.2704	
E4 Jamb	39.7600	0.0170	0.6759	
E5 Ground floor (normal)	22.2400	0.0470	1.0453	
E6 Intermediate floor within a dwelling	21.5100	0.0010	0.0215	
E16 Corner (normal)	18.1000	0.0410	0.7421	
E18 Party wall between dwellings	10.4000	0.0320	0.3328	
R1 Head of roof window	3.2000	0.2400	0.7680	
R2 Sill of roof window	3.2000	0.2400	0.7680	
R3 Jamb of roof window	4.8000	0.2400	1.1520	
E10 Eaves (insulation at ceiling level)	7.3100	0.0530	0.3874	
E11 Eaves (insulation at rafter level)	12.0600	0.0170	0.2050	
E12 Gable (insulation at ceiling level)	14.2000	0.0370	0.5254	
E14 Flat roof	1.9000	0.1600	0.3040	
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0860	-0.6622	
P1 Party wall - Ground floor	14.8000	0.0380	0.5624	
P2 Party wall - Intermediate floor within a dwelling	12.5600	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	14.8000	0.0330	0.4884	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9294 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 63.9972 (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	56.2735	56.0058	55.7434	54.5108	54.2802	53.2066	53.2066	53.0078	53.6202	54.2802	54.7467	55.2344	(38)
Heat transfer coeff	120.2707	120.0030	119.7406	118.5080	118.2774	117.2038	117.2038	117.0050	117.6174	118.2774	118.7439	119.2316	(39)
Average = Sum(39)m / 12 =												118.5069	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0389	1.0366	1.0343	1.0237	1.0217	1.0124	1.0124	1.0107	1.0160	1.0217	1.0257	1.0299	(40)
HLP (average)												1.0236	
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 2.8454 (42)
Hot water usage for mixer showers

98.9002	97.4139	95.2481	91.1043	88.0462	84.6359	82.6974	84.8468	87.2030	90.8646	95.0975	98.5213	(42a)

Hot water usage for baths

31.0544	30.5932	29.9437	28.7462	27.8495	26.8552	26.3182	26.9631	27.6653	28.7292	29.9514	30.9494	(42b)

Hot water usage for other uses

43.7695	42.1779	40.5863	38.9946	37.4030	35.8114	35.8114	37.4030	38.9946	40.5863	42.1779	43.7695	(42c)

Average daily hot water use (litres/day) 159.7654 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.7241	170.1850	165.7781	158.8451	153.2987	147.3025	144.8270	149.2130	153.8629	160.1801	167.2268	173.2401	(44)
Energy conte	275.1364	242.3411	254.7947	217.4510	206.3696	181.1256	175.1557	184.7568	189.7284	217.3629	238.2452	271.2522	(45)
Energy content (annual)										Total = Sum(45)m =		2653.7197	
Distribution loss (46)m = 0.15 x (45)m	41.2705	36.3512	38.2192	32.6176	30.9554	27.1688	26.2734	27.7135	28.4593	32.6044	35.7368	40.6878	(46)
Water storage loss:													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(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	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(64)
										Total per year (kWh/year) = Sum(64)m =		2971.0507	(64)
12Total per year (kWh/year)												2971	(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	91.4829	80.5784	84.7192	72.3025	68.6179	60.2243	58.2393	61.4316	63.0847	72.2732	79.2165	90.1914	(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	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	144.5836	160.0747	144.5836	149.4031	144.5836	149.4031	144.5836	144.5836	149.4031	144.5836	149.4031	144.5836	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	279.5993	282.5007	275.1893	259.6243	239.9763	221.5099	209.1733	206.2719	213.5833	229.1483	248.7963	267.2626	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	(71)
Water heating gains (Table 5)	122.9608	119.9084	113.8700	100.4201	92.2283	83.6448	78.2786	82.5694	87.6176	97.1414	110.0230	121.2249	(72)
Total internal gains	615.8244	631.1644	602.3235	578.1281	545.4689	520.2385	497.7162	499.1056	516.2846	539.5539	576.9029	601.7518	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

		W/m2	or Table 6b	or Table 6c	Table 6d		
North	3.0100	10.6334	0.5700	0.7000	0.7700	8.8500	(74)
East	1.1000	19.6403	0.5700	0.7000	0.7700	5.9737	(76)
South	7.2500	46.7521	0.5700	0.7000	0.7700	93.7227	(78)
North	0.9600	26.0000	0.5700	0.7000	1.0000	8.9631	(82)
East	0.9600	26.0000	0.5700	0.7000	1.0000	8.9631	(82)
North	8.4000	10.6334	0.6300	0.7000	0.7700	27.2975	(74)

Solar gains	153.7703	271.4908	398.3415	541.0206	651.0472	666.6245	634.2210	548.7271	447.0525	307.1592	185.8872	130.5109 (83)
Total gains	769.5947	902.6552	1000.6650	1119.1487	1196.5161	1186.8630	1131.9372	1047.8327	963.3372	846.7131	762.7901	732.2627 (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	60.4857	60.6207	60.7535	61.3854	61.5051	62.0685	62.0685	62.1739	61.8502	61.5051	61.2635	61.0129	
alpha	5.0324	5.0414	5.0502	5.0924	5.1003	5.1379	5.1379	5.1449	5.1233	5.1003	5.0842	5.0675	
util living area	0.9950	0.9884	0.9728	0.9202	0.7990	0.6086	0.4512	0.5054	0.7576	0.9483	0.9893	0.9961	(86)
MIT	19.9843	20.1398	20.3525	20.6280	20.8283	20.9182	20.9358	20.9331	20.8765	20.6102	20.2494	19.9592	(87)
Th 2	20.0511	20.0530	20.0549	20.0637	20.0653	20.0730	20.0730	20.0745	20.0701	20.0653	20.0620	20.0585	(88)
util rest of house	0.9936	0.9850	0.9648	0.8972	0.7478	0.5297	0.3584	0.4078	0.6832	0.9283	0.9856	0.9950	(89)
MIT 2	18.8591	19.0582	19.3276	19.6705	19.8938	19.9830	19.9943	19.9946	19.9489	19.6577	19.2060	18.8330	(90)
Living area fraction									fLA = Living area / (4) =			0.1325	(91)
MIT	19.0082	19.2015	19.4634	19.7973	20.0176	20.1069	20.1190	20.1189	20.0718	19.7839	19.3443	18.9822	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8582	19.0515	19.3134	19.6473	19.8676	19.9569	19.9690	19.9689	19.9218	19.6339	19.1943	18.8322	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9910	0.9802	0.9566	0.8848	0.7357	0.5194	0.3478	0.3964	0.6700	0.9164	0.9808	0.9928	(94)
Useful gains	762.6559	884.7852	957.1926	990.2540	880.3207	616.3992	393.7146	415.3673	645.4336	775.9452	748.1444	727.0156	(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	1750.9251	1698.2276	1534.2888	1273.6457	966.0454	627.8497	394.8650	417.5847	684.7441	1068.5032	1436.1229	1744.6209	(97)
Space heating kWh	735.2723	546.6333	429.3595	204.0420	63.7792	0.0000	0.0000	0.0000	0.0000	217.6631	495.3445	757.0983	(98a)
Space heating requirement - total per year (kWh/year)												3449.1923	
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	735.2723	546.6333	429.3595	204.0420	63.7792	0.0000	0.0000	0.0000	0.0000	217.6631	495.3445	757.0983	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3449.1923	
Space heating per m2											(98c) / (4) =	29.7935	(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)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
Efficiency of main space heating system 1 (in %)	88.8000 (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	735.2723	546.6333	429.3595	204.0420	63.7792	0.0000	0.0000	0.0000	0.0000	217.6631	495.3445	757.0983	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)	828.0093	615.5781	483.5130	229.7770	71.8234	0.0000	0.0000	0.0000	0.0000	245.1162	557.8204	852.5882	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(64)
Efficiency of water heater												330.5476	(216)
(217)m	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	(217)
Fuel for water heating, kWh/month	91.3901	80.6795	85.2362	73.6756	70.5862	62.6862	61.1431	64.0477	65.2887	73.9120	79.9665	90.2150	(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	36.9177	29.6167	26.6666	19.5371	15.0910	12.3295	13.7665	17.8942	23.2429	30.4959	34.4450	37.9437	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.2938	-61.6547	-94.2390	-111.4034	-124.0907	-116.9726	-115.1081	-106.9814	-92.1029	-72.7838	-46.4360	-35.2192	(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	-17.7794	-39.9117	-86.0240	-139.6692	-193.5286	-198.1524	-194.6604	-158.8533	-109.3319	-59.0987	-24.2389	-13.7975	(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	3884.2255	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	330.5476	
Water heating fuel used	898.8268	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	297.9468	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2253.3316	(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	2913.6676	(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	3884.2255	0.2100	815.6874	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	898.8268	0.1413	126.9792	(264)
Space and water heating			942.6666	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	297.9468	0.1443	43.0029	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1018.2856	0.1336	-136.0082	
PV Unit electricity exported	-1235.0460	0.1240	-153.1396	
Total			-289.1478	(269)
Total CO2, kg/year			708.4510	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.1200	(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	3884.2255	1.1300	4389.1749	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	898.8268	1.5224	1368.3668	(278)
Space and water heating			5757.5416	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	297.9468	1.5338	457.0007	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1018.2856	1.4936	-1520.8929	
PV Unit electricity exported	-1235.0460	0.4551	-562.0137	
Total			-2082.9066	(283)
Total Primary energy kWh/year			4261.7365	(286)
Dwelling Primary energy Rate (DPER)			36.8100	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5600 (1b)	x	2.5000 (2b)	=	166.4000 (1b) - (3b)	
First floor	49.2100 (1c)	x	2.7000 (2c)	=	132.8670 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	115.7700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	299.2670	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1337	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3837	(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) =	0.3549	(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	0.4525	0.4436	0.4347	0.3904	0.3815	0.3371	0.3371	0.3283	0.3549	0.3815	0.3992	0.4170	(22b)
Effective ac	0.6024	0.5984	0.5945	0.5762	0.5728	0.5568	0.5568	0.5539	0.5630	0.5728	0.5797	0.5869	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			19.7600	1.1450	22.6260			(27)
Opening			0.9600	1.5918	1.5281			(27a)
Opening			0.9600	1.5918	1.5281			(27a)
Heatloss Floor 1			66.5600	0.1300	8.6528			(28a)
External Wall 1	113.6770	21.6500	92.0270	0.1800	16.5649			(29a)
External Roof 1	49.6300		49.6300	0.1100	5.4593			(30)
External Roof 2	3.7900		3.7900	0.1100	0.4169			(30)
External Roof 3	13.1400	1.9200	11.2200	0.1100	1.2342			(30)
Total net area of external elements Aum(A, m2)			246.7970					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9002			(33)
Party Wall 1			70.9100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	226.2139	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	13.1900	0.0500	0.6595
E3	Sill	12.2900	0.0500	0.6145
E4	Jamb	39.7600	0.0500	1.9880
E5	Ground floor (normal)	22.2400	0.1600	3.5584
E6	Intermediate floor within a dwelling	21.5100	0.0000	0.0000
E16	Corner (normal)	18.1000	0.0900	1.6290
E18	Party wall between dwellings	10.4000	0.0600	0.6240
R1	Head of roof window	3.2000	0.0800	0.2560
R2	Sill of roof window	3.2000	0.0600	0.1920
R3	Jamb of roof window	4.8000	0.0800	0.3840
E10	Eaves (insulation at ceiling level)	7.3100	0.0600	0.4386
E11	Eaves (insulation at rafter level)	12.0600	0.0400	0.4824
E12	Gable (insulation at ceiling level)	14.2000	0.0600	0.8520
E14	Flat roof	1.9000	0.0800	0.1520
E17	Corner (inverted - internal area greater than external area)	7.7000	-0.0900	-0.6930
P1	Party wall - Ground floor	14.8000	0.0800	1.1840
P2	Party wall - Intermediate floor within a dwelling	12.5600	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	14.8000	0.1200	1.7760

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.0974	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 73.9976	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	59.4888	59.0962	58.7114	56.9040	56.5659	54.9917	54.9917	54.7002	55.5980	56.5659	57.2500	57.9651	(38)
Heat transfer coeff	133.4864	133.0938	132.7090	130.9016	130.5635	128.9893	128.9893	128.6978	129.5956	130.5635	131.2475	131.9627	(39)
Average = Sum(39)m / 12 =												130.9000	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1530	1.1496	1.1463	1.1307	1.1278	1.1142	1.1142	1.1117	1.1194	1.1278	1.1337	1.1399	(40)
HLP (average)												1.1307	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8454	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.9274	70.8465	69.2714	66.2576	64.0336	61.5534	60.1436	61.7068	63.4204	66.0834	69.1618	71.6518	(42a)

Hot water usage for baths

31.0544	30.5932	29.9437	28.7462	27.8495	26.8552	26.3182	26.9631	27.6653	28.7292	29.9514	30.9494	(42b)

Hot water usage for other uses

43.7695	42.1779	40.5863	38.9946	37.4030	35.8114	35.8114	37.4030	38.9946	40.5863	42.1779	43.7695	(42c)

Average daily hot water use (litres/day)	134.8974	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.7513	143.6175	139.8013	133.9985	129.2861	124.2200	122.2732	126.0729	130.0803	135.3989	141.2911	146.3707	(44)
Energy conte	232.4181	204.5094	214.8694	183.4372	174.0440	152.7430	147.8788	156.1046	160.4020	183.7350	201.2951	229.1811	(45)
Energy content (annual)										Total = Sum(45)m =		2240.6178	
Distribution loss (46)m = 0.15 x (45)m													
	34.8627	30.6764	32.2304	27.5156	26.1066	22.9114	22.1818	23.4157	24.0603	27.5602	30.1943	34.3772	(46)

Water storage loss:		
Store volume	150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7527	(55)

Total storage loss

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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

	279.0130	246.5952	261.4643	228.5291	220.6389	197.8348	194.4737	202.6995	205.4939	230.3299	246.3869	275.7761	(62)
WWHRS	-32.8822	-29.0813	-30.4523	-25.2157	-23.5001	-20.1092	-18.8492	-20.0442	-20.8058	-24.5277	-27.7869	-32.2733	(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													
	246.1308	217.5139	231.0121	203.3134	197.1388	177.7256	175.6245	182.6553	184.6881	205.8022	218.6000	243.5028	(64)
										Total per year (kWh/year) = Sum(64)m =		2483.7075	(64)
12Total per year (kWh/year)												2484	(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													
	114.5550	101.6680	108.7200	97.0663	95.1455	86.8605	86.4456	89.1807	89.4071	98.3678	103.0041	113.4787	(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	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	142.8276	158.1306	142.8276	147.5885	142.8276	147.5885	142.8276	142.8276	147.5885	142.8276	147.5885	142.8276	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.5993	282.5007	275.1893	259.6243	239.9763	221.5099	209.1733	206.2719	213.5833	229.1483	248.7963	267.2626	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	(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)													
	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	(71)
Water heating gains (Table 5)													
	153.9717	151.2916	146.1290	134.8144	127.8838	120.6396	116.1904	119.8665	124.1766	132.2148	143.0612	152.5251	(72)
Total internal gains													
	645.0793	660.6035	632.8266	610.7079	579.3684	555.4187	533.8719	534.6467	551.0290	572.8713	608.1267	631.2960	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	11.4100	10.6334	0.6300	0.7000	0.7700	37.0791	(74)
East	1.1000	19.6403	0.6300	0.7000	0.7700	6.6026	(76)
South	7.2500	46.7521	0.6300	0.7000	0.7700	103.5883	(78)
North	0.9600	26.0000	0.6300	0.7000	1.0000	9.9066	(82)
East	0.9600	26.0000	0.6300	0.7000	1.0000	9.9066	(82)

Solar gains	167.0832	294.5776	430.9412	582.9822	699.3883	715.1814	680.8015	590.4780	482.8918	332.9552	201.9095	141.8534	(83)
Total gains	812.1625	955.1811	1063.7678	1193.6901	1278.7567	1270.6001	1214.6735	1125.1247	1033.9209	905.8265	810.0362	773.1494	(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	54.4974	54.6582	54.8166	55.5735	55.7174	56.3974	56.3974	56.5252	56.1335	55.7174	55.4270	55.1266	
alpha	4.6332	4.6439	4.6544	4.7049	4.7145	4.7598	4.7598	4.7683	4.7422	4.7145	4.6951	4.6751	
util living area													
	0.9941	0.9869	0.9706	0.9187	0.8030	0.6178	0.4605	0.5142	0.7611	0.9452	0.9876	0.9953	(86)
MIT	19.5772	19.7982	20.1065	20.5103	20.8115	20.9591	20.9917	20.9864	20.8919	20.4955	19.9710	19.5478	(87)
Th 2	19.9578	19.9605	19.9632	19.9758	19.9782	19.9893	19.9893	19.9913	19.9850	19.9782	19.9734	19.9684	(88)
util rest of house													
	0.9923	0.9830	0.9617	0.8944	0.7493	0.5326	0.3581	0.4073	0.6823	0.9235	0.9832	0.9938	(89)
MIT 2	18.3088	18.5914	18.9814	19.4829	19.8200	19.9654	19.9865	19.9862	19.9110	19.4776	18.8222	18.2788	(90)
Living area fraction										fLA = Living area / (4) =		0.1325	(91)
MIT	18.4769	18.7513	19.1305	19.6190	19.9514	20.0971	20.1197	20.1187	20.0410	19.6125	18.9744	18.4469	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4769	18.7513	19.1305	19.6190	19.9514	20.0971	20.1197	20.1187	20.0410	19.6125	18.9744	18.4469	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9886	0.9767	0.9523	0.8842	0.7478	0.5421	0.3716	0.4212	0.6871	0.9136	0.9772	0.9907	(94)
Useful gains	802.8778	932.9148	1013.0707	1055.4373	956.2102	688.8550	451.3633	473.8921	710.4050	827.5280	791.5779	765.9574	(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													
	1892.4205	1843.5253	1676.1771	1403.1333	1077.3260	709.0689	453.9992	478.5947	769.9258	1176.7011	1558.4907	1880.0647	(97)
Space heating kWh													
	810.6197	611.9303	493.3512	250.3411	90.1102	0.0000	0.0000	0.0000	0.0000	259.7847	552.1772	828.8959	(98a)
Space heating requirement - total per year (kWh/year)												3897.2102	
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													
	810.6197	611.9303	493.3512	250.3411	90.1102	0.0000	0.0000	0.0000	0.0000	259.7847	552.1772	828.8959	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3897.2102	
Space heating per m2											(98c) / (4) =	33.6634	(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	810.6197	611.9303	493.3512	250.3411	90.1102	0.0000	0.0000	0.0000	0.0000	259.7847	552.1772	828.8959	(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)	878.2446	662.9797	534.5083	271.2255	97.6275	0.0000	0.0000	0.0000	0.0000	281.4569	598.2418	898.0453	(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	246.1308	217.5139	231.0121	203.3134	197.1388	177.7256	175.6245	182.6553	184.6881	205.8022	218.6000	243.5028	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.5271	86.2491	85.7169	84.5275	82.4205	79.8000	79.8000	79.8000	79.8000	84.5833	86.0477	86.5827	(217)
Fuel for water heating, kWh/month	284.4553	252.1926	269.5058	240.5292	239.1867	222.7138	220.0809	228.8914	231.4387	243.3130	254.0452	281.2371	(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	29.6768	23.8078	21.4363	15.7051	12.1311	9.9112	11.0664	14.3845	18.6841	24.5145	27.6891	30.5016	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-57.7998	-79.3018	-110.9509	-121.2840	-127.8842	-118.2693	-116.7061	-111.5043	-102.0186	-88.9158	-62.7202	-50.2231	(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	-39.6571	-82.5086	-162.3704	-241.6031	-317.3586	-318.1868	-314.5287	-267.3407	-197.2741	-117.3321	-52.7186	-31.4381	(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	4222.3296	(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	2967.5897	(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)	239.5084	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3289.8948	(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	4225.5330	(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	4222.3296	0.2100	886.6892	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2967.5897	0.2100	623.1938	(264)
Space and water heating			1509.8830	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	239.5084	0.1443	34.5685	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1147.5779	0.1352	-155.1406	
PV Unit electricity exported	-2142.3169	0.1262	-270.2906	
Total			-425.4312	(269)
Total CO2, kg/year			1130.9496	(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	4222.3296	1.1300	4771.2324	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2967.5897	1.1300	3353.3764	(278)
Space and water heating			8124.6088	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	239.5084	1.5338	367.3661	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1147.5779	1.4997	-1720.9896	
PV Unit electricity exported	-2142.3169	0.4631	-992.1778	
Total			-2713.1674	(283)
Total Primary energy kWh/year			5908.9082	(286)
Target Primary Energy Rate (TPER)			51.0400	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5600 (1b)	x	2.5000 (2b)	=	166.4000 (1b) - (3b)	
First floor	49.2100 (1c)	x	2.7000 (2c)	=	132.8670 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	115.7700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	299.2670	(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	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1337	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3837	(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) =	0.3549	(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	0.4525	0.4436	0.4347	0.3904	0.3815	0.3371	0.3371	0.3283	0.3549	0.3815	0.3992	0.4170	(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	0.6024	0.5984	0.5945	0.5762	0.5728	0.5568	0.5568	0.5539	0.5630	0.5728	0.5797	0.5869	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.00)			11.3600	0.9615	10.9231			(27)
Opening Type 2			1.8900	1.0000	1.8900			(26)
Opening Type 4 (Uw = 1.40)			8.4000	1.3258	11.1364			(27)
Opening			0.9600	0.9615	0.9231			(27a)
Opening			0.9600	0.9615	0.9231			(27a)
Heatloss Floor 1			66.5600	0.1200	7.9872	110.0000	7321.6000	(28a)
External Wall 1	113.6770	21.6500	92.0270	0.1600	14.7243	60.0000	5521.6200	(29a)
External Roof 1	49.6300		49.6300	0.1100	5.4593	9.0000	446.6700	(30)
External Roof 2	3.7900		3.7900	0.1400	0.5306	9.0000	34.1100	(30)
External Roof 3	13.1400	1.9200	11.2200	0.1400	1.5708	9.0000	100.9800	(30)
Total net area of external elements Aum(A, m2)			246.7970					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.0678			(33)
Party Wall 1			70.9100	0.0000	0.0000	180.0000	12763.8000	(32)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	26188.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.2139 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	13.1900	0.0260	0.3429
E3	Sill	12.2900	0.0220	0.2704
E4	Jamb	39.7600	0.0170	0.6759
E5	Ground floor (normal)	22.2400	0.0470	1.0453
E6	Intermediate floor within a dwelling	21.5100	0.0010	0.0215
E16	Corner (normal)	18.1000	0.0410	0.7421
E18	Party wall between dwellings	10.4000	0.0320	0.3328
R1	Head of roof window	3.2000	0.2400	0.7680
R2	Sill of roof window	3.2000	0.2400	0.7680
R3	Jamb of roof window	4.8000	0.2400	1.1520
E10	Eaves (insulation at ceiling level)	7.3100	0.0530	0.3874
E11	Eaves (insulation at rafter level)	12.0600	0.0170	0.2050
E12	Gable (insulation at ceiling level)	14.2000	0.0370	0.5254
E14	Flat roof	1.9000	0.1600	0.3040
E17	Corner (inverted - internal area greater than external area)	7.7000	-0.0860	-0.6622
P1	Party wall - Ground floor	14.8000	0.0380	0.5624
P2	Party wall - Intermediate floor within a dwelling	12.5600	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	14.8000	0.0330	0.4884

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.9294 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.9972 (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	59.4888	59.0962	58.7114	56.9040	56.5659	54.9917	54.9917	54.7002	55.5980	56.5659	57.2500	57.9651	(38)
Heat transfer coeff	123.4860	123.0934	122.7086	120.9012	120.5631	118.9889	118.9889	118.6974	119.5952	120.5631	121.2471	121.9623	(39)

Average = Sum(39)m / 12 = 120.8996

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0666	1.0633	1.0599	1.0443	1.0414	1.0278	1.0278	1.0253	1.0330	1.0414	1.0473	1.0535	(40)
HLP (average)												1.0443	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8454	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	31.0544	30.5932	29.9437	28.7462	27.8495	26.8552	26.3182	26.9631	27.6653	28.7292	29.9514	30.9494	(42b)
Hot water usage for other uses													
	43.7695	42.1779	40.5863	38.9946	37.4030	35.8114	35.8114	37.4030	38.9946	40.5863	42.1779	43.7695	(42c)
Average daily hot water use (litres/day)												68.5827	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	74.8239	72.7710	70.5300	67.7408	65.2525	62.6667	62.1296	64.3661	66.6600	69.3155	72.1293	74.7189	(44)
Energy conte	118.5027	103.6250	108.4019	92.7338	87.8425	77.0560	75.1404	79.6987	82.1984	94.0605	102.7614	116.9917	(45)
Energy content (annual)										Total = Sum(45)m =		1139.0128	
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													
	100.7273	88.0812	92.1416	78.8237	74.6661	65.4976	63.8693	67.7439	69.8686	79.9514	87.3472	99.4429	(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													
	100.7273	88.0812	92.1416	78.8237	74.6661	65.4976	63.8693	67.7439	69.8686	79.9514	87.3472	99.4429	(64)
										Total per year (kWh/year) = Sum(64)m =		968.1609	(64)
12Total per year (kWh/year)												968	(64)
Electric shower(s)													
	57.6019	51.3237	56.0436	53.4817	54.4852	51.9736	53.7061	54.4852	53.4817	56.0436	54.9897	57.6019	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		655.2179	(64a)
Heat gains from water heating, kWh/month													
	39.5823	34.8512	37.0463	33.0764	32.2878	29.3678	29.3939	30.5573	30.8376	33.9987	35.5842	39.2612	(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	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	144.5836	160.0747	144.5836	149.4031	144.5836	149.4031	144.5836	144.5836	149.4031	144.5836	149.4031	144.5836	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.5993	282.5007	275.1893	259.6243	239.9763	221.5099	209.1733	206.2719	213.5833	229.1483	248.7963	267.2626	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	(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)													
	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	(71)
Water heating gains (Table 5)													
	53.2020	51.8620	49.7934	45.9394	43.3976	40.7886	39.5079	41.0716	42.8300	45.6972	49.4225	52.7704	(72)
Total internal gains													
	543.0656	560.1180	535.2470	520.6474	493.6382	477.3823	458.9454	457.6078	471.4970	485.1098	513.3025	530.2973	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.0100	10.6334	0.5700	0.7000	0.7700	8.8500	(74)
East	1.1000	19.6403	0.5700	0.7000	0.7700	5.9737	(76)
South	7.2500	46.7521	0.5700	0.7000	0.7700	93.7227	(78)
North	0.9600	26.0000	0.5700	0.7000	1.0000	8.9631	(82)
East	0.9600	26.0000	0.5700	0.7000	1.0000	8.9631	(82)
North	8.4000	10.6334	0.6300	0.7000	0.7700	27.2975	(74)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	153.7703	271.4908	398.3415	541.0206	651.0472	666.6245	634.2210	548.7271	447.0525	307.1592	185.8872	130.5109	(83)
Total gains	696.8358	831.6088	933.5884	1061.6681	1144.6854	1144.0068	1093.1664	1006.3349	918.5495	792.2690	699.1897	660.8082	(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	58.9108	59.0987	59.2840	60.1703	60.3391	61.1373	61.1373	61.2875	60.8274	60.3391	59.9986	59.6468	
alpha	4.9274	4.9399	4.9523	5.0114	5.0226	5.0758	5.0758	5.0858	5.0552	5.0226	4.9999	4.9765	
util living area													
	0.9968	0.9920	0.9801	0.9356	0.8252	0.6349	0.4729	0.5312	0.7871	0.9608	0.9928	0.9976	(86)
MIT	19.6078	19.8216	20.1190	20.5198	20.8193	20.9638	20.9933	20.9883	20.8953	20.4960	19.9871	19.5815	(87)
Th 2	20.0282	20.0310	20.0337	20.0466	20.0490	20.0602	20.0602	20.0623	20.0559	20.0490	20.0441	20.0390	(88)
util rest of house													
	0.9959	0.9896	0.9739	0.9157	0.7762	0.5536	0.3750	0.4285	0.7142	0.9446	0.9902	0.9968	(89)
MIT 2	18.7575	18.9720	19.2677	19.6626	19.9281	20.0434	20.0584	20.0587	19.9982	19.6491	19.1478	18.7397	(90)

Living area fraction										fLA = Living area / (4) =		0.1325	(91)
MIT	18.8702	19.0846	19.3805	19.7762	20.0462	20.1654	20.1822	20.1819	20.1171	19.7614	19.2590	18.8512	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8702	19.0846	19.3805	19.7762	20.0462	20.1654	20.1822	20.1819	20.1171	19.7614	19.2590	18.8512	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9864	0.9684	0.9089	0.7760	0.5631	0.3879	0.4420	0.7194	0.9384	0.9872	0.9955	(94)
Useful gains	692.8354	820.3098	904.1293	964.9543	888.2720	644.1745	424.0579	444.7748	660.8244	743.4586	690.2671	657.8519	(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													
	1799.2113	1746.0265	1580.5441	1314.9454	1006.2434	662.2148	426.2474	448.9031	719.6118	1104.5213	1474.2405	1786.8949	(97)
Space heating kWh													
	823.1436	622.0816	503.2526	251.9936	87.7707	0.0000	0.0000	0.0000	0.0000	268.6306	564.4609	840.0080	(98a)
Space heating requirement - total per year (kWh/year)												3961.3417	
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													
	823.1436	622.0816	503.2526	251.9936	87.7707	0.0000	0.0000	0.0000	0.0000	268.6306	564.4609	840.0080	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3961.3417	
Space heating per m2											(98c) / (4) =	34.2173	(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	1118.4955	880.5177	902.1000	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8786	0.9341	0.9068	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	982.7424	822.4734	818.0485	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1251.7668	1196.4981	1101.6271	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	193.6975	278.2744	210.9825	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	48.4244	69.5686	52.7456	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												170.7386	(107)
Energy for space heating												34.2173	(99)
Energy for space cooling												1.4748	(108)
Total												35.6922	(109)
Fabric Energy Efficiency (DFEE)												35.7	(109)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.5600 (1b)	x	2.5000 (2b)	=	166.4000	(1b) - (3b)
First floor		49.2100 (1c)	x	2.7000 (2c)	=	132.8670	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	115.7700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	299.2670	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1337	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3837	(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) =	0.3549	(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													

	0.4525	0.4436	0.4347	0.3904	0.3815	0.3371	0.3371	0.3283	0.3549	0.3815	0.3992	0.4170 (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	0.6024	0.5984	0.5945	0.5762	0.5728	0.5568	0.5568	0.5539	0.5630	0.5728	0.5797	0.5869 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			19.7600	1.1450	22.6260			(27)
Opening			0.9600	1.5918	1.5281			(27a)
Opening			0.9600	1.5918	1.5281			(27a)
Heatloss Floor 1			66.5600	0.1300	8.6528			(28a)
External Wall 1	113.6770	21.6500	92.0270	0.1800	16.5649			(29a)
External Roof 1	49.6300		49.6300	0.1100	5.4593			(30)
External Roof 2	3.7900		3.7900	0.1100	0.4169			(30)
External Roof 3	13.1400	1.9200	11.2200	0.1100	1.2342			(30)
Total net area of external elements Aum(A, m2)			246.7970					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9002			(33)
Party Wall 1			70.9100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	226.2139	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	13.1900	0.0500	0.6595
E3	Sill	12.2900	0.0500	0.6145
E4	Jamb	39.7600	0.0500	1.9880
E5	Ground floor (normal)	22.2400	0.1600	3.5584
E6	Intermediate floor within a dwelling	21.5100	0.0000	0.0000
E16	Corner (normal)	18.1000	0.0900	1.6290
E18	Party wall between dwellings	10.4000	0.0600	0.6240
R1	Head of roof window	3.2000	0.0800	0.2560
R2	Sill of roof window	3.2000	0.0600	0.1920
R3	Jamb of roof window	4.8000	0.0800	0.3840
E10	Eaves (insulation at ceiling level)	7.3100	0.0600	0.4386
E11	Eaves (insulation at rafter level)	12.0600	0.0400	0.4824
E12	Gable (insulation at ceiling level)	14.2000	0.0600	0.8520
E14	Flat roof	1.9000	0.0800	0.1520
E17	Corner (inverted - internal area greater than external area)	7.7000	-0.0900	-0.6930
P1	Party wall - Ground floor	14.8000	0.0800	1.1840
P2	Party wall - Intermediate floor within a dwelling	12.5600	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	14.8000	0.1200	1.7760

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.0974	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	73.9976	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	59.4888	59.0962	58.7114	56.9040	56.5659	54.9917	54.9917	54.7002	55.5980	56.5659	57.2500	57.9651	(38)
Heat transfer coeff	133.4864	133.0938	132.7090	130.9016	130.5635	128.9893	128.9893	128.6978	129.5956	130.5635	131.2475	131.9627	(39)
Average = Sum(39)m / 12 =												130.9000	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1530	1.1496	1.1463	1.1307	1.1278	1.1142	1.1142	1.1117	1.1194	1.1278	1.1337	1.1399	(40)
HLP (average)												1.1307	
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	2.8454	(42)

Hot water usage for mixer showers

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

Hot water usage for baths

31.0544	30.5932	29.9437	28.7462	27.8495	26.8552	26.3182	26.9631	27.6653	28.7292	29.9514	30.9494	(42b)

Hot water usage for other uses

43.7695	42.1779	40.5863	38.9946	37.4030	35.8114	35.8114	37.4030	38.9946	40.5863	42.1779	43.7695	(42c)

Average daily hot water use (litres/day)	68.5827	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.8239	72.7710	70.5300	67.7408	65.2525	62.6667	62.1296	64.3661	66.6600	69.3155	72.1293	74.7189	(44)
Energy conte	118.5027	103.6250	108.4019	92.7338	87.8425	77.0560	75.1404	79.6987	82.1984	94.0605	102.7614	116.9917	(45)
Energy content (annual)										Total = Sum(45)m =		1139.0128	
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													
	100.7273	88.0812	92.1416	78.8237	74.6661	65.4976	63.8693	67.7439	69.8686	79.9514	87.3472	99.4429	(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													
	100.7273	88.0812	92.1416	78.8237	74.6661	65.4976	63.8693	67.7439	69.8686	79.9514	87.3472	99.4429	(64)
										Total per year (kWh/year) = Sum(64)m =		968.1609	(64)
12Total per year (kWh/year)												968	(64)

Electric shower(s)

57.6019	51.3237	56.0436	53.4817	54.4852	51.9736	53.7061	54.4852	53.4817	56.0436	54.9897	57.6019	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					655.2179	(64a)

Heat gains from water heating, kWh/month

39.5823	34.8512	37.0463	33.0764	32.2878	29.3678	29.3939	30.5573	30.8376	33.9987	35.5842	39.2612	(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	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	142.2688	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	142.8276	158.1306	142.8276	147.5885	142.8276	147.5885	142.8276	142.8276	147.5885	142.8276	147.5885	142.8276	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	279.5993	282.5007	275.1893	259.6243	239.9763	221.5099	209.1733	206.2719	213.5833	229.1483	248.7963	267.2626	(68)

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

	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	37.2269	(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)

	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	(71)

Water heating gains (Table 5)

	53.2020	51.8620	49.7934	45.9394	43.3976	40.7886	39.5079	41.0716	42.8300	45.6972	49.4225	52.7704	(72)

Total internal gains

	541.3096	558.1738	533.4910	518.8329	491.8822	475.5677	457.1894	455.8518	469.6824	483.3537	511.4880	528.5413	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	11.4100	10.6334	0.6300	0.7000	0.7700	37.0791	(74)
East	1.1000	19.6403	0.6300	0.7000	0.7700	6.6026	(76)
South	7.2500	46.7521	0.6300	0.7000	0.7700	103.5883	(78)
North	0.9600	26.0000	0.6300	0.7000	1.0000	9.9066	(82)
East	0.9600	26.0000	0.6300	0.7000	1.0000	9.9066	(82)

Solar gains	167.0832	294.5776	430.9412	582.9822	699.3883	715.1814	680.8015	590.4780	482.8918	332.9552	201.9095	141.8534	(83)
Total gains	708.3927	852.7514	964.4321	1101.8151	1191.2705	1190.7491	1137.9910	1046.3298	952.5743	816.3089	713.3975	670.3947	(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	54.4974	54.6582	54.8166	55.5735	55.7174	56.3974	56.3974	56.5252	56.1335	55.7174	55.4270	55.1266	
alpha	4.6332	4.6439	4.6544	4.7049	4.7145	4.7598	4.7598	4.7683	4.7422	4.7145	4.6951	4.6751	
util living area	0.9966	0.9916	0.9796	0.9369	0.8328	0.6510	0.4894	0.5489	0.7988	0.9617	0.9926	0.9974	(86)
MIT	19.4758	19.7011	20.0185	20.4455	20.7766	20.9492	20.9893	20.9822	20.8657	20.4239	19.8787	19.4466	(87)
Th 2	19.9578	19.9605	19.9632	19.9758	19.9782	19.9893	19.9893	19.9913	19.9850	19.9782	19.9734	19.9684	(88)
util rest of house	0.9956	0.9891	0.9731	0.9166	0.7826	0.5642	0.3817	0.4367	0.7235	0.9453	0.9898	0.9966	(89)
MIT 2	18.5720	18.7979	19.1133	19.5337	19.8289	19.9657	19.9864	19.9860	19.9110	19.5229	18.9855	18.5511	(90)
Living area fraction									fLA = Living area / (4) =			0.1325	(91)
MIT	18.6918	18.9176	19.2332	19.6545	19.9544	20.0960	20.1193	20.1180	20.0375	19.6423	19.1039	18.6697	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6918	18.9176	19.2332	19.6545	19.9544	20.0960	20.1193	20.1180	20.0375	19.6423	19.1039	18.6697	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9671	0.9089	0.7813	0.5739	0.3959	0.4513	0.7279	0.9383	0.9866	0.9951	(94)
Useful gains	703.9809	840.3957	932.6676	1001.4056	930.7478	683.3317	450.4965	472.2007	693.3944	765.9661	703.8310	667.1255	(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	1921.1050	1865.6539	1689.8141	1407.7820	1077.7269	708.9258	453.9507	478.4955	769.4739	1180.5897	1575.4823	1909.4657	(97)
Space heating kWh	905.5403	688.9735	563.3170	292.5910	109.3524	0.0000	0.0000	0.0000	0.0000	308.4800	627.5889	924.3011	(98a)
Space heating requirement - total per year (kWh/year)												4420.1441	
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	905.5403	688.9735	563.3170	292.5910	109.3524	0.0000	0.0000	0.0000	0.0000	308.4800	627.5889	924.3011	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4420.1441	
Space heating per m2											(98c) / (4) =	38.1804	(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	1212.4992	954.5207	978.1030	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8556	0.9166	0.8857	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1037.3715	874.9467	866.3346	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1305.9173	1248.4610	1148.2872	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	193.3530	277.8947	209.7728	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	48.3382	69.4737	52.4432	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												170.2551	(107)
Energy for space heating												38.1804	(99)
Energy for space cooling												1.4706	(108)
Total												39.6510	(109)
Fabric Energy Efficiency (TFEE)												39.7	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5600 (1b)	x	2.5000 (2b)	=	166.4000	(1b) - (3b)
First floor	49.2100 (1c)	x	2.7000 (2c)	=	132.8670	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	115.7700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	299.2670	(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	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0668 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3168 (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) =	0.2931 (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	0.3737	0.3663	0.3590	0.3224	0.3150	0.2784	0.2784	0.2711	0.2931	0.3150	0.3297	0.3444	(22b)
Effective ac	0.5698	0.5671	0.5644	0.5520	0.5496	0.5388	0.5388	0.5367	0.5429	0.5496	0.5544	0.5593	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.00)			11.3600	0.9615	10.9231			(27)
Opening Type 2			1.8900	1.0000	1.8900			(26)
Opening Type 4 (Uw = 1.40)			8.4000	1.3258	11.1364			(27)
Opening			0.9600	0.9615	0.9231			(27a)
Opening			0.9600	0.9615	0.9231			(27a)
Heatloss Floor 1			66.5600	0.1200	7.9872	110.0000	7321.6000	(28a)
External Wall 1	113.6770	21.6500	92.0270	0.1600	14.7243	60.0000	5521.6200	(29a)
External Roof 1	49.6300		49.6300	0.1100	5.4593	9.0000	446.6700	(30)
External Roof 2	3.7900		3.7900	0.1400	0.5306	9.0000	34.1100	(30)
External Roof 3	13.1400	1.9200	11.2200	0.1400	1.5708	9.0000	100.9800	(30)
Total net area of external elements Aum(A, m2)			246.7970					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.0678			(33)
Party Wall 1			70.9100	0.0000	0.0000	180.0000	12763.8000	(32)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	26188.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.2139 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	13.1900	0.0260	0.3429
E3 Sill	12.2900	0.0220	0.2704
E4 Jamb	39.7600	0.0170	0.6759
E5 Ground floor (normal)	22.2400	0.0470	1.0453
E6 Intermediate floor within a dwelling	21.5100	0.0010	0.0215
E16 Corner (normal)	18.1000	0.0410	0.7421
E18 Party wall between dwellings	10.4000	0.0320	0.3328
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	4.8000	0.2400	1.1520
E10 Eaves (insulation at ceiling level)	7.3100	0.0530	0.3874
E11 Eaves (insulation at rafter level)	12.0600	0.0170	0.2050
E12 Gable (insulation at ceiling level)	14.2000	0.0370	0.5254
E14 Flat roof	1.9000	0.1600	0.3040
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0860	-0.6622
P1 Party wall - Ground floor	14.8000	0.0380	0.5624
P2 Party wall - Intermediate floor within a dwelling	12.5600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	14.8000	0.0330	0.4884

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.9294 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.9972 (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	56.2735	56.0058	55.7434	54.5108	54.2802	53.2066	53.2066	53.0078	53.6202	54.2802	54.7467	55.2344	(38)
Heat transfer coeff	120.2707	120.0030	119.7406	118.5080	118.2774	117.2038	117.2038	117.0050	117.6174	118.2774	118.7439	119.2316	(39)

Average = Sum(39)m / 12 = 118.5069

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0389	1.0366	1.0343	1.0237	1.0217	1.0124	1.0124	1.0107	1.0160	1.0217	1.0257	1.0299	(40)
HLP (average)												1.0236	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8454 (42)

Hot water usage for mixer showers

98.9002	97.4139	95.2481	91.1043	88.0462	84.6359	82.6974	84.8468	87.2030	90.8646	95.0975	98.5213	(42a)

Hot water usage for baths

31.0544	30.5932	29.9437	28.7462	27.8495	26.8552	26.3182	26.9631	27.6653	28.7292	29.9514	30.9494	(42b)

Hot water usage for other uses

43.7695	42.1779	40.5863	38.9946	37.4030	35.8114	35.8114	37.4030	38.9946	40.5863	42.1779	43.7695	(42c)

Average daily hot water use (litres/day) 159.7654 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.7241	170.1850	165.7781	158.8451	153.2987	147.3025	144.8270	149.2130	153.8629	160.1801	167.2268	173.2401	(44)
Energy conte	275.1364	242.3411	254.7947	217.4510	206.3696	181.1256	175.1557	184.7568	189.7284	217.3629	238.2452	271.2522	(45)
Energy content (annual)										Total = Sum(45)m =		2653.7197	

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

41.2705	36.3512	38.2192	32.6176	30.9554	27.1688	26.2734	27.7135	28.4593	32.6044	35.7368	40.6878	(46)

Water storage loss:

Store volume 201.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6100 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8694 (55)

Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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

302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(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

302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(64)
								Total per year (kWh/year) = Sum(64)m =			2971.0507	(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

91.4829	80.5784	84.7192	72.3025	68.6179	60.2243	58.2393	61.4316	63.0847	72.2732	79.2165	90.1914	(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	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	42.1775	37.4616	30.4659	23.0646	17.2411	14.5556	15.7279	20.4437	27.4395	34.8407	40.6643	43.3497	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.3124	421.6428	410.7303	387.4990	358.1736	330.6119	312.1989	307.8685	318.7810	342.0123	371.3377	398.8994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	(71)
Water heating gains (Table 5)													
	122.9608	119.9084	113.8700	100.4201	92.2283	83.6448	78.2786	82.5694	87.6176	97.1414	110.0230	121.2249	(72)
Total internal gains													
	697.2758	693.8379	669.8913	625.8088	582.4681	540.6375	518.0306	522.7068	545.6632	588.8195	636.8501	678.2992	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.0100	10.6334	0.5700	0.7000	0.7700	8.8500	(74)
East	1.1000	19.6403	0.5700	0.7000	0.7700	5.9737	(76)
South	7.2500	46.7521	0.5700	0.7000	0.7700	93.7227	(78)
North	0.9600	26.0000	0.5700	0.7000	1.0000	8.9631	(82)
East	0.9600	26.0000	0.5700	0.7000	1.0000	8.9631	(82)
North	8.4000	10.6334	0.6300	0.7000	0.7700	27.2975	(74)

Solar gains	153.7703	271.4908	398.3415	541.0206	651.0472	666.6245	634.2210	548.7271	447.0525	307.1592	185.8872	130.5109	(83)
Total gains	851.0461	965.3288	1068.2327	1166.8294	1233.5153	1207.2620	1152.2516	1071.4339	992.7158	895.9788	822.7372	808.8101	(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	60.4857	60.6207	60.7535	61.3854	61.5051	62.0685	62.0685	62.1739	61.8502	61.5051	61.2635	61.0129	
alpha	5.0324	5.0414	5.0502	5.0924	5.1003	5.1379	5.1379	5.1449	5.1233	5.1003	5.0842	5.0675	
util living area	0.9923	0.9846	0.9650	0.9088	0.7847	0.5998	0.4436	0.4950	0.7425	0.9369	0.9852	0.9940	(86)
MIT	20.0448	20.1846	20.3966	20.6515	20.8376	20.9196	20.9361	20.9337	20.8821	20.6383	20.2925	20.0165	(87)

Th 2	20.0511	20.0530	20.0549	20.0637	20.0653	20.0730	20.0730	20.0745	20.0701	20.0653	20.0620	20.0585	(88)
util rest of house	0.9901	0.9803	0.9551	0.8836	0.7324	0.5215	0.3522	0.3991	0.6674	0.9137	0.9803	0.9922	(89)
MIT 2	18.9359	19.1146	19.3817	19.6970	19.9024	19.9838	19.9944	19.9948	19.9532	19.6899	19.2601	18.9059	(90)
Living area fraction										fLA = Living area / (4) =		0.1325	(91)
MIT	19.0828	19.2564	19.5162	19.8235	20.0263	20.1078	20.1192	20.1192	20.0763	19.8156	19.3969	19.0531	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9328	19.1064	19.3662	19.6735	19.8763	19.9578	19.9692	19.9692	19.9263	19.6656	19.2469	18.9031	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9865	0.9745	0.9458	0.8711	0.7207	0.5113	0.3418	0.3879	0.6546	0.9012	0.9744	0.9892	(94)
Useful gains	839.5507	940.7297	1010.3809	1016.3804	888.9994	617.2805	393.8203	415.6126	649.8326	807.4463	801.6892	800.0868	(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	1759.9012	1704.8053	1540.6061	1276.7470	967.0690	627.9580	394.8803	417.6188	685.2761	1072.2560	1442.3698	1753.0731	(97)
Space heating kWh	684.7408	513.4588	394.4876	187.4639	58.0838	0.0000	0.0000	0.0000	0.0000	197.0184	461.2901	709.0218	(98a)
Space heating requirement - total per year (kWh/year)												3205.5653	
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	684.7408	513.4588	394.4876	187.4639	58.0838	0.0000	0.0000	0.0000	0.0000	197.0184	461.2901	709.0218	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3205.5653	
Space heating per m2											(98c) / (4) =	27.6891	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	88.8000	(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	684.7408	513.4588	394.4876	187.4639	58.0838	0.0000	0.0000	0.0000	0.0000	197.0184	461.2901	709.0218	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)	771.1045	578.2194	444.2428	211.1080	65.4097	0.0000	0.0000	0.0000	0.0000	221.8676	519.4708	798.4480	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(64)
Efficiency of water heater												330.5476	(216)
(217)m	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	(217)
Fuel for water heating, kWh/month	91.3901	80.6795	85.2362	73.6756	70.5862	62.6862	61.1431	64.0477	65.2887	73.9120	79.9665	90.2150	(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	36.9177	29.6167	26.6666	19.5371	15.0910	12.3295	13.7665	17.8942	23.2429	30.4959	34.4450	37.9437	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.2938	-61.6547	-94.2390	-111.4034	-124.0907	-116.9726	-115.1081	-106.9814	-92.1029	-72.7838	-46.4360	-35.2192	(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	-17.7794	-39.9117	-86.0240	-139.6692	-193.5286	-198.1524	-194.6604	-158.8533	-109.3319	-59.0987	-24.2389	-13.7975	(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	3609.8708	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	330.5476	
Water heating fuel used	898.8268	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	297.9468	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2253.3316	(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	2639.3129	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3609.8708	3.6400	131.3993	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	898.8268	16.4900	148.2165	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	297.9468	16.4900	49.1314	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1018.2856	16.4900	-167.9153	
PV Unit electricity exported	-1235.0460	5.5900	-69.0391	
Total			-236.9544	(252)
Total energy cost			197.9743	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4433 (257)
SAP value		92.8140
SAP rating (Section 12)		93 (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	3609.8708	0.2100	758.0729	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	898.8268	0.1413	126.9792	(264)
Space and water heating			885.0521	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	297.9468	0.1443	43.0029	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1018.2856	0.1336	-136.0082	
PV Unit electricity exported	-1235.0460	0.1240	-153.1396	
Total			-289.1478	(269)
Total CO2, kg/year			650.8365	(272)
CO2 emissions per m2			5.6200	(273)
EI value			94.5754	
EI rating			95	(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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5600 (1b)	x	2.5000 (2b)	=	166.4000	(1b) - (3b)
First floor	49.2100 (1c)	x	2.7000 (2c)	=	132.8670	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 115.7700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	299.2670	(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	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0668	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3168	(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) =	0.2931	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.8000	3.5000	3.5000	3.3000	3.4000	3.1000	3.3000	3.0000	3.0000	3.1000	3.1000	3.5000	(22)
Wind factor	0.9500	0.8750	0.8750	0.8250	0.8500	0.7750	0.8250	0.7500	0.7500	0.7750	0.7750	0.8750	(22a)
Adj infilt rate	0.2784	0.2564	0.2564	0.2418	0.2491	0.2271	0.2418	0.2198	0.2198	0.2271	0.2271	0.2564	(22b)
Effective ac	0.5388	0.5329	0.5329	0.5292	0.5310	0.5258	0.5292	0.5242	0.5242	0.5258	0.5258	0.5329	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.00)			11.3600	0.9615	10.9231			(27)
Opening Type 2			1.8900	1.0000	1.8900			(26)
Opening Type 4 (Uw = 1.40)			8.4000	1.3258	11.1364			(27)
Opening			0.9600	0.9615	0.9231			(27a)
Opening			0.9600	0.9615	0.9231			(27a)
Heatloss Floor 1			66.5600	0.1200	7.9872	110.0000	7321.6000	(28a)
External Wall 1	113.6770	21.6500	92.0270	0.1600	14.7243	60.0000	5521.6200	(29a)
External Roof 1	49.6300		49.6300	0.1100	5.4593	9.0000	446.6700	(30)
External Roof 2	3.7900		3.7900	0.1400	0.5306	9.0000	34.1100	(30)
External Roof 3	13.1400	1.9200	11.2200	0.1400	1.5708	9.0000	100.9800	(30)
Total net area of external elements Aum(A, m2)			246.7970					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.0678			(33)
Party Wall 1			70.9100	0.0000	0.0000	180.0000	12763.8000	(32)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 26188.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 226.2139 (35)
List of Thermal Bridges

		Length	Psi-value	Total
K1	Element			
E2	Other lintels (including other steel lintels)	13.1900	0.0260	0.3429
E3	Sill	12.2900	0.0220	0.2704
E4	Jamb	39.7600	0.0170	0.6759
E5	Ground floor (normal)	22.2400	0.0470	1.0453
E6	Intermediate floor within a dwelling	21.5100	0.0010	0.0215
E16	Corner (normal)	18.1000	0.0410	0.7421
E18	Party wall between dwellings	10.4000	0.0320	0.3328
R1	Head of roof window	3.2000	0.2400	0.7680
R2	Sill of roof window	3.2000	0.2400	0.7680
R3	Jamb of roof window	4.8000	0.2400	1.1520
E10	Eaves (insulation at ceiling level)	7.3100	0.0530	0.3874
E11	Eaves (insulation at rafter level)	12.0600	0.0170	0.2050
E12	Gable (insulation at ceiling level)	14.2000	0.0370	0.5254
E14	Flat roof	1.9000	0.1600	0.3040
E17	Corner (inverted - internal area greater than external area)	7.7000	-0.0860	-0.6622
P1	Party wall - Ground floor	14.8000	0.0380	0.5624
P2	Party wall - Intermediate floor within a dwelling	12.5600	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	14.8000	0.0330	0.4884

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9294 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 63.9972 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.2066	52.6261	52.6261	52.2657	52.4433	51.9264	52.2657	51.7647	51.7647	51.9264	51.9264	52.6261	(38)
Heat transfer coeff	117.2038	116.6233	116.6233	116.2628	116.4404	115.9236	116.2628	115.7619	115.7619	115.9236	115.9236	116.6233	(39)
Average = Sum(39)m / 12 =												116.2779	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0124	1.0074	1.0074	1.0043	1.0058	1.0013	1.0043	0.9999	0.9999	1.0013	1.0013	1.0074	(40)
HLP (average)												1.0044	
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 2.8454 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	98.9002	97.4139	95.2481	91.1043	88.0462	84.6359	82.6974	84.8468	87.2030	90.8646	95.0975	98.5213	(42a)
Hot water usage for baths	31.0544	30.5932	29.9437	28.7462	27.8495	26.8552	26.3182	26.9631	27.6653	28.7292	29.9514	30.9494	(42b)
Hot water usage for other uses	43.7695	42.1779	40.5863	38.9946	37.4030	35.8114	35.8114	37.4030	38.9946	40.5863	42.1779	43.7695	(42c)
Average daily hot water use (litres/day)												159.7654	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.7241	170.1850	165.7781	158.8451	153.2987	147.3025	144.8270	149.2130	153.8629	160.1801	167.2268	173.2401	(44)
Energy conte	275.1364	242.3411	254.7947	217.4510	206.3696	181.1256	175.1557	184.7568	189.7284	217.3629	238.2452	271.2522	(45)
Energy content (annual)										Total = Sum(45)m =		2653.7197	
Distribution loss (46)m = 0.15 x (45)m	41.2705	36.3512	38.2192	32.6176	30.9554	27.1688	26.2734	27.7135	28.4593	32.6044	35.7368	40.6878	(46)
Water storage loss:													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(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	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(64)
										Total per year (kWh/year) = Sum(64)m =		2971.0507	(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

91.4829	80.5784	84.7192	72.3025	68.6179	60.2243	58.2393	61.4316	63.0847	72.2732	79.2165	90.1914	(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	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

42.1775	37.4616	30.4659	23.0646	17.2411	14.5556	15.7279	20.4437	27.4395	34.8407	40.6643	43.3497	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

417.3124	421.6428	410.7303	387.4990	358.1736	330.6119	312.1989	307.8685	318.7810	342.0123	371.3377	398.8994	(68)

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

54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	(69)

Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	(71)

Water heating gains (Table 5)

122.9608	119.9084	113.8700	100.4201	92.2283	83.6448	78.2786	82.5694	87.6176	97.1414	110.0230	121.2249	(72)

Total internal gains

697.2758	693.8379	669.8913	625.8088	582.4681	540.6375	518.0306	522.7068	545.6632	588.8195	636.8501	678.2992	(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	
North	3.0100	11.9672	0.5700	0.7000	0.7700	9.9602	(74)
East	1.1000	22.3142	0.5700	0.7000	0.7700	6.7870	(76)
South	7.2500	50.8329	0.5700	0.7000	0.7700	101.9034	(78)
North	0.9600	30.0000	0.5700	0.7000	1.0000	10.3421	(82)
East	0.9600	30.0000	0.5700	0.7000	1.0000	10.3421	(82)
North	8.4000	11.9672	0.6300	0.7000	0.7700	30.7217	(74)

Solar gains	170.0564	266.0988	394.9698	553.1295	652.0321	712.4851	673.0753	593.2310	478.0578	332.4159	205.3483	142.8564	(83)
Total gains	867.3322	959.9368	1064.8611	1178.9383	1234.5002	1253.1226	1191.1058	1115.9377	1023.7210	921.2355	842.1984	821.1556	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.0685	62.3774	62.3774	62.5708	62.4754	62.7539	62.5708	62.8416	62.8416	62.7539	62.7539	62.3774	
alpha	5.1379	5.1585	5.1585	5.1714	5.1650	5.1836	5.1714	5.1894	5.1894	5.1836	5.1836	5.1585	
util living area	0.9882	0.9785	0.9486	0.8560	0.6681	0.4137	0.2439	0.2901	0.6008	0.8856	0.9748	0.9906	(86)
MIT	20.1990	20.3230	20.5310	20.7675	20.9025	20.9377	20.9400	20.9400	20.9236	20.7643	20.4454	20.1717	(87)
Th 2	20.0730	20.0772	20.0772	20.0798	20.0785	20.0822	20.0798	20.0834	20.0834	20.0822	20.0822	20.0772	(88)
util rest of house	0.9846	0.9722	0.9336	0.8179	0.5994	0.3307	0.1542	0.1953	0.5099	0.8453	0.9660	0.9877	(89)
MIT 2	19.1498	19.3092	19.5662	19.8430	19.9756	20.0046	20.0029	20.0067	19.9982	19.8484	19.4688	19.1188	(90)
Living area fraction									fLA = Living area / (4) =			0.1325	(91)
MIT	19.2888	19.4435	19.6941	19.9655	20.0985	20.1282	20.1270	20.1304	20.1208	19.9698	19.5982	19.2583	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1388	19.2935	19.5441	19.8155	19.9485	19.9782	19.9770	19.9804	19.9708	19.8198	19.4482	19.1083	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9651	0.9229	0.8054	0.5891	0.3212	0.1442	0.1847	0.4982	0.8314	0.9579	0.9836	(94)
Useful gains	849.7722	926.4389	982.7538	949.4811	727.2001	402.4445	171.7194	206.0746	510.0156	765.9590	806.7087	807.6846	(95)
Ext temp.	5.5000	6.1000	7.8000	10.4000	13.5000	16.5000	18.5000	18.2000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1598.5204	1538.6758	1369.6342	1094.6721	750.8617	403.2111	171.7260	206.1009	517.5533	906.4989	1280.7426	1587.0442	(97)
Space heating kWh	557.0686	411.4231	287.8390	104.5375	17.6042	0.0000	0.0000	0.0000	0.0000	104.5617	341.3044	579.8435	(98a)
Space heating requirement - total per year (kWh/year)												2404.1820	
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	557.0686	411.4231	287.8390	104.5375	17.6042	0.0000	0.0000	0.0000	0.0000	104.5617	341.3044	579.8435	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2404.1820	
Space heating per m2											(98c) / (4) =	20.7669	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	88.8000	(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	557.0686	411.4231	287.8390	104.5375	17.6042	0.0000	0.0000	0.0000	0.0000	104.5617	341.3044	579.8435	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)

Space heating fuel (main heating system)
627.3295 463.3144 324.1430 117.7224 19.8246 0.0000 0.0000 0.0000 0.0000 117.7496 384.3518 652.9770 (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)
Space heating fuel used, main system 2 0.0000 (213)

Water heating
Water heating requirement
302.0878 266.6843 281.7461 243.5330 233.3210 207.2076 202.1071 211.7082 215.8104 244.3143 264.3272 298.2036 (64)
Efficiency of water heater 330.5476 (216)
(217)m 330.5476 330.5476 330.5476 330.5476 330.5476 330.5476 330.5476 330.5476 330.5476 330.5476 330.5476 330.5476 (217)
Fuel for water heating, kWh/month
91.3901 80.6795 85.2362 73.6756 70.5862 62.6862 61.1431 64.0477 65.2887 73.9120 79.9665 90.2150 (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 36.9177 29.6167 26.6666 19.5371 15.0910 12.3295 13.7665 17.8942 23.2429 30.4959 34.4450 37.9437 (232)
Electricity generated by PVs (Appendix M) (negative quantity)
(233a)m -45.5230 -61.5560 -94.5172 -113.2282 -124.2558 -120.7759 -118.4908 -111.6603 -96.4074 -77.7274 -50.9366 -38.5718 (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 -21.0941 -39.7922 -86.5428 -144.9547 -194.1773 -215.8422 -210.2854 -176.7552 -121.1811 -67.3584 -28.6530 -16.1474 (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 2707.4122 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 330.5476
Water heating fuel used 898.8268 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 86.0000 (231)
Electricity for lighting (calculated in Appendix L) 297.9468 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -2376.4340 (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 1613.7518 (238)

10a. Fuel costs - using BEDF prices (542)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2707.4122	6.1900	167.5888	(240)
Space heating - main system 2	0.0000	25.1600	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	898.8268	25.1600	226.1448	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	25.1600	21.6376	(249)
Energy for lighting	297.9468	25.1600	74.9634	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1053.6502	25.1600	-265.0984	
PV Unit electricity exported	-1322.7838	5.8100	-76.8537	
Total			-341.9521	(252)
Total energy cost			250.3825	(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	2707.4122	0.2100	568.5566	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	898.8268	0.1413	126.9792	(264)
Space and water heating			695.5358	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	297.9468	0.1443	43.0029	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1053.6502	0.1336	-140.7865	
PV Unit electricity exported	-1322.7838	0.1235	-163.3794	
Total			-304.1659	(269)
Total CO2, kg/year			446.3021	(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	2707.4122	1.1300	3059.3758	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	898.8268	1.5224	1368.3668	(278)
Space and water heating			4427.7426	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	297.9468	1.5338	457.0007	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1053.6502	1.4938	-1573.9076	
PV Unit electricity exported	-1322.7838	0.4532	-599.4680	
Total			-2173.3757	(283)
Total Primary energy kWh/year			2841.4684	(286)

SAP 10 EPC IMPROVEMENTS

As Designed Gas Boiler/Solar

Current energy efficiency rating: A 93
Current environmental impact rating: A 95

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

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

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.6	-£ 28	-16 kg (3.5%)

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

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 542 TEST (30 Apr 2024)
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	£323	£323	£0
Mains gas	£270	£270	£0
Space heating	£291	£291	£0
Water heating	£226	£226	£0
Lighting	£75	£75	£0
Generated (PV)	-£342	-£342	£0
Total cost of fuels	£251	£251	£0
Total cost of uses	£250	£250	£0
Delivered energy	14 kWh/m²	14 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	25 kWh/m²	25 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5600 (1b)	x	2.5000 (2b)	=	166.4000	(1b) - (3b)
First floor	49.2100 (1c)	x	2.7000 (2c)	=	132.8670	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	115.7700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	299.2670	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0668 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3168 (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) =	0.2931 (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	0.3737	0.3663	0.3590	0.3224	0.3150	0.2784	0.2784	0.2711	0.2931	0.3150	0.3297	0.3444	(22b)
Effective ac	0.5698	0.5671	0.5644	0.5520	0.5496	0.5388	0.5388	0.5367	0.5429	0.5496	0.5544	0.5593	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.00)			11.3600	0.9615	10.9231			(27)
Opening Type 2			1.8900	1.0000	1.8900			(26)
Opening Type 4 (Uw = 1.40)			8.4000	1.3258	11.1364			(27)
Opening			0.9600	0.9615	0.9231			(27a)
Opening			0.9600	0.9615	0.9231			(27a)
Heatloss Floor 1			66.5600	0.1200	7.9872	110.0000	7321.6000	(28a)
External Wall 1	113.6770	21.6500	92.0270	0.1600	14.7243	60.0000	5521.6200	(29a)
External Roof 1	49.6300		49.6300	0.1100	5.4593	9.0000	446.6700	(30)
External Roof 2	3.7900		3.7900	0.1400	0.5306	9.0000	34.1100	(30)
External Roof 3	13.1400	1.9200	11.2200	0.1400	1.5708	9.0000	100.9800	(30)
Total net area of external elements Aum(A, m2)			246.7970					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.0678			(33)
Party Wall 1			70.9100	0.0000	0.0000	180.0000	12763.8000	(32)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	26188.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.2139 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	13.1900	0.0260	0.3429
E3 Sill	12.2900	0.0220	0.2704
E4 Jamb	39.7600	0.0170	0.6759
E5 Ground floor (normal)	22.2400	0.0470	1.0453
E6 Intermediate floor within a dwelling	21.5100	0.0010	0.0215
E16 Corner (normal)	18.1000	0.0410	0.7421
E18 Party wall between dwellings	10.4000	0.0320	0.3328
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	4.8000	0.2400	1.1520
E10 Eaves (insulation at ceiling level)	7.3100	0.0530	0.3874
E11 Eaves (insulation at rafter level)	12.0600	0.0170	0.2050
E12 Gable (insulation at ceiling level)	14.2000	0.0370	0.5254
E14 Flat roof	1.9000	0.1600	0.3040
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0860	-0.6622
P1 Party wall - Ground floor	14.8000	0.0380	0.5624
P2 Party wall - Intermediate floor within a dwelling	12.5600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	14.8000	0.0330	0.4884

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.9294 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.9972 (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	56.2735	56.0058	55.7434	54.5108	54.2802	53.2066	53.2066	53.0078	53.6202	54.2802	54.7467	55.2344	(38)
Heat transfer coeff	120.2707	120.0030	119.7406	118.5080	118.2774	117.2038	117.2038	117.0050	117.6174	118.2774	118.7439	119.2316	(39)
Average = Sum(39)m / 12 =												118.5069	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0389	1.0366	1.0343	1.0237	1.0217	1.0124	1.0124	1.0107	1.0160	1.0217	1.0257	1.0299	(40)
HLP (average)												1.0236	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8454 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
98.9002	97.4139	95.2481	91.1043	88.0462	84.6359	82.6974	84.8468	87.2030	90.8646	95.0975	98.5213	(42a)

Hot water usage for baths

31.0544	30.5932	29.9437	28.7462	27.8495	26.8552	26.3182	26.9631	27.6653	28.7292	29.9514	30.9494	(42b)

Hot water usage for other uses

43.7695	42.1779	40.5863	38.9946	37.4030	35.8114	35.8114	37.4030	38.9946	40.5863	42.1779	43.7695	(42c)

Average daily hot water use (litres/day)		159.7654 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.7241	170.1850	165.7781	158.8451	153.2987	147.3025	144.8270	149.2130	153.8629	160.1801	167.2268	173.2401	(44)
Energy conte	275.1364	242.3411	254.7947	217.4510	206.3696	181.1256	175.1557	184.7568	189.7284	217.3629	238.2452	271.2522	(45)
Energy content (annual)										Total = Sum(45)m =		2653.7197	

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

41.2705	36.3512	38.2192	32.6176	30.9554	27.1688	26.2734	27.7135	28.4593	32.6044	35.7368	40.6878	(46)

Water storage loss:		
Store volume		201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.6100 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.8694 (55)

Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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

	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(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													
	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(64)
										Total per year (kWh/year) = Sum(64)m =		2971.0507	(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													
	91.4829	80.5784	84.7192	72.3025	68.6179	60.2243	58.2393	61.4316	63.0847	72.2732	79.2165	90.1914	(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	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	42.1775	37.4616	30.4659	23.0646	17.2411	14.5556	15.7279	20.4437	27.4395	34.8407	40.6643	43.3497	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.3124	421.6428	410.7303	387.4990	358.1736	330.6119	312.1989	307.8685	318.7810	342.0123	371.3377	398.8994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	(71)
Water heating gains (Table 5)													
	122.9608	119.9084	113.8700	100.4201	92.2283	83.6448	78.2786	82.5694	87.6176	97.1414	110.0230	121.2249	(72)
Total internal gains													
	697.2758	693.8379	669.8913	625.8088	582.4681	540.6375	518.0306	522.7068	545.6632	588.8195	636.8501	678.2992	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.0100	10.6334	0.5700	0.7000	0.7700	8.8500	(74)
East	1.1000	19.6403	0.5700	0.7000	0.7700	5.9737	(76)
South	7.2500	46.7521	0.5700	0.7000	0.7700	93.7227	(78)
North	0.9600	26.0000	0.5700	0.7000	1.0000	8.9631	(82)
East	0.9600	26.0000	0.5700	0.7000	1.0000	8.9631	(82)
North	8.4000	10.6334	0.6300	0.7000	0.7700	27.2975	(74)

Solar gains	153.7703	271.4908	398.3415	541.0206	651.0472	666.6245	634.2210	548.7271	447.0525	307.1592	185.8872	130.5109	(83)
Total gains	851.0461	965.3288	1068.2327	1166.8294	1233.5153	1207.2620	1152.2516	1071.4339	992.7158	895.9788	822.7372	808.8101	(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	60.4857	60.6207	60.7535	61.3854	61.5051	62.0685	62.0685	62.1739	61.8502	61.5051	61.2635	61.0129	
alpha	5.0324	5.0414	5.0502	5.0924	5.1003	5.1379	5.1379	5.1449	5.1233	5.1003	5.0842	5.0675	
util living area													
	0.9923	0.9846	0.9650	0.9088	0.7847	0.5998	0.4436	0.4950	0.7425	0.9369	0.9852	0.9940	(86)
MIT	20.0448	20.1846	20.3966	20.6515	20.8376	20.9196	20.9361	20.9337	20.8821	20.6383	20.2925	20.0165	(87)
Th 2	20.0511	20.0530	20.0549	20.0637	20.0653	20.0730	20.0730	20.0745	20.0701	20.0653	20.0620	20.0585	(88)
util rest of house													
	0.9901	0.9803	0.9551	0.8836	0.7324	0.5215	0.3522	0.3991	0.6674	0.9137	0.9803	0.9922	(89)
MIT 2	18.9359	19.1146	19.3817	19.6970	19.9024	19.9838	19.9944	19.9948	19.9532	19.6899	19.2601	18.9059	(90)
Living area fraction										fLA = Living area / (4) =		0.1325	(91)
MIT	19.0828	19.2564	19.5162	19.8235	20.0263	20.1078	20.1192	20.1192	20.0763	19.8156	19.3969	19.0531	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9328	19.1064	19.3662	19.6735	19.8763	19.9578	19.9692	19.9692	19.9263	19.6656	19.2469	18.9031	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9865	0.9745	0.9458	0.8711	0.7207	0.5113	0.3418	0.3879	0.6546	0.9012	0.9744	0.9892	(94)
Useful gains	839.5507	940.7297	1010.3809	1016.3804	888.9994	617.2805	393.8203	415.6126	649.8326	807.4463	801.6892	800.0868	(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													
	1759.9012	1704.8053	1540.6061	1276.7470	967.0690	627.9580	394.8803	417.6188	685.2761	1072.2560	1442.3698	1753.0731	(97)
Space heating kWh													
	684.7408	513.4588	394.4876	187.4639	58.0838	0.0000	0.0000	0.0000	0.0000	197.0184	461.2901	709.0218	(98a)
Space heating requirement - total per year (kWh/year)												3205.5653	
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													
	684.7408	513.4588	394.4876	187.4639	58.0838	0.0000	0.0000	0.0000	0.0000	197.0184	461.2901	709.0218	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3205.5653	
Space heating per m2											(98c) / (4) =	27.6891	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)

Fraction of total heating from main system 2												0.0000	(205)
Efficiency of main space heating system 1 (in %)												88.8000	(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													
	684.7408	513.4588	394.4876	187.4639	58.0838	0.0000	0.0000	0.0000	0.0000	197.0184	461.2901	709.0218	(98)
Space heating efficiency (main heating system 1)													
	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)													
	771.1045	578.2194	444.2428	211.1080	65.4097	0.0000	0.0000	0.0000	0.0000	221.8676	519.4708	798.4480	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(64)
Efficiency of water heater												330.5476	(216)
(217)m	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	(217)
Fuel for water heating, kWh/month													
	91.3901	80.6795	85.2362	73.6756	70.5862	62.6862	61.1431	64.0477	65.2887	73.9120	79.9665	90.2150	(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	36.9177	29.6167	26.6666	19.5371	15.0910	12.3295	13.7665	17.8942	23.2429	30.4959	34.4450	37.9437	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.2938	-61.6547	-94.2390	-111.4034	-124.0907	-116.9726	-115.1081	-106.9814	-92.1029	-72.7838	-46.4360	-35.2192	(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	-17.7794	-39.9117	-86.0240	-139.6692	-193.5286	-198.1524	-194.6604	-158.8533	-109.3319	-59.0987	-24.2389	-13.7975	(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												3609.8708	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												330.5476	
Water heating fuel used												898.8268	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												297.9468	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2253.3316	(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												2639.3129	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3609.8708	3.6400	131.3993	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	898.8268	16.4900	148.2165	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	297.9468	16.4900	49.1314	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1018.2856	16.4900	-167.9153	
PV Unit electricity exported	-1235.0460	5.5900	-69.0391	
Total			-236.9544	(252)
Total energy cost			197.9743	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4433	(257)
SAP value		92.8140	
SAP rating (Section 12)		93	(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	3609.8708	0.2100	758.0729	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	898.8268	0.1413	126.9792	(264)
Space and water heating			885.0521	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	297.9468	0.1443	43.0029	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1018.2856	0.1336	-136.0082	
PV Unit electricity exported	-1235.0460	0.1240	-153.1396	
Total			-289.1478	(269)
Total CO2, kg/year			650.8365	(272)
CO2 emissions per m2			5.6200	(273)
EI value			94.5754	
EI rating			95	(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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5600	(1b) x	2.5000	(2b) =	166.4000	(1b) - (3b)
First floor	49.2100	(1c) x	2.7000	(2c) =	132.8670	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	115.7700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		299.2670	(5)

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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	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0668 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3168 (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) =	0.2931 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.8000	3.5000	3.5000	3.3000	3.4000	3.1000	3.3000	3.0000	3.0000	3.1000	3.1000	3.5000	(22)
Wind factor	0.9500	0.8750	0.8750	0.8250	0.8500	0.7750	0.8250	0.7500	0.7500	0.7750	0.7750	0.8750	(22a)
Adj infilt rate	0.2784	0.2564	0.2564	0.2418	0.2491	0.2271	0.2418	0.2198	0.2198	0.2271	0.2271	0.2564	(22b)
Effective ac	0.5388	0.5329	0.5329	0.5292	0.5310	0.5258	0.5292	0.5242	0.5242	0.5258	0.5258	0.5329	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.00)			11.3600	0.9615	10.9231			(27)
Opening Type 2			1.8900	1.0000	1.8900			(26)
Opening Type 4 (Uw = 1.40)			8.4000	1.3258	11.1364			(27)
Opening			0.9600	0.9615	0.9231			(27a)
Opening			0.9600	0.9615	0.9231			(27a)
Heatloss Floor 1			66.5600	0.1200	7.9872	110.0000	7321.6000	(28a)
External Wall 1	113.6770	21.6500	92.0270	0.1600	14.7243	60.0000	5521.6200	(29a)
External Roof 1	49.6300		49.6300	0.1100	5.4593	9.0000	446.6700	(30)
External Roof 2	3.7900		3.7900	0.1400	0.5306	9.0000	34.1100	(30)
External Roof 3	13.1400	1.9200	11.2200	0.1400	1.5708	9.0000	100.9800	(30)
Total net area of external elements Aum(A, m2)			246.7970					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.0678			(33)
Party Wall 1			70.9100	0.0000	0.0000	180.0000	12763.8000	(32)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	26188.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.2139 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	13.1900	0.0260	0.3429
E3 Sill	12.2900	0.0220	0.2704
E4 Jamb	39.7600	0.0170	0.6759
E5 Ground floor (normal)	22.2400	0.0470	1.0453
E6 Intermediate floor within a dwelling	21.5100	0.0010	0.0215
E16 Corner (normal)	18.1000	0.0410	0.7421
E18 Party wall between dwellings	10.4000	0.0320	0.3328

R1 Head of roof window	3.2000	0.2400	0.7680		
R2 Sill of roof window	3.2000	0.2400	0.7680		
R3 Jamb of roof window	4.8000	0.2400	1.1520		
E10 Eaves (insulation at ceiling level)	7.3100	0.0530	0.3874		
E11 Eaves (insulation at rafter level)	12.0600	0.0170	0.2050		
E12 Gable (insulation at ceiling level)	14.2000	0.0370	0.5254		
E14 Flat roof	1.9000	0.1600	0.3040		
E17 Corner (inverted - internal area greater than external area)	7.7000	-0.0860	-0.6622		
P1 Party wall - Ground floor	14.8000	0.0380	0.5624		
P2 Party wall - Intermediate floor within a dwelling	12.5600	0.0000	0.0000		
P4 Party wall - Roof (insulation at ceiling level)	14.8000	0.0330	0.4884		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				7.9294	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	63.9972	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.2066	52.6261	52.6261	52.2657	52.4433	51.9264	52.2657	51.7647	51.7647	51.9264	51.9264	52.6261	(38)
Heat transfer coeff	117.2038	116.6233	116.6233	116.2628	116.4404	115.9236	116.2628	115.7619	115.7619	115.9236	115.9236	116.6233	(39)
Average = Sum(39)m / 12 =												116.2779	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0124	1.0074	1.0074	1.0043	1.0058	1.0013	1.0043	0.9999	0.9999	1.0013	1.0013	1.0074	(40)
HLP (average)												1.0044	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8454	(42)
Hot water usage for mixer showers	98.9002	97.4139	95.2481	91.1043	88.0462	84.6359	82.6974	84.8468	87.2030	90.8646	95.0975	98.5213	(42a)
Hot water usage for baths	31.0544	30.5932	29.9437	28.7462	27.8495	26.8552	26.3182	26.9631	27.6653	28.7292	29.9514	30.9494	(42b)
Hot water usage for other uses	43.7695	42.1779	40.5863	38.9946	37.4030	35.8114	35.8114	37.4030	38.9946	40.5863	42.1779	43.7695	(42c)
Average daily hot water use (litres/day)												159.7654	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.7241	170.1850	165.7781	158.8451	153.2987	147.3025	144.8270	149.2130	153.8629	160.1801	167.2268	173.2401	(44)
Energy conte	275.1364	242.3411	254.7947	217.4510	206.3696	181.1256	175.1557	184.7568	189.7284	217.3629	238.2452	271.2522	(45)
Energy content (annual)										Total = Sum(45)m =		2653.7197	
Distribution loss (46)m = 0.15 x (45)m	41.2705	36.3512	38.2192	32.6176	30.9554	27.1688	26.2734	27.7135	28.4593	32.6044	35.7368	40.6878	(46)
Water storage loss:													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(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	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(64)
										Total per year (kWh/year) = Sum(64)m =		2971.0507	(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	91.4829	80.5784	84.7192	72.3025	68.6179	60.2243	58.2393	61.4316	63.0847	72.2732	79.2165	90.1914	(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	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	170.7225	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.1775	37.4616	30.4659	23.0646	17.2411	14.5556	15.7279	20.4437	27.4395	34.8407	40.6643	43.3497	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	417.3124	421.6428	410.7303	387.4990	358.1736	330.6119	312.1989	307.8685	318.7810	342.0123	371.3377	398.8994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	54.9176	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	-113.8150	(71)
Water heating gains (Table 5)	122.9608	119.9084	113.8700	100.4201	92.2283	83.6448	78.2786	82.5694	87.6176	97.1414	110.0230	121.2249	(72)
Total internal gains	697.2758	693.8379	669.8913	625.8088	582.4681	540.6375	518.0306	522.7068	545.6632	588.8195	636.8501	678.2992	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.0100	11.9672	0.5700	0.7000	0.7700	9.9602	(74)
East	1.1000	22.3142	0.5700	0.7000	0.7700	6.7870	(76)
South	7.2500	50.8329	0.5700	0.7000	0.7700	101.9034	(78)
North	0.9600	30.0000	0.5700	0.7000	1.0000	10.3421	(82)
East	0.9600	30.0000	0.5700	0.7000	1.0000	10.3421	(82)

North				8.4000		11.9672		0.6300		0.7000		0.7700	30.7217 (74)
Solar gains	170.0564	266.0988	394.9698	553.1295	652.0321	712.4851	673.0753	593.2310	478.0578	332.4159	205.3483	142.8564 (83)	
Total gains	867.3322	959.9368	1064.8611	1178.9383	1234.5002	1253.1226	1191.1058	1115.9377	1023.7210	921.2355	842.1984	821.1556 (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	62.0685	62.3774	62.3774	62.5708	62.4754	62.7539	62.5708	62.8416	62.8416	62.7539	62.7539	62.3774	
alpha	5.1379	5.1585	5.1585	5.1714	5.1650	5.1836	5.1714	5.1894	5.1894	5.1836	5.1836	5.1585	
util living area	0.9882	0.9785	0.9486	0.8560	0.6681	0.4137	0.2439	0.2901	0.6008	0.8856	0.9748	0.9906	(86)
MIT	20.1990	20.3230	20.5310	20.7675	20.9025	20.9377	20.9400	20.9400	20.9236	20.7643	20.4454	20.1717	(87)
Th 2	20.0730	20.0772	20.0772	20.0798	20.0785	20.0822	20.0798	20.0834	20.0834	20.0822	20.0822	20.0772	(88)
util rest of house	0.9846	0.9722	0.9336	0.8179	0.5994	0.3307	0.1542	0.1953	0.5099	0.8453	0.9660	0.9877	(89)
MIT 2	19.1498	19.3092	19.5662	19.8430	19.9756	20.0046	20.0029	20.0067	19.9982	19.8484	19.4688	19.1188	(90)
Living area fraction									fLA = Living area / (4) =			0.1325	(91)
MIT	19.2888	19.4435	19.6941	19.9655	20.0985	20.1282	20.1270	20.1304	20.1208	19.9698	19.5982	19.2583	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1388	19.2935	19.5441	19.8155	19.9485	19.9782	19.9770	19.9804	19.9708	19.8198	19.4482	19.1083	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9651	0.9229	0.8054	0.5891	0.3212	0.1442	0.1847	0.4982	0.8314	0.9579	0.9836	(94)
Useful gains	849.7722	926.4389	982.7538	949.4811	727.2001	402.4445	171.7194	206.0746	510.0156	765.9590	806.7087	807.6846	(95)
Ext temp.	5.5000	6.1000	7.8000	10.4000	13.5000	16.5000	18.5000	18.2000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1598.5204	1538.6758	1369.6342	1094.6721	750.8617	403.2111	171.7260	206.1009	517.5533	906.4989	1280.7426	1587.0442	(97)
Space heating kWh	557.0686	411.4231	287.8390	104.5375	17.6042	0.0000	0.0000	0.0000	0.0000	104.5617	341.3044	579.8435	(98a)
Space heating requirement - total per year (kWh/year)												2404.1820	
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	557.0686	411.4231	287.8390	104.5375	17.6042	0.0000	0.0000	0.0000	0.0000	104.5617	341.3044	579.8435	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2404.1820	
Space heating per m2											(98c) / (4) =	20.7669	(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)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
Efficiency of main space heating system 1 (in %)	88.8000 (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	557.0686	411.4231	287.8390	104.5375	17.6042	0.0000	0.0000	0.0000	0.0000	104.5617	341.3044	579.8435	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)	627.3295	463.3144	324.1430	117.7224	19.8246	0.0000	0.0000	0.0000	0.0000	117.7496	384.3518	652.9770	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	302.0878	266.6843	281.7461	243.5330	233.3210	207.2076	202.1071	211.7082	215.8104	244.3143	264.3272	298.2036	(64)
Efficiency of water heater												330.5476	(216)
(217)m	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	330.5476	(217)
Fuel for water heating, kWh/month	91.3901	80.6795	85.2362	73.6756	70.5862	62.6862	61.1431	64.0477	65.2887	73.9120	79.9665	90.2150	(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	36.9177	29.6167	26.6666	19.5371	15.0910	12.3295	13.7665	17.8942	23.2429	30.4959	34.4450	37.9437	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-45.5230	-61.5560	-94.5172	-113.2282	-124.2558	-120.7759	-118.4908	-111.6603	-96.4074	-77.7274	-50.9366	-38.5718	(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	-21.0941	-39.7922	-86.5428	-144.9547	-194.1773	-215.8422	-210.2854	-176.7552	-121.1811	-67.3584	-28.6530	-16.1474	(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												2707.4122	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	330.5476	
Water heating fuel used	898.8268	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	297.9468	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2376.4340	(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	1613.7518	(238)

10a. Fuel costs - using BEDF prices (542)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2707.4122	6.1900	167.5888	(240)
Space heating - main system 2	0.0000	25.1600	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	898.8268	25.1600	226.1448	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	25.1600	21.6376	(249)
Energy for lighting	297.9468	25.1600	74.9634	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1053.6502	25.1600	-265.0984	
PV Unit electricity exported	-1322.7838	5.8100	-76.8537	
Total			-341.9521	(252)
Total energy cost			250.3825	(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	2707.4122	0.2100	568.5566	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	898.8268	0.1413	126.9792	(264)
Space and water heating			695.5358	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	297.9468	0.1443	43.0029	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1053.6502	0.1336	-140.7865	
PV Unit electricity exported	-1322.7838	0.1235	-163.3794	
Total			-304.1659	(269)
Total CO2, kg/year			446.3021	(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	2707.4122	1.1300	3059.3758	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	898.8268	1.5224	1368.3668	(278)
Space and water heating			4427.7426	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	297.9468	1.5338	457.0007	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1053.6502	1.4938	-1573.9076	
PV Unit electricity exported	-1322.7838	0.4532	-599.4680	
Total			-2173.3757	(283)
Total Primary energy kWh/year			2841.4684	(286)