Your Reference : V60

Marc Evans
Vieo Ltd
The Boathouse Design Studio
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Teddington
TW11 9NN

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45 Graham Road
Worthing
West Sussex
BN11 1TL

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Our Reference : ZA-09 Sent By : E-Mail

9 February 2024

Dear Marc

ENERGY STATEMENT (PLANNING)	
Statement By :	Joe Solti Accredited SAP Assessor

Thank you for sending the drawings. We are pleased to present our report as follows.

Development Details	
Site Location :	255 Guildford Road, Effingham KT24 5NP
Development :	5 no 1 Bedroom Flats
Local Authority :	Guildford Borough Council
Policy D2 :	C02 > 20% reduction in CO2 Water > 110 litres/person/day

Baseline Energy Demand (CO2)	
Base CO2 Emissions :	Total = 3,712 kg/year
Note 1 : See thermal (SAP) calculations ZA0901 - ZA9005 Note 2 : Calculations are based on SAP10 (Part L Building Regulations 2021)	

Actual Energy Demand (CO2)	
Renewable 1 (LZC) : Renewable 2 (LZC) :	Hot Water Heat Pumps (Units 1-5) Min 0.9kW/peak solar pv total (eg 3 x 300W panels) Unit 5
Actual CO2 Emissions :	Total = 1873.5 kg/year
Saving :	Total = 1,838.5 kg/year = 49.53%
Note 1 : See thermal (SAP) calculations ZA0901 - ZA0905 Note 2 : Calculations are based on SAP10 (Part L Building Regulations 2021)	

Water Use	
Water Use :	110 litres/person/day (or less)
Note 1 : See water efficiency calculation ZA0901G Note 2 : Calculations based on Building Regulations Part G 2015 (inc 2016 amendments)	

Design

Energy & CO_2 Emissions

> Fabric insulation standards (including glazing), and air-tightness, will meet or exceed current (2021) Building Regulations Part L standards.

> Attention to be paid to minimise thermal bridging and air leakage at junctions.

> 100% of new internal fixed lighting and external lighting will be low-energy (eg LEDs).

> Advanced heating controls.

> Where supplied, white goods will be energy efficient (A++, A+ or A rated).

Materials

> Consideration will be given to using materials and construction that have a low environmental impact, such as those achieving an A+ or A rated under BRE's Green Guide.

> Where possible, materials will be chosen that are responsibly sourced (such as FSC timber), recycled or reclaimed.

> All insulation materials will have a GWP (Global Warming Potential) of 5 or less.

Water Use

> Indoor water use will be restricted by use of fittings with lower flow rates, baths with smaller capacity (if applicable), dual-flush toilets, and (where applicable) washing machines and dishwashers with low water usage.

Surface Water & Flood Risk

> Where possible, Sustainable Drainage Systems will be used to avoid, reduce, and delay the discharge of rain-fall run-off to public watercourses and sewers.

> Measures are to be undertaken to reduce the risk of flooding where developments are in medium or high risk flood zones.

Waste

> Construction site waste is to be minimised (diverted from landfill) by re-using materials on site (or to/from other sites), returning to the supplier where possible/practical, recovery/recycling, and composting.

> Hazardous waste will be avoided (or minimised where unavoidable).

> If available, the kitchen design will incorporate fixed bin(s) in the kitchen cupboards to encourage recycling.

Health & Wellbeing

> Key rooms have reasonably good levels of daylighting, and décor will enhance this (the need for artificial lighting will also be reduced).

> Sound insulation (between dwellings, and within the dwellings), will meet or exceed

current Building Regulation standards.

> To ensure the dwellings are usable/adaptable for all potential existing and future owners or occupiers, as many as possible/practical of the 16 no Lifetime Homes criteria will be incorporated into the design and construction of the dwellings.

Management

> Guidance will be provided to the end owner/occupier of the dwellings, providing information on the correct and efficient use of their home.

> Security measures will be incorporated into the design and construction of the dwellings.

Renewable Energy (and LZCs)

Various options were considered, but were found to be not feasible for the following reasons :

> Solar Thermal = A possibility, but CO2 savings not as good as heat pumps or solar PV.

> Solar PV = Incorporated (Unit 5).

> Ground Source Heat Pump = Limited space + cost prohibitive.

> Hot Water Heat Pumps = Incorporated (Units 1-5).

> Biomass = Unfavourable solution for small domestic developments. No saving in energy use.

> Wind Power = Siting extremely difficult, location not suitable.

> Combined Heat & Power (CHP) = Limited savings in CO2 emissions.

Summary/Conclusion

The dwellings are to be designed to high levels of fabric insulation and air tightness, in line with current thinking, with hot water heat pumps and solar pv panels added to reduce energy use and CO2 emissions.

Therefore the proposal meets the requirements of Guildford Borough Council's Strategy for Sustainable Design and Renewable Energy.

I trust this is satisfactory. Should you have any queries, or would like to discuss anything, please do not hesitate to contact me.

Yours sincerely

Joe Solti (Project Director) joe@thermenergy.co.uk

Construction and Insulation	
Element	U-Value (W/m^2K)
Exposed Wall (external) 102.5mm facing brick outer leaf + 10mm residual (clear) cavity + 90mm Celotex ThermaClass 21 insulation + 100mm medium dense concrete block inner leaf + plaster or plasterboard on dabs internal finish. Exposed Wall (flat-common) 100mm medium dense concrete outer leaf + 10mm residual (clear) cavity + 90mm Celotex ThermaClass 21 insulation + 100mm medium dense concrete block inner leaf + plaster or plasterboard on dabs finish both sides.	0.19 0.16
Ground Floor Screed + 150mm PIR insulation + solid or suspended concrete floor.	0.12
Roof (loft voids) 400mm mineral wool insulation quilt (100mm between joists + 200mm cross-laid over joists, or 200mm + 200mm). Roof (skeilings) 100mm PIR insulation (between rafters) + 50mm PIR insulation (under rafters). Roof (flat) 150mm PIR insulation (over roof deck).	0.11 0.16 0.14
Windows/Doors/Rooflights PVC-u or timber or thermally-broken metal or composite frame double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass, or similar to achieve U-value of 1.30W/m^2K (or better).	1.30

Heating, Ventilation & Renewables
Main Heating System Electric panel heaters (standard tariff electric) + programmer/appliance thermostats.
Secondary Heating System Not applicable.
Water Heating **Hot water heat pump (eg Dimplex Edel or equal).**
Ventilation Background ventilators and intermittent extract fans, or passive stack ventilation (Approved Document F).
Solar Panels (Unit 5) **Minimum 0.9kW (eg 3 x 300W panels) on flat roof, mounted horizontally, or angled towards south-east or south-west.**

Other
Detailing Recognised Construction Details - limiting thermal bridging and air leakage - fully adopted.
Water Use Total water use < 105 litres/person/day. Water efficient sanitary fittings and white goods.
Lighting 100% of light fittings are dedicated low-energy (lamp luminous efficacy > 75 lumens/circuit watt, total output > 400 lamp lumens).
Air Tightness Design air permeability is $5m^3/h/m^2$ at 50 Pa - to be achieved by air pressure test.

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 09 Feb 2024 13:05:36

Project Information			
Assessed By	Joe Solti	Building Type	Flat, Semi-detached
OCDEA Registration	EES/003578	Assessment Date	2024-02-09

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m^2
Site Reference	ZA0901	Plot Reference	ZA0901
Address	Unit 1 255 Guildford Road, Effingham, KT24 5NP		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*14.76 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	7.47 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*77.73 kWh_{PE}/m^2*	
Dwelling primary energy	76.92 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*41.8 kWh/m^2*	
Dwelling fabric energy efficiency	38.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.12	Ground Floor (0.12)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.3	Front Door (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	54.6	0.19
Sheltered wall: Walls (2)	8.1	0.16
Ground floor: Ground Floor, Ground Floor	50	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front Door, Front Door	1.9	North West	N/A	1.3
Windows (NE), Windows	2.1	North East	0.7	1.3
Windows (SE), Windows	5.5	South East	0.7	1.3
Windows (SW), Windows	0.8	South West	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.06	
External wall	E3: Sill	Calculated by person with suitable expertise	0.018 **(!)**	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.014 **(!)**	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.111	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.049	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.023 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	5 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	Auer
Model	EDL170-520RF
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and appliance thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Main heating 2 - type: Not applicable	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	ZA0901	**Issued on Date**	09/02/2024
Assessment Reference	ZA0901	**Prop Type Ref**	ZA0901
Property	Unit 1, 255 Guildford Road, Effingham, Surrey, KT24 5NP		

SAP Rating	77 C	**DER**	7.47	**TER**	14.76
Environmental	95 A	**% DER < TER**			49.39
CO_2 Emissions (t/year)	0.33	**DFEE**	38.28	**TFEE**	41.78
Compliance Check	See BREL	**% DFEE < TFEE**			8.38
% DPER < TPER	1.05	**DPER**	76.92	**TPER**	77.73

Assessor Details	Mr. Joe Solti	**Assessor ID**	5122-0001
Client	Vieo Projects, .		

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		50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	120.0000	(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) =	0.1667 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4167 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			8.4000	1.2357	10.3802			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	63.0000	8.4000	54.6000	0.1900	10.3740	60.0000	3276.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Total net area of external elements Aum(A, m2)			123.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.5202			(33)
Party Ceiling			50.0000			30.0000	1500.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	20262.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		405.2400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.6000	0.0600	0.3960
E3 Sill	4.2000	0.0180	0.0756
E4 Jamb	15.9000	0.0140	0.2226
E5 Ground floor (normal)	30.1000	0.1110	3.3411
E16 Corner (normal)	16.8000	0.0490	0.8232

E7 Party floor between dwellings (in blocks of flats)								30.1000	0.0230	0.6923			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												5.5508	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	36.0710	(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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	59.9084	59.7516	59.5980	58.8762	58.7411	58.1125	58.1125	57.9961	58.3546	58.7411	59.0143	59.2999	(39)
Average = Sum(39)m / 12 =												58.8755	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1982	1.1950	1.1920	1.1775	1.1748	1.1622	1.1622	1.1599	1.1671	1.1748	1.1803	1.1860	(40)
HLP (average)												1.1775	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901	(42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)											Total = Sum(45)m =	1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(64)
12Total per year (kWh/year)												2015	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.7576	84.9816	76.7576	79.3162	76.7576	79.3162	76.7576	76.7576	79.3162	76.7576	79.3162	76.7576	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	348.2325	356.0268	340.1812	326.2766	308.3081	295.8498	283.5437	284.7014	294.2588	305.7694	326.5991	340.6791	(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	
Northeast	2.1000	11.2829	0.6300	0.7000	0.7700	7.2412	(75)
Southeast	5.5000	36.7938	0.6300	0.7000	0.7700	61.8457	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Solar gains	78.0827	135.4090	191.6612	248.1861	287.7634	289.9818	277.7842	247.6005	211.1330	151.3783	93.9631	66.5391	(83)
Total gains	426.3152	491.4358	531.8425	574.4627	596.0715	585.8316	561.3279	532.3019	505.3918	457.1477	420.5622	407.2182	(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	93.9490	94.1955	94.4383	95.5961	95.8159	96.8524	96.8524	97.0468	96.4505	95.8159	95.3723	94.9130	
alpha	7.2633	7.2797	7.2959	7.3731	7.3877	7.4568	7.4568	7.4698	7.4300	7.3877	7.3582	7.3275	
util living area	0.9988	0.9963	0.9887	0.9526	0.8390	0.6269	0.4548	0.4997	0.7616	0.9676	0.9964	0.9992	(86)
MIT	20.1785	20.3244	20.5159	20.7632	20.9338	20.9933	20.9994	20.9989	20.9745	20.7583	20.4251	20.1562	(87)
Th 2	19.9215	19.9240	19.9264	19.9380	19.9402	19.9503	19.9503	19.9522	19.9464	19.9402	19.9358	19.9312	(88)
util rest of house	0.9982	0.9943	0.9824	0.9274	0.7723	0.5285	0.3468	0.3868	0.6628	0.9447	0.9941	0.9987	(89)
MIT 2	18.9853	19.1733	19.4166	19.7227	19.8967	19.9479	19.9502	19.9520	19.9350	19.7254	19.3118	18.9646	(90)
Living area fraction										fLA = Living area / (4) =		0.4800	(91)
MIT	19.5580	19.7258	19.9443	20.2221	20.3945	20.4497	20.4538	20.4545	20.4340	20.2212	19.8462	19.5365	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5580	19.7258	19.9443	20.2221	20.3945	20.4497	20.4538	20.4545	20.4340	20.2212	19.8462	19.5365	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9938	0.9825	0.9352	0.8029	0.5760	0.3987	0.4412	0.7106	0.9520	0.9938	0.9985	(94)
Useful gains	425.4203	488.4124	522.5398	537.2336	478.5811	337.4500	223.8142	234.8519	359.1549	435.2128	417.9707	406.5937	(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	914.0845	885.8678	801.2509	666.6044	510.7239	339.9398	223.9566	235.1458	369.6168	565.1589	752.2083	909.4558	(97)
Space heating kWh	363.5662	267.0900	207.3610	93.1470	23.9142	0.0000	0.0000	0.0000	0.0000	96.6799	240.6511	374.1294	(98a)
Space heating requirement - total per year (kWh/year)												1666.5389	
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	363.5662	267.0900	207.3610	93.1470	23.9142	0.0000	0.0000	0.0000	0.0000	96.6799	240.6511	374.1294	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1666.5389	
Space heating per m2											(98c) / (4) =	33.3308	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	363.5662	267.0900	207.3610	93.1470	23.9142	0.0000	0.0000	0.0000	0.0000	96.6799	240.6511	374.1294	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	363.5662	267.0900	207.3610	93.1470	23.9142	0.0000	0.0000	0.0000	0.0000	96.6799	240.6511	374.1294	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	16.3182	13.0910	11.7870	8.6357	6.6704	5.4498	6.0850	7.9095	10.2737	13.4796	15.2252	16.7717	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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												1666.5389	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												302.9550	
Water heating fuel used												665.2763	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												131.6969	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(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	2463.5120	(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	1666.5389	0.1564	260.6685	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			354.4991	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	131.6969	0.1443	19.0079	(268)
Total CO2, kg/year			373.5070	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.4700	(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	1666.5389	1.5791	2631.5694	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			3643.8018	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	131.6969	1.5338	202.0011	(282)
Total Primary energy kWh/year			3845.8029	(286)
Dwelling Primary energy Rate (DPER)			76.9200	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b) x	2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4167 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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			1.9000	1.0000	1.9000			(26)
TER Opening Type (Uw = 1.20)			8.4000	1.1450	9.6183			(27)
Ground Floor			50.0000	0.1300	6.5000			(28a)
Wall (external)	63.0000	8.4000	54.6000	0.1800	9.8280			(29a)

Wall (common)	10.0000	1.9000	8.1000	0.1800	1.4580	(29a)
Total net area of external elements Aum(A, m2)			123.0000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.3043	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 415.2400 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	6.6000	0.0500	0.3300	
E3 Sill	4.2000	0.0500	0.2100	
E4 Jamb	15.9000	0.0500	0.7950	
E5 Ground floor (normal)	30.1000	0.1600	4.8160	
E16 Corner (normal)	16.8000	0.0900	1.5120	
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0700	2.1070	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.7700 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	39.0743 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	62.9117	62.7549	62.6013	61.8795	61.7444	61.1158	61.1158	60.9993	61.3579	61.7444	62.0176	62.3032	(39)
Average = Sum(39)m / 12 =												61.8788	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2582	1.2551	1.2520	1.2376	1.2349	1.2223	1.2223	1.2200	1.2272	1.2349	1.2404	1.2461	(40)
HLP (average)												1.2376	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556 (42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)
Average daily hot water use (litres/day)												98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(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	216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
										Total per year (kWh/year) = Sum(64)m =		1962.4258	(64)
12Total per year (kWh/year)												1962	(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	93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.7576	84.9816	76.7576	79.3162	76.7576	79.3162	76.7576	76.7576	79.3162	76.7576	79.3162	76.7576	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344	(72)
Total internal gains	401.3345	409.1289	393.2833	379.3786	361.4101	345.9518	333.6457	334.8035	344.3608	358.8714	379.7012	393.7812	(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	
Northeast	2.1000	11.2829	0.6300	0.7000	0.7700	7.2412	(75)
Southeast	5.5000	36.7938	0.6300	0.7000	0.7700	61.8457	(77)

Southwest			0.8000		36.7938		0.6300		0.7000		0.7700		8.9957 (79)
Solar gains	78.0827	135.4090	191.6612	248.1861	287.7634	289.9818	277.7842	247.6005	211.1330	151.3783	93.9631	66.5391 (83)	
Total gains	479.4172	544.5378	584.9445	627.5647	649.1735	635.9336	611.4299	582.4039	555.4938	510.2498	473.6643	460.3202 (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	91.6717	91.9007	92.1263	93.2009	93.4047	94.3655	94.3655	94.5456	93.9931	93.4047	92.9933	92.5670	
alpha	7.1114	7.1267	7.1418	7.2134	7.2270	7.2910	7.2910	7.3030	7.2662	7.2270	7.1996	7.1711	
util living area	0.9979	0.9943	0.9841	0.9408	0.8183	0.6081	0.4392	0.4806	0.7340	0.9541	0.9939	0.9984	(86)
MIT	20.2046	20.3479	20.5381	20.7794	20.9401	20.9938	20.9995	20.9990	20.9782	20.7835	20.4549	20.1827	(87)
Th 2	19.8737	19.8762	19.8786	19.8900	19.8922	19.9022	19.9022	19.9040	19.8983	19.8922	19.8879	19.8833	(88)
util rest of house	0.9968	0.9913	0.9754	0.9105	0.7467	0.5077	0.3300	0.3668	0.6312	0.9234	0.9900	0.9976	(89)
MIT 2	18.9784	19.1623	19.4021	19.6957	19.8544	19.9001	19.9021	19.9039	19.8891	19.7087	19.3084	18.9581	(90)
Living area fraction										fLA = Living area / (4) =		0.4800	(91)
MIT	19.5670	19.7314	19.9474	20.2159	20.3755	20.4251	20.4288	20.4295	20.4119	20.2246	19.8587	19.5459	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5670	19.7314	19.9474	20.2159	20.3755	20.4251	20.4288	20.4295	20.4119	20.2246	19.8587	19.5459	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9908	0.9761	0.9206	0.7799	0.5562	0.3825	0.4216	0.6810	0.9343	0.9899	0.9972	(94)
Useful gains	477.6956	539.5201	570.9652	577.7673	506.2636	353.7048	233.8715	245.5387	378.2969	476.7017	468.8657	459.0540	(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	960.4716	930.7437	841.8212	700.2206	535.6661	356.0042	234.0029	245.7998	387.2824	594.2651	791.2667	956.1003	(97)
Space heating kWh	359.1854	262.9023	201.5168	88.1664	21.8754	0.0000	0.0000	0.0000	0.0000	87.4672	232.1287	369.8025	(98a)
Space heating requirement - total per year (kWh/year)												1623.0447	
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	359.1854	262.9023	201.5168	88.1664	21.8754	0.0000	0.0000	0.0000	0.0000	87.4672	232.1287	369.8025	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1623.0447	
Space heating per m2										(98c) / (4) =		32.4609	(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	359.1854	262.9023	201.5168	88.1664	21.8754	0.0000	0.0000	0.0000	0.0000	87.4672	232.1287	369.8025	(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)	389.1499	284.8345	218.3281	95.5216	23.7004	0.0000	0.0000	0.0000	0.0000	94.7640	251.4937	400.6527	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4391	85.0306	84.2970	82.7721	80.8039	79.8000	79.8000	79.8000	79.8000	82.7291	84.7346	85.5211	(217)
Fuel for water heating, kWh/month	225.1637	200.2296	215.1134	194.1379	193.7854	177.9421	176.5248	182.9609	184.3137	196.9238	202.8200	222.7023	(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	15.9487	12.7947	11.5202	8.4402	6.5194	5.3264	5.9472	7.7304	10.0411	13.1744	14.8805	16.3920	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-23.8453	-33.8545	-49.0231	-55.5770	-60.3671	-56.5608	-55.9161	-52.6009	-46.7730	-38.9727	-26.3198	-20.5924	(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	-12.7596	-26.9216	-53.6366	-80.7238	-106.8665	-107.3725	-106.0561	-89.6936	-65.6416	-38.4942	-17.0391	-10.0796	(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	1758.4449 (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	2372.6176 (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)	128.7153	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1235.6876	(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	3110.0902	(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	1758.4449	0.2100	369.2734	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2372.6176	0.2100	498.2497	(264)
Space and water heating			867.5231	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	128.7153	0.1443	18.5776	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.4027	0.1344	-69.9427	
PV Unit electricity exported	-715.2849	0.1258	-90.0171	
Total			-159.9599	(269)
Total CO2, kg/year			738.0701	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.7600	(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	1758.4449	1.1300	1987.0428	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2372.6176	1.1300	2681.0579	(278)
Space and water heating			4668.1007	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	128.7153	1.5338	197.4278	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.4027	1.4967	-778.8937	
PV Unit electricity exported	-715.2849	0.4619	-330.4241	
Total			-1109.3177	(283)
Total Primary energy kWh/year			3886.3115	(286)
Target Primary Energy Rate (TPER)			77.7300	(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		50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(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

	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (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	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			8.4000	1.2357	10.3802			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	63.0000	8.4000	54.6000	0.1900	10.3740	60.0000	3276.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Total net area of external elements Aum(A, m2)			123.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.5202			(33)
Party Ceiling			50.0000			40.0000	2000.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20762.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 415.2400 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.6000	0.0600	0.3960
E3 Sill	4.2000	0.0180	0.0756
E4 Jamb	15.9000	0.0140	0.2226
E5 Ground floor (normal)	30.1000	0.1110	3.3411
E16 Corner (normal)	16.8000	0.0490	0.8232
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5508 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 36.0710 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)

Heat transfer coeff

	59.9084	59.7516	59.5980	58.8762	58.7411	58.1125	58.1125	57.9961	58.3546	58.7411	59.0143	59.2999	(39)

Average = Sum(39)m / 12 = 58.8755

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1982	1.1950	1.1920	1.1775	1.1748	1.1622	1.1622	1.1599	1.1671	1.1748	1.1803	1.1860	(40)
HLP (average)												1.1775	
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 1.6901 (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

	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)

Hot water usage for other uses

	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)

Average daily hot water use (litres/day) 50.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)

Energy content (annual) Total = Sum(45)m = 832.1197
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

	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481 (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

	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481 (64)

Total per year (kWh/year) = Sum(64)m = 707.3017 (64)
12Total per year (kWh/year) 707 (64)
Electric shower(s)

	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 478.7637 (64a)
Heat gains from water heating, kWh/month

	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844 (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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)

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

	76.7576	84.9816	76.7576	79.3162	76.7576	79.3162	76.7576	76.7576	79.3162	76.7576	79.3162	76.7576	(67)

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

	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)

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

	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)

	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)												
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542 (72)
Total internal gains												
	311.2127	319.9859	306.4008	297.9473	283.1855	274.1138	264.1230	263.7374	271.4305	279.1630	294.7896	304.4010 (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	
Northeast	2.1000	11.2829	0.6300	0.7000	0.7700	7.2412	(75)
Southeast	5.5000	36.7938	0.6300	0.7000	0.7700	61.8457	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Solar gains	78.0827	135.4090	191.6612	248.1861	287.7634	289.9818	277.7842	247.6005	211.1330	151.3783	93.9631	66.5391 (83)
Total gains	389.2953	455.3948	498.0620	546.1334	570.9489	564.0957	541.9072	511.3379	482.5635	430.5413	388.7527	370.9400 (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	96.2673	96.5199	96.7688	97.9551	98.1803	99.2424	99.2424	99.4416	98.8306	98.1803	97.7258	97.2551
alpha	7.4178	7.4347	7.4513	7.5303	7.5454	7.6162	7.6162	7.6294	7.5887	7.5454	7.5151	7.4837
util living area												
	0.9994	0.9980	0.9930	0.9648	0.8626	0.6496	0.4710	0.5200	0.7901	0.9778	0.9981	0.9996 (86)
MIT	20.1440	20.2891	20.4821	20.7397	20.9245	20.9923	20.9994	20.9987	20.9699	20.7334	20.3935	20.1231 (87)
Th 2	19.9215	19.9240	19.9264	19.9380	19.9402	19.9503	19.9503	19.9522	19.9464	19.9402	19.9358	19.9312 (88)
util rest of house												
	0.9991	0.9968	0.9888	0.9443	0.7987	0.5485	0.3592	0.4027	0.6913	0.9605	0.9968	0.9994 (89)
MIT 2	19.1558	19.3024	19.4953	19.7497	19.9008	19.9482	19.9502	19.9520	19.9358	19.7505	19.4167	19.1430 (90)
Living area fraction										fLA = Living area / (4) =		0.4800 (91)
MIT	19.6301	19.7761	19.9690	20.2249	20.3922	20.4494	20.4538	20.4545	20.4322	20.2223	19.8855	19.6134 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6301	19.7761	19.9690	20.2249	20.3922	20.4494	20.4538	20.4545	20.4322	20.2223	19.8855	19.6134 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9966	0.9890	0.9508	0.8281	0.5975	0.4130	0.4592	0.7394	0.9661	0.9967	0.9993	(94)
Useful gains	388.9098	453.8508	492.5693	519.2507	472.8208	337.0326	223.7985	234.8030	356.8094	415.9579	387.4573	370.6816	(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													
	918.4027	888.8689	802.7228	666.7658	510.5883	339.9221	223.9555	235.1421	369.5110	565.2220	754.5289	914.0160	(97)
Space heating kWh													
	393.9427	292.3322	230.7542	106.2109	28.0990	0.0000	0.0000	0.0000	0.0000	111.0525	264.2916	404.2408	(98a)
Space heating requirement - total per year (kWh/year)												1830.9238	
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													
	393.9427	292.3322	230.7542	106.2109	28.0990	0.0000	0.0000	0.0000	0.0000	111.0525	264.2916	404.2408	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1830.9238	
Space heating per m2											(98c) / (4) =	36.6185	(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	546.2572	430.0323	440.7700	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9367	0.9775	0.9648	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	511.6653	420.3553	425.2332	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	630.1865	605.8385	571.5966	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	85.3353	137.9995	108.8944	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	21.3338	34.4999	27.2236	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												83.0573	(107)
Energy for space heating												36.6185	(99)
Energy for space cooling												1.6611	(108)
Total												38.2796	(109)
Fabric Energy Efficiency (DFEE)												38.3	(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	50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4167 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(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	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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			1.9000	1.0000	1.9000			(26)
TER Opening Type (Uw = 1.20)			8.4000	1.1450	9.6183			(27)
Ground Floor			50.0000	0.1300	6.5000			(28a)
Wall (external)	63.0000	8.4000	54.6000	0.1800	9.8280			(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1800	1.4580			(29a)
Total net area of external elements Aum(A, m2)			123.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.3043			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				415.2400	(35)
List of Thermal Bridges					
K1 Element	Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)	6.6000	0.0500	0.3300		
E3 Sill	4.2000	0.0500	0.2100		
E4 Jamb	15.9000	0.0500	0.7950		
E5 Ground floor (normal)	30.1000	0.1600	4.8160		
E16 Corner (normal)	16.8000	0.0900	1.5120		
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0700	2.1070		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.7700	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	39.0743	(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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	62.9117	62.7549	62.6013	61.8795	61.7444	61.1158	61.1158	60.9993	61.3579	61.7444	62.0176	62.3032	(39)
Average = Sum(39)m / 12 =												61.8788	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2582	1.2551	1.2520	1.2376	1.2349	1.2223	1.2223	1.2200	1.2272	1.2349	1.2404	1.2461	(40)
HLP (average)												1.2376	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6901	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												50.1040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)
Energy content (annual)										Total = Sum(45)m =		832.1197	
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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)
										Total per year (kWh/year) = Sum(64)m =		707.3017	(64)
12Total per year (kWh/year)												707	(64)
Electric shower(s)													
	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		478.7637	(64a)
Heat gains from water heating, kWh/month													
	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	76.7576	84.9816	76.7576	79.3162	76.7576	79.3162	76.7576	76.7576	79.3162	76.7576	79.3162	76.7576	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542	(72)
Total internal gains													
	311.2127	319.9859	306.4008	297.9473	283.1855	274.1138	264.1230	263.7374	271.4305	279.1630	294.7896	304.4010	(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	
Northeast	2.1000	11.2829	0.6300	0.7000	0.7700	7.2412	(75)
Southeast	5.5000	36.7938	0.6300	0.7000	0.7700	61.8457	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Solar gains	78.0827	135.4090	191.6612	248.1861	287.7634	289.9818	277.7842	247.6005	211.1330	151.3783	93.9631	66.5391	(83)
Total gains	389.2953	455.3948	498.0620	546.1334	570.9489	564.0957	541.9072	511.3379	482.5635	430.5413	388.7527	370.9400	(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	91.6717	91.9007	92.1263	93.2009	93.4047	94.3655	94.3655	94.5456	93.9931	93.4047	92.9933	92.5670	
alpha	7.1114	7.1267	7.1418	7.2134	7.2270	7.2910	7.2910	7.3030	7.2662	7.2270	7.1996	7.1711	
util living area													
	0.9995	0.9981	0.9937	0.9700	0.8809	0.6779	0.4947	0.5456	0.8144	0.9810	0.9982	0.9996	(86)
MIT	20.0804	20.2270	20.4258	20.6948	20.9007	20.9878	20.9989	20.9978	20.9576	20.6936	20.3397	20.0590	(87)
Th 2	19.8737	19.8762	19.8786	19.8900	19.8922	19.9022	19.9022	19.9040	19.8983	19.8922	19.8879	19.8833	(88)
util rest of house													
	0.9991	0.9970	0.9899	0.9515	0.8192	0.5701	0.3722	0.4176	0.7143	0.9654	0.9970	0.9994	(89)
MIT 2	19.0524	19.2006	19.3994	19.6665	19.8391	19.8988	19.9021	19.9037	19.8829	19.6718	19.3230	19.0391	(90)
Living area fraction										fLA = Living area / (4) =		0.4800	(91)
MIT	19.5458	19.6933	19.8921	20.1601	20.3486	20.4215	20.4285	20.4289	20.3988	20.1623	19.8110	19.5287	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5458	19.6933	19.8921	20.1601	20.3486	20.4215	20.4285	20.4289	20.3988	20.1623	19.8110	19.5287	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9968	0.9900	0.9569	0.8471	0.6225	0.4312	0.4794	0.7631	0.9701	0.9969	0.9993	(94)
Useful gains	388.9155	453.9415	493.0854	522.5754	483.6619	351.1222	233.6913	245.1521	368.2376	417.6858	387.5352	370.6826	(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													
	959.1400	928.3525	838.3594	696.7683	534.0049	355.7862	233.9829	245.7591	386.4782	590.4168	788.3055	955.0264	(97)
Space heating kWh													
	424.2470	318.8042	256.8839	125.4189	37.4552	0.0000	0.0000	0.0000	0.0000	128.5119	288.5546	434.7518	(98a)
Space heating requirement - total per year (kWh/year)												2014.6275	
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													
	424.2470	318.8042	256.8839	125.4189	37.4552	0.0000	0.0000	0.0000	0.0000	128.5119	288.5546	434.7518	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2014.6275	
Space heating per m2											(98c) / (4) =	40.2926	(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	574.4882	452.2567	463.5950	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9160	0.9670	0.9503	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	526.2133	437.3326	440.5706	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	630.1865	605.8385	571.5966	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	74.8607	125.3684	97.4833	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	18.7152	31.3421	24.3708	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												74.4281	(107)
Energy for space heating												40.2926	(99)
Energy for space cooling												1.4886	(108)
Total												41.7811	(109)
Fabric Energy Efficiency (TFEE)												41.8	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4167 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542 (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													
	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			8.4000	1.2357	10.3802			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	63.0000	8.4000	54.6000	0.1900	10.3740	60.0000	3276.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Total net area of external elements Aum(A, m2)			123.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.5202			(33)
Party Ceiling			50.0000			40.0000	2000.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	20762.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		415.2400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.6000	0.0600	0.3960
E3 Sill	4.2000	0.0180	0.0756
E4 Jamb	15.9000	0.0140	0.2226
E5 Ground floor (normal)	30.1000	0.1110	3.3411
E16 Corner (normal)	16.8000	0.0490	0.8232
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.5508 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	36.0710 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	59.9084	59.7516	59.5980	58.8762	58.7411	58.1125	58.1125	57.9961	58.3546	58.7411	59.0143	59.2999	(39)
Average = Sum(39)m / 12 =												58.8755	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1982	1.1950	1.1920	1.1775	1.1748	1.1622	1.1622	1.1599	1.1671	1.1748	1.1803	1.1860	(40)
HLP (average)												1.1775	
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												1.6901	(42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
									Total per year (kWh/year) = Sum(64)m =			2015.4877	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.6431	16.5586	13.4664	10.1949	7.6208	6.4338	6.9520	9.0364	12.1287	15.4001	17.9742	19.1612	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	394.9174	393.1557	380.5456	356.7739	333.6939	312.7005	300.2714	302.7611	314.7484	336.1261	362.0673	384.6824	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.1000	11.2829	0.6300	0.7000	0.7700	7.2412	(75)
Southeast	5.5000	36.7938	0.6300	0.7000	0.7700	61.8457	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Solar gains	78.0827	135.4090	191.6612	248.1861	287.7634	289.9818	277.7842	247.6005	211.1330	151.3783	93.9631	66.5391	(83)
Total gains	473.0001	528.5647	572.2069	604.9600	621.4573	602.6823	578.0556	550.3616	525.8814	487.5044	456.0304	451.2215	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	96.2673	96.5199	96.7688	97.9551	98.1803	99.2424	99.2424	99.4416	98.8306	98.1803	97.7258	97.2551
alpha	7.4178	7.4347	7.4513	7.5303	7.5454	7.6162	7.6162	7.6294	7.5887	7.5454	7.5151	7.4837
util living area												

	0.9980	0.9947	0.9839	0.9414	0.8188	0.6110	0.4418	0.4837	0.7394	0.9569	0.9946	0.9985	(86)
MIT	20.2601	20.3890	20.5780	20.7995	20.9475	20.9949	20.9996	20.9992	20.9806	20.7973	20.4854	20.2349	(87)
Th 2	19.9215	19.9240	19.9264	19.9380	19.9402	19.9503	19.9503	19.9522	19.9464	19.9402	19.9358	19.9312	(88)
util rest of house													
	0.9969	0.9919	0.9751	0.9118	0.7492	0.5143	0.3368	0.3742	0.6400	0.9281	0.9911	0.9977	(89)
MIT 2	19.0872	19.2528	19.4910	19.7611	19.9070	19.9486	19.9503	19.9521	19.9381	19.7669	19.3857	19.0628	(90)
Living area fraction										fLA = Living area / (4) =		0.4800	(91)
MIT	19.6502	19.7982	20.0127	20.2595	20.4064	20.4508	20.4539	20.4547	20.4385	20.2615	19.9136	19.6254	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6502	19.7982	20.0127	20.2595	20.4064	20.4508	20.4539	20.4547	20.4385	20.2615	19.9136	19.6254	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9915	0.9760	0.9220	0.7816	0.5610	0.3873	0.4269	0.6882	0.9384	0.9910	0.9974	(94)
Useful gains	471.3368	524.0549	558.4627	557.7852	485.7574	338.0953	223.8619	234.9517	361.8960	457.4757	451.9280	450.0641	(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													
	919.6081	890.1919	805.3310	668.8046	511.4257	340.0032	223.9621	235.1569	369.8800	567.5259	756.1854	914.7266	(97)
Space heating kWh													
	333.5139	246.0441	183.6700	79.9339	19.0972	0.0000	0.0000	0.0000	0.0000	81.8773	219.0653	345.7089	(98a)
Space heating requirement - total per year (kWh/year)												1508.9107	
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													
	333.5139	246.0441	183.6700	79.9339	19.0972	0.0000	0.0000	0.0000	0.0000	81.8773	219.0653	345.7089	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1508.9107	
Space heating per m2											(98c) / (4) =	30.1782	(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 %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	333.5139	246.0441	183.6700	79.9339	19.0972	0.0000	0.0000	0.0000	0.0000	81.8773	219.0653	345.7089	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	333.5139	246.0441	183.6700	79.9339	19.0972	0.0000	0.0000	0.0000	0.0000	81.8773	219.0653	345.7089	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month													
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	16.3182	13.0910	11.7870	8.6357	6.6704	5.4498	6.0850	7.9095	10.2737	13.4796	15.2252	16.7717	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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												1508.9107	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												302.9550	
Water heating fuel used												665.2763	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												131.6969	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(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												2305.8839	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1508.9107	16.4900	248.8194	(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)	665.2763	16.4900	109.7041	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	131.6969	16.4900	21.7168	(250)
Additional standing charges			0.0000	(251)
Total energy cost			380.2402	(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] =	1.4409	(257)
SAP value		76.6428	
SAP rating (Section 12)		77	(258)
SAP band		C	

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	1508.9107	0.1566	236.3474	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			330.1780	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	131.6969	0.1443	19.0079	(268)
Total CO2, kg/year			349.1860	(272)
CO2 emissions per m2			6.9800	(273)
EI value			95.0746	
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	50.0000	(1b) x	2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate	0.3807	0.3630	0.3630	0.3276	0.3187	0.3010	0.3010	0.2833	0.2833	0.3010	0.3010	0.3276	(22b)
Effective ac	0.5725	0.5659	0.5659	0.5537	0.5508	0.5453	0.5453	0.5401	0.5401	0.5453	0.5453	0.5537	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			8.4000	1.2357	10.3802			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	63.0000	8.4000	54.6000	0.1900	10.3740	60.0000	3276.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Total net area of external elements Aum(A, m2)			123.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.5202			(33)
Party Ceiling			50.0000			40.0000	2000.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	20762.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		415.2400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.6000	0.0600	0.3960
E3 Sill	4.2000	0.0180	0.0756
E4 Jamb	15.9000	0.0140	0.2226
E5 Ground floor (normal)	30.1000	0.1110	3.3411
E16 Corner (normal)	16.8000	0.0490	0.8232
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.5508 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	36.0710 (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	22.6701	22.4093	22.4093	21.9250	21.8117	21.5944	21.5944	21.3895	21.3895	21.5944	21.5944	21.9250	(38)
Heat transfer coeff	58.7411	58.4804	58.4804	57.9961	57.8827	57.6654	57.6654	57.4605	57.4605	57.6654	57.6654	57.9961	(39)
Average = Sum(39)m / 12 =												57.9300	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1748	1.1696	1.1696	1.1599	1.1577	1.1533	1.1533	1.1492	1.1492	1.1533	1.1533	1.1599	(40)
HLP (average)												1.1586	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6901 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day)		98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.6431	16.5586	13.4664	10.1949	7.6208	6.4338	6.9520	9.0364	12.1287	15.4001	17.9742	19.1612	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	394.9174	393.1557	380.5456	356.7739	333.6939	312.7005	300.2714	302.7611	314.7484	336.1261	362.0673	384.6824	(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	
Northeast	2.1000	13.3408	0.6300	0.7000	0.7700	8.5620	(75)
Southeast	5.5000	41.5040	0.6300	0.7000	0.7700	69.7629	(77)
Southwest	0.8000	41.5040	0.6300	0.7000	0.7700	10.1473	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	88.4722	131.4048	189.8157	254.1951	287.0404	311.7491	295.1900	264.9349	224.9771	164.2891	105.5816	72.2441	(83)
Total gains	483.3896	524.5606	570.3613	610.9690	620.7343	624.4495	595.4614	567.6960	539.7256	500.4152	467.6490	456.9265	(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	98.1803	98.6181	98.6181	99.4416	99.6363	100.0118	100.0118	100.3684	100.3684	100.0118	100.0118	99.4416	
alpha	7.5454	7.5745	7.5745	7.6294	7.6424	7.6675	7.6675	7.6912	7.6912	7.6675	7.6675	7.6294	
util living area	0.9973	0.9943	0.9818	0.9304	0.7939	0.5603	0.3968	0.4248	0.7062	0.9426	0.9926	0.9981	(86)
MIT	20.3243	20.4264	20.6118	20.8288	20.9604	20.9973	20.9998	20.9997	20.9865	20.8361	20.5414	20.2955	(87)
Th 2	19.9402	19.9444	19.9444	19.9522	19.9540	19.9575	19.9575	19.9608	19.9608	19.9575	19.9575	19.9522	(88)
util rest of house	0.9958	0.9912	0.9720	0.8968	0.7206	0.4663	0.2961	0.3199	0.6077	0.9070	0.9879	0.9971	(89)
MIT 2	19.1840	19.3167	19.5475	19.8052	19.9304	19.9567	19.9575	19.9608	19.9554	19.8235	19.4736	19.1571	(90)
Living area fraction									fLA = Living area / (4) =			0.4800	(91)
MIT	19.7313	19.8494	20.0584	20.2965	20.4248	20.4562	20.4578	20.4595	20.4503	20.3095	19.9861	19.7035	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7313	19.8494	20.0584	20.2965	20.4248	20.4562	20.4578	20.4595	20.4503	20.3095	19.9861	19.7035	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9908	0.9733	0.9092	0.7552	0.5116	0.3445	0.3703	0.6554	0.9208	0.9881	0.9968	(94)
Useful gains	481.1515	519.7405	555.1260	555.4854	468.7683	319.4627	205.1255	210.2126	353.7526	460.7965	462.0743	455.4609	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W	888.8303	862.5487	781.2045	649.3544	487.6500	320.4012	205.1636	210.2763	359.1473	548.3703	731.5521	881.7458	(97)
Space heating kWh	303.3131	230.3671	168.2024	67.5857	14.0480	0.0000	0.0000	0.0000	0.0000	65.1549	194.0240	317.1559	(98a)
Space heating requirement - total per year (kWh/year)												1359.8511	
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	303.3131	230.3671	168.2024	67.5857	14.0480	0.0000	0.0000	0.0000	0.0000	65.1549	194.0240	317.1559	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1359.8511	
Space heating per m2											(98c) / (4) =	27.1970	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	303.3131	230.3671	168.2024	67.5857	14.0480	0.0000	0.0000	0.0000	0.0000	65.1549	194.0240	317.1559	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	303.3131	230.3671	168.2024	67.5857	14.0480	0.0000	0.0000	0.0000	0.0000	65.1549	194.0240	317.1559	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	16.3182	13.0910	11.7870	8.6357	6.6704	5.4498	6.0850	7.9095	10.2737	13.4796	15.2252	16.7717	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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	1359.8511	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	131.6969	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	2156.8242	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1359.8511	25.1600	342.1385	(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)	665.2763	25.1600	167.3835	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	131.6969	25.1600	33.1349	(250)
Additional standing charges			0.0000	(251)
Total energy cost			542.6570	(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	1359.8511	0.1569	213.4079	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			307.2385	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	131.6969	0.1443	19.0079	(268)
Total CO2, kg/year			326.2464	(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	1359.8511	1.5810	2149.9196	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			3162.1519	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	131.6969	1.5338	202.0011	(282)
Total Primary energy kWh/year			3364.1531	(286)

SAP 10 EPC IMPROVEMENTS

ZA0901

Current energy efficiency rating:	C 77
Current environmental impact rating:	A 95

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

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

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

Potential energy efficiency rating:	C 77
Potential environmental impact rating:	A 95

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£543	£543	£0
Space heating	£342	£342	£0
Water heating	£167	£167	£0
Lighting	£33	£33	£0
Total cost of fuels	£543	£543	£0
Total cost of uses	£542	£542	£0
Delivered energy	43 kWh/m²	43 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	67 kWh/m²	67 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		50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			8.4000	1.2357	10.3802			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	63.0000	8.4000	54.6000	0.1900	10.3740	60.0000	3276.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Total net area of external elements Aum(A, m2)			123.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.5202			(33)
Party Ceiling			50.0000			40.0000	2000.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	20762.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		415.2400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.6000	0.0600	0.3960
E3 Sill	4.2000	0.0180	0.0756
E4 Jamb	15.9000	0.0140	0.2226
E5 Ground floor (normal)	30.1000	0.1110	3.3411
E16 Corner (normal)	16.8000	0.0490	0.8232
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.5508 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	36.0710 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	59.9084	59.7516	59.5980	58.8762	58.7411	58.1125	58.1125	57.9961	58.3546	58.7411	59.0143	59.2999	(39)
Average = Sum(39)m / 12 =												58.8755	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1982	1.1950	1.1920	1.1775	1.1748	1.1622	1.1622	1.1599	1.1671	1.1748	1.1803	1.1860	(40)
HLP (average)												1.1775	
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												1.6901	(42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.6431	16.5586	13.4664	10.1949	7.6208	6.4338	6.9520	9.0364	12.1287	15.4001	17.9742	19.1612	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	394.9174	393.1557	380.5456	356.7739	333.6939	312.7005	300.2714	302.7611	314.7484	336.1261	362.0673	384.6824	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.1000	11.2829	0.6300	0.7000	0.7700	7.2412	(75)
Southeast	5.5000	36.7938	0.6300	0.7000	0.7700	61.8457	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Solar gains	78.0827	135.4090	191.6612	248.1861	287.7634	289.9818	277.7842	247.6005	211.1330	151.3783	93.9631	66.5391	(83)
Total gains	473.0001	528.5647	572.2069	604.9600	621.4573	602.6823	578.0556	550.3616	525.8814	487.5044	456.0304	451.2215	(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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	96.2673	96.5199	96.7688	97.9551	98.1803	99.2424	99.2424	99.4416	98.8306	98.1803	97.7258	97.2551	
alpha	7.4178	7.4347	7.4513	7.5303	7.5454	7.6162	7.6162	7.6294	7.5887	7.5454	7.5151	7.4837	
util living area	0.9980	0.9947	0.9839	0.9414	0.8188	0.6110	0.4418	0.4837	0.7394	0.9569	0.9946	0.9985	(86)

MIT	20.2601	20.3890	20.5780	20.7995	20.9475	20.9949	20.9996	20.9992	20.9806	20.7973	20.4854	20.2349	(87)
Th 2	19.9215	19.9240	19.9264	19.9380	19.9402	19.9503	19.9503	19.9522	19.9464	19.9402	19.9358	19.9312	(88)
util rest of house													
	0.9969	0.9919	0.9751	0.9118	0.7492	0.5143	0.3368	0.3742	0.6400	0.9281	0.9911	0.9977	(89)
MIT 2	19.0872	19.2528	19.4910	19.7611	19.9070	19.9486	19.9503	19.9521	19.9381	19.7669	19.3857	19.0628	(90)
Living area fraction										fLA = Living area / (4) =		0.4800	(91)
MIT	19.6502	19.7982	20.0127	20.2595	20.4064	20.4508	20.4539	20.4547	20.4385	20.2615	19.9136	19.6254	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6502	19.7982	20.0127	20.2595	20.4064	20.4508	20.4539	20.4547	20.4385	20.2615	19.9136	19.6254	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9915	0.9760	0.9220	0.7816	0.5610	0.3873	0.4269	0.6882	0.9384	0.9910	0.9974	(94)
Useful gains	471.3368	524.0549	558.4627	557.7852	485.7574	338.0953	223.8619	234.9517	361.8960	457.4757	451.9280	450.0641	(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													
	919.6081	890.1919	805.3310	668.8046	511.4257	340.0032	223.9621	235.1569	369.8800	567.5259	756.1854	914.7266	(97)
Space heating kWh													
	333.5139	246.0441	183.6700	79.9339	19.0972	0.0000	0.0000	0.0000	0.0000	81.8773	219.0653	345.7089	(98a)
Space heating requirement - total per year (kWh/year)												1508.9107	
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													
	333.5139	246.0441	183.6700	79.9339	19.0972	0.0000	0.0000	0.0000	0.0000	81.8773	219.0653	345.7089	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1508.9107	
Space heating per m2											(98c) / (4) =	30.1782	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	333.5139	246.0441	183.6700	79.9339	19.0972	0.0000	0.0000	0.0000	0.0000	81.8773	219.0653	345.7089	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	333.5139	246.0441	183.6700	79.9339	19.0972	0.0000	0.0000	0.0000	0.0000	81.8773	219.0653	345.7089	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month													
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	16.3182	13.0910	11.7870	8.6357	6.6704	5.4498	6.0850	7.9095	10.2737	13.4796	15.2252	16.7717	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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												1508.9107	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												302.9550	
Water heating fuel used												665.2763	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												131.6969	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(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												2305.8839	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1508.9107	16.4900	248.8194	(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)	665.2763	16.4900	109.7041	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	131.6969	16.4900	21.7168	(250)
Additional standing charges			0.0000	(251)
Total energy cost			380.2402	(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] =	1.4409	(257)
SAP value		76.6428	
SAP rating (Section 12)		77	(258)
SAP band		C	

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	1508.9107	0.1566	236.3474	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			330.1780	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	131.6969	0.1443	19.0079	(268)
Total CO2, kg/year			349.1860	(272)
CO2 emissions per m2			6.9800	(273)
EI value			95.0746	
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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000 (1b)	x	2.4000 (2b)	=	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate	0.3807	0.3630	0.3630	0.3276	0.3187	0.3010	0.3010	0.2833	0.2833	0.3010	0.3010	0.3276	(22b)
Effective ac	0.5725	0.5659	0.5659	0.5537	0.5508	0.5453	0.5453	0.5401	0.5401	0.5453	0.5453	0.5537	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			8.4000	1.2357	10.3802			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	63.0000	8.4000	54.6000	0.1900	10.3740	60.0000	3276.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Total net area of external elements Aum(A, m2)			123.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.5202			(33)
Party Ceiling			50.0000			40.0000	2000.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20762.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 415.2400 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.6000	0.0600	0.3960
E3 Sill	4.2000	0.0180	0.0756
E4 Jamb	15.9000	0.0140	0.2226
E5 Ground floor (normal)	30.1000	0.1110	3.3411
E16 Corner (normal)	16.8000	0.0490	0.8232
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5508 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 36.0710 (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	22.6701	22.4093	22.4093	21.9250	21.8117	21.5944	21.5944	21.3895	21.3895	21.5944	21.5944	21.9250	(38)
Heat transfer coeff	58.7411	58.4804	58.4804	57.9961	57.8827	57.6654	57.6654	57.4605	57.4605	57.6654	57.6654	57.9961	(39)

Average = Sum(39)m / 12 = 57.9300

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1748	1.1696	1.1696	1.1599	1.1577	1.1533	1.1533	1.1492	1.1492	1.1533	1.1533	1.1599	(40)
HLP (average)												1.1586	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	

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

25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:
Store volume 173.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0368 (55)
Total storage loss

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)

If cylinder contains dedicated solar storage

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)

Total per year (kWh/year) = Sum(64)m = 2015.4877 (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

56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.6431	16.5586	13.4664	10.1949	7.6208	6.4338	6.9520	9.0364	12.1287	15.4001	17.9742	19.1612	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	394.9174	393.1557	380.5456	356.7739	333.6939	312.7005	300.2714	302.7611	314.7484	336.1261	362.0673	384.6824	(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	
Northeast	2.1000	13.3408	0.6300	0.7000	0.7700	8.5620	(75)
Southeast	5.5000	41.5040	0.6300	0.7000	0.7700	69.7629	(77)
Southwest	0.8000	41.5040	0.6300	0.7000	0.7700	10.1473	(79)

Solar gains	88.4722	131.4048	189.8157	254.1951	287.0404	311.7491	295.1900	264.9349	224.9771	164.2891	105.5816	72.2441	(83)
Total gains	483.3896	524.5606	570.3613	610.9690	620.7343	624.4495	595.4614	567.6960	539.7256	500.4152	467.6490	456.9265	(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	98.1803	98.6181	98.6181	99.4416	99.6363	100.0118	100.0118	100.3684	100.3684	100.0118	100.0118	99.4416	
alpha	7.5454	7.5745	7.5745	7.6294	7.6424	7.6675	7.6675	7.6912	7.6912	7.6675	7.6675	7.6294	
util living area	0.9973	0.9943	0.9818	0.9304	0.7939	0.5603	0.3968	0.4248	0.7062	0.9426	0.9926	0.9981	(86)
MIT	20.3243	20.4264	20.6118	20.8288	20.9604	20.9973	20.9998	20.9997	20.9865	20.8361	20.5414	20.2955	(87)
Th 2	19.9402	19.9444	19.9444	19.9522	19.9540	19.9575	19.9575	19.9608	19.9608	19.9575	19.9575	19.9522	(88)
util rest of house	0.9958	0.9912	0.9720	0.8968	0.7206	0.4663	0.2961	0.3199	0.6077	0.9070	0.9879	0.9971	(89)
MIT 2	19.1840	19.3167	19.5475	19.8052	19.9304	19.9567	19.9575	19.9608	19.9554	19.8235	19.4736	19.1571	(90)
Living area fraction									fLA = Living area / (4) =			0.4800	(91)
MIT	19.7313	19.8494	20.0584	20.2965	20.4248	20.4562	20.4578	20.4595	20.4503	20.3095	19.9861	19.7035	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7313	19.8494	20.0584	20.2965	20.4248	20.4562	20.4578	20.4595	20.4503	20.3095	19.9861	19.7035	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9908	0.9733	0.9092	0.7552	0.5116	0.3445	0.3703	0.6554	0.9208	0.9881	0.9968	(94)
Useful gains	481.1515	519.7405	555.1260	555.4854	468.7683	319.4627	205.1255	210.2126	353.7526	460.7965	462.0743	455.4609	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W	888.8303	862.5487	781.2045	649.3544	487.6500	320.4012	205.1636	210.2763	359.1473	548.3703	731.5521	881.7458	(97)
Space heating kWh	303.3131	230.3671	168.2024	67.5857	14.0480	0.0000	0.0000	0.0000	0.0000	65.1549	194.0240	317.1559	(98a)
Space heating requirement - total per year (kWh/year)												1359.8511	
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	303.3131	230.3671	168.2024	67.5857	14.0480	0.0000	0.0000	0.0000	0.0000	65.1549	194.0240	317.1559	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1359.8511	
Space heating per m2											(98c) / (4) =	27.1970	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	303.3131	230.3671	168.2024	67.5857	14.0480	0.0000	0.0000	0.0000	0.0000	65.1549	194.0240	317.1559	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	303.3131	230.3671	168.2024	67.5857	14.0480	0.0000	0.0000	0.0000	0.0000	65.1549	194.0240	317.1559	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	16.3182	13.0910	11.7870	8.6357	6.6704	5.4498	6.0850	7.9095	10.2737	13.4796	15.2252	16.7717	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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	1359.8511	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	131.6969	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	2156.8242	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1359.8511	25.1600	342.1385	(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)	665.2763	25.1600	167.3835	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	131.6969	25.1600	33.1349	(250)
Additional standing charges			0.0000	(251)
Total energy cost			542.6570	(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	1359.8511	0.1569	213.4079	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			307.2385	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	131.6969	0.1443	19.0079	(268)
Total CO2, kg/year			326.2464	(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	1359.8511	1.5810	2149.9196	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			3162.1519	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	131.6969	1.5338	202.0011	(282)
Total Primary energy kWh/year			3364.1531	(286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 09 Feb 2024 13:05:05

Project Information			
Assessed By	Joe Solti	Building Type	Flat, Semi-detached
OCDEA Registration	EES/003578	Assessment Date	2024-02-09

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m^2
Site Reference	ZA0902	Plot Reference	ZA0902
Address	Unit 2 255 Guildford Road, Effingham, KT24 5NP		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*17.69 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	9.06 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*93.42 kWh_{PE}/m^2*	
Dwelling primary energy	93.07 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*55.4 kWh/m^2*	
Dwelling fabric energy efficiency	49.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.12	Ground Floor (0.12)	OK
Roofs	*0.16*	0.14	Roof (1) (0.14)	OK
Windows, doors, and roof windows	*1.6*	1.3	Front Door (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	49.6	0.19
Sheltered wall: Walls (2)	8.1	0.16
Ground floor: Ground Floor, Ground Floor	50	0.12
Exposed roof: Roof (1)	4	0.14

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front Door, Front Door	1.9	South East	N/A	1.3
Windows (NE), Windows	3.2	North East	0.7	1.3
Windows (NW), Windows	6.8	North West	0.7	1.3
Windows (SW), Windows	1.9	South West	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.06	
External wall	E3: Sill	Calculated by person with suitable expertise	0.018 **(!)**	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.014 **(!)**	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.111	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.049	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.023 **(!)**	
External wall	E15: Flat roof with parapet	SAP table default	0.3	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	5 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	Auer
Model	EDL170-520RF
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and appliance thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Main heating 2 - type: Not applicable	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	ZA0902	**Issued on Date**	09/02/2024
Assessment Reference	ZA0902	**Prop Type Ref**	ZA0902
Property	Unit 2, 255 Guildford Road, Effingham, Surrey, KT24 5NP		

SAP Rating	72 C	**DER**	9.06	**TER**	17.69
Environmental	94 A	**% DER < TER**			48.78
CO_2 Emissions (t/year)	0.4	**DFEE**	49.17	**TFEE**	55.44
Compliance Check	See BREL	**% DFEE < TFEE**			11.31
% DPER < TPER	0.38	**DPER**	93.07	**TPER**	93.42

Assessor Details	Mr. Joe Solti	**Assessor ID**	5122-0001
Client	Vieo Projects, .		

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		50.0000 (1b)	x	2.4000 (2b)	=	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	120.0000	(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) =	0.1667 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4167 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			11.9000	1.2357	14.7053			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	61.5000	11.9000	49.6000	0.1900	9.4240	60.0000	2976.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Roof	4.0000		4.0000	0.1400	0.5600	9.0000	36.0000	(30)
Total net area of external elements Aum(A, m2)			125.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4553			(33)
Party Ceiling			46.0000			30.0000	1380.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	19878.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		397.5600 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.4000	0.0600	0.5640
E3 Sill	8.5000	0.0180	0.1530
E4 Jamb	15.0000	0.0140	0.2100
E5 Ground floor (normal)	29.8000	0.1110	3.3078

E16 Corner (normal)	19.2000	0.0490	0.9408	
E7 Party floor between dwellings (in blocks of flats)	28.7000	0.0230	0.6601	
E15 Flat roof with parapet	12.2000	0.3000	3.6600	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4957 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.9510 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	67.7884	67.6316	67.4780	66.7562	66.6211	65.9925	65.9925	65.8760	66.2346	66.6211	66.8943	67.1799	(39)

Average = Sum(39)m / 12 = 66.7555

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3558	1.3526	1.3496	1.3351	1.3324	1.3198	1.3198	1.3175	1.3247	1.3324	1.3379	1.3436	(40)
HLP (average)												1.3351	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(64)
12Total per year (kWh/year)												2015	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	345.7375	353.2645	337.6863	323.6984	305.8131	293.2716	281.0487	282.2064	291.6806	303.2744	324.0210	338.1841	(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	
Northeast	3.2000	11.2829	0.6300	0.7000	0.7700	11.0343	(75)
Southwest	1.9000	36.7938	0.6300	0.7000	0.7700	21.3649	(79)
Northwest	6.8000	11.2829	0.6300	0.7000	0.7700	23.4479	(81)

Solar gains	55.8470	106.5817	176.2525	269.3785	348.2706	366.2253	344.5602	282.5732	208.0081	125.9982	68.9777	46.4437	(83)
Total gains	401.5845	459.8462	513.9387	593.0769	654.0837	659.4969	625.6089	564.7796	499.6887	429.2726	392.9986	384.6278	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	81.4544	81.6432	81.8292	82.7140	82.8816	83.6712	83.6712	83.8190	83.3653	82.8816	82.5431	82.1922	
alpha	6.4303	6.4429	6.4553	6.5143	6.5254	6.5781	6.5781	6.5879	6.5577	6.5254	6.5029	6.4795	
util living area	0.9992	0.9978	0.9925	0.9606	0.8425	0.6277	0.4625	0.5324	0.8260	0.9828	0.9979	0.9994	(86)
MIT	19.9583	20.1016	20.3319	20.6599	20.9021	20.9880	20.9986	20.9966	20.9366	20.6127	20.2319	19.9376	(87)
Th 2	19.7974	19.7998	19.8022	19.8134	19.8155	19.8253	19.8253	19.8271	19.8215	19.8155	19.8113	19.8068	(88)
util rest of house	0.9987	0.9965	0.9881	0.9381	0.7723	0.5193	0.3400	0.3992	0.7243	0.9688	0.9964	0.9990	(89)
MIT 2	18.6095	18.7945	19.0888	19.4978	19.7503	19.8210	19.8251	19.8265	19.7903	19.4522	18.9704	18.5902	(90)
Living area fraction									fLA = Living area / (4) =			0.4400	(91)
MIT	19.2030	19.3696	19.6358	20.0091	20.2571	20.3345	20.3414	20.3414	20.2947	19.9628	19.5255	19.1830	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2030	19.3696	19.6358	20.0091	20.2571	20.3345	20.3414	20.3414	20.2947	19.9628	19.5255	19.1830	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9959	0.9873	0.9426	0.8008	0.5674	0.3941	0.4582	0.7690	0.9710	0.9959	0.9988	(94)
Useful gains	400.9420	457.9612	507.4243	559.0273	523.7613	374.1945	246.5757	258.8020	384.2798	416.8406	391.4047	384.1610	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1010.2478	978.6023	886.3738	741.5994	570.0834	378.4339	246.9060	259.6429	410.3007	623.7599	831.1949	1006.5595	(97)
Space heating kWh	453.3235	349.8708	281.9384	131.4519	34.4637	0.0000	0.0000	0.0000	0.0000	153.9479	316.6490	463.0645	(98a)
Space heating requirement - total per year (kWh/year)												2184.7097	
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	453.3235	349.8708	281.9384	131.4519	34.4637	0.0000	0.0000	0.0000	0.0000	153.9479	316.6490	463.0645	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2184.7097	
Space heating per m2											(98c) / (4) =	43.6942	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	453.3235	349.8708	281.9384	131.4519	34.4637	0.0000	0.0000	0.0000	0.0000	153.9479	316.6490	463.0645	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	453.3235	349.8708	281.9384	131.4519	34.4637	0.0000	0.0000	0.0000	0.0000	153.9479	316.6490	463.0645	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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	2184.7097	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	127.4161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	2977.4021	(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	2184.7097	0.1559	340.5849	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			434.4155	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)
Total CO2, kg/year			452.8056	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.0600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2184.7097	1.5772	3445.6490	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			4457.8813	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	127.4161	1.5338	195.4351	(282)
Total Primary energy kWh/year			4653.3165	(286)
Dwelling Primary energy Rate (DPER)			93.0700	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b) x	2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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			1.9000	1.0000	1.9000			(26)
TER Opening Type (Uw = 1.20)			10.6000	1.1450	12.1374			(27)

Ground Floor			50.0000	0.1300	6.5000	(28a)
Wall (external)	61.5000	10.6000	50.9000	0.1800	9.1620	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1800	1.4580	(29a)
Roof	4.0000		4.0000	0.1100	0.4400	(30)
Total net area of external elements Aum(A, m2)			125.5000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.5974	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 406.7600 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.4000	0.0500	0.4700
E3 Sill	8.5000	0.0500	0.4250
E4 Jamb	15.0000	0.0500	0.7500
E5 Ground floor (normal)	29.8000	0.1600	4.7680
E16 Corner (normal)	19.2000	0.0900	1.7280
E7 Party floor between dwellings (in blocks of flats)	28.7000	0.0700	2.0090
E15 Flat roof with parapet	12.2000	0.5600	6.8320

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.9820 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 48.5794 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	72.4168	72.2600	72.1063	71.3846	71.2495	70.6208	70.6208	70.5044	70.8630	71.2495	71.5227	71.8083	(39)
Average = Sum(39)m / 12 =												71.3839	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4483	1.4452	1.4421	1.4277	1.4250	1.4124	1.4124	1.4101	1.4173	1.4250	1.4305	1.4362	(40)
HLP (average)												1.4277	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
										Total per year (kWh/year) = Sum(64)m =		1962.4258	(64)
12Total per year (kWh/year)												1962	(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	93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.4194	82.3929	74.4194	76.9000	74.4194	76.9000	74.4194	74.4194	76.9000	74.4194	76.9000	74.4194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344	(72)
Total internal gains	398.9963	406.5401	390.9451	376.9625	359.0719	343.5356	331.3075	332.4652	341.9447	356.5332	377.2850	391.4429	(73)

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					
Northeast				2.8500	11.2829	0.6300	0.7000	0.7700				9.8274 (75)
Southwest				1.6900	36.7938	0.6300	0.7000	0.7700				19.0035 (79)
Northwest				6.0600	11.2829	0.6300	0.7000	0.7700				20.8962 (81)
Solar gains	49.7271	94.9087	156.9650	239.9221	310.2036	326.2020	306.9022	251.6802	185.2529	112.2030	61.4200	41.3535 (83)
Total gains	448.7234	501.4489	547.9100	616.8845	669.2755	669.7376	638.2097	584.1454	527.1975	468.7362	438.7050	432.7964 (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	78.0129	78.1822	78.3488	79.1410	79.2910	79.9968	79.9968	80.1289	79.7235	79.2910	78.9881	78.6740	
alpha	6.2009	6.2121	6.2233	6.2761	6.2861	6.3331	6.3331	6.3419	6.3149	6.2861	6.2659	6.2449	
util living area	0.9987	0.9969	0.9914	0.9622	0.8584	0.6556	0.4842	0.5492	0.8287	0.9786	0.9967	0.9989	(86)
MIT	19.9471	20.0820	20.3047	20.6254	20.8778	20.9821	20.9977	20.9951	20.9277	20.6085	20.2281	19.9278	(87)
Th 2	19.7265	19.7288	19.7312	19.7422	19.7442	19.7538	19.7538	19.7556	19.7501	19.7442	19.7401	19.7357	(88)
util rest of house	0.9979	0.9952	0.9863	0.9395	0.7878	0.5382	0.3487	0.4042	0.7224	0.9611	0.9944	0.9983	(89)
MIT 2	18.5385	18.7124	18.9964	19.3963	19.6626	19.7475	19.7535	19.7548	19.7153	19.3864	18.9081	18.5208	(90)
Living area fraction										fLA = Living area / (4) =		0.4400	(91)
MIT	19.1583	19.3150	19.5721	19.9371	20.1973	20.2907	20.3009	20.3005	20.2488	19.9241	19.4889	19.1399	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1583	19.3150	19.5721	19.9371	20.1973	20.2907	20.3009	20.3005	20.2488	19.9241	19.4889	19.1399	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9944	0.9854	0.9438	0.8160	0.5904	0.4087	0.4687	0.7692	0.9643	0.9938	0.9979	(94)
Useful gains	447.5669	498.6626	539.9100	582.2064	546.0956	395.4014	260.8215	273.7760	405.5404	452.0078	435.9822	431.9040	(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	1075.9879	1041.6298	942.5785	787.8779	605.4256	401.8843	261.3630	275.0056	435.7199	664.3394	886.0850	1072.8110	(97)
Space heating kWh	467.5452	364.8739	299.5853	148.0834	44.1415	0.0000	0.0000	0.0000	0.0000	157.9748	324.0740	476.8348	(98a)
Space heating requirement - total per year (kWh/year)												2283.1130	
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	467.5452	364.8739	299.5853	148.0834	44.1415	0.0000	0.0000	0.0000	0.0000	157.9748	324.0740	476.8348	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2283.1130	
Space heating per m2											(98c) / (4) =	45.6623	(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	467.5452	364.8739	299.5853	148.0834	44.1415	0.0000	0.0000	0.0000	0.0000	157.9748	324.0740	476.8348	(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)	506.5496	395.3131	324.5778	160.4371	47.8240	0.0000	0.0000	0.0000	0.0000	171.1536	351.1094	516.6141	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9734	85.7240	85.1778	83.8770	81.6191	79.8000	79.8000	79.8000	79.8000	83.9908	85.4600	86.0307	(217)
Fuel for water heating, kWh/month	223.7644	198.6100	212.8890	191.5807	191.8498	177.9421	176.5248	182.9609	184.3137	193.9656	201.0985	221.3833	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	15.4629	12.4049	11.1692	8.1831	6.3208	5.1642	5.7661	7.4950	9.7352	12.7731	14.4272	15.8926	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-23.8328	-33.8329	-48.9899	-55.5401	-60.3303	-56.5282	-55.8797	-52.5593	-46.7312	-38.9404	-26.3027	-20.5817	(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	-12.7722	-26.9432	-53.6699	-80.7607	-106.9033	-107.4051	-106.0926	-89.7353	-65.6835	-38.5265	-17.0562	-10.0903	(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												2473.5786	(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	2356.8828	(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)	124.7943	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1235.6876	(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	3805.5680	(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	2473.5786	0.2100	519.4515	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2356.8828	0.2100	494.9454	(264)
Space and water heating			1014.3969	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	124.7943	0.1443	18.0117	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.0489	0.1344	-69.8956	
PV Unit electricity exported	-715.6388	0.1259	-90.0647	
Total			-159.9602	(269)
Total CO2, kg/year			884.3776	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.6900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2473.5786	1.1300	2795.1438	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2356.8828	1.1300	2663.2776	(278)
Space and water heating			5458.4214	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	124.7943	1.5338	191.4136	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.0489	1.4967	-778.3655	
PV Unit electricity exported	-715.6388	0.4620	-330.5987	
Total			-1108.9642	(283)
Total Primary energy kWh/year			4670.9716	(286)
Target Primary Energy Rate (TPER)			93.4200	(287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000 (1b)	x	2.4000 (2b)	=	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(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													
	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(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	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			11.9000	1.2357	14.7053			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	61.5000	11.9000	49.6000	0.1900	9.4240	60.0000	2976.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Roof	4.0000		4.0000	0.1400	0.5600	9.0000	36.0000	(30)
Total net area of external elements Aum(A, m2)			125.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4553			(33)
Party Ceiling			46.0000			40.0000	1840.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	20338.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		406.7600 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.4000	0.0600	0.5640
E3 Sill	8.5000	0.0180	0.1530
E4 Jamb	15.0000	0.0140	0.2100
E5 Ground floor (normal)	29.8000	0.1110	3.3078
E16 Corner (normal)	19.2000	0.0490	0.9408
E7 Party floor between dwellings (in blocks of flats)	28.7000	0.0230	0.6601
E15 Flat roof with parapet	12.2000	0.3000	3.6600

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.4957 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.9510 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	67.7884	67.6316	67.4780	66.7562	66.6211	65.9925	65.9925	65.8760	66.2346	66.6211	66.8943	67.1799	(39)
Average = Sum(39)m / 12 =												66.7555	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3558	1.3526	1.3496	1.3351	1.3324	1.3198	1.3198	1.3175	1.3247	1.3324	1.3379	1.3436	(40)
HLP (average)												1.3351	
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		1.6901 (42)

Hot water usage for mixer showers

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

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day)		50.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)
Energy content (annual)										Total = Sum(45)m =		832.1197	
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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)
										Total per year (kWh/year) = Sum(64)m =		707.3017	(64)
12Total per year (kWh/year)												707	(64)
Electric shower(s)													
	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		478.7637	(64a)
Heat gains from water heating, kWh/month													
	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)

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

	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376 (68)

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

	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505 (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)

	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)

Water heating gains (Table 5)

	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542 (72)

Total internal gains

	308.7177	317.2236	303.9058	295.3692	280.6905	271.5357	261.6280	261.2424	268.8523	276.6680	292.2114	301.9060 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.2000	11.2829	0.6300	0.7000	0.7700	11.0343	(75)
Southwest	1.9000	36.7938	0.6300	0.7000	0.7700	21.3649	(79)
Northwest	6.8000	11.2829	0.6300	0.7000	0.7700	23.4479	(81)

Solar gains	55.8470	106.5817	176.2525	269.3785	348.2706	366.2253	344.5602	282.5732	208.0081	125.9982	68.9777	46.4437 (83)
Total gains	364.5647	423.8052	480.1583	564.7477	628.9611	637.7610	606.1882	543.8157	476.8604	402.6662	361.1891	348.3497 (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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.3394	83.5326	83.7228	84.6280	84.7996	85.6074	85.6074	85.7587	85.2944	84.7996	84.4533	84.0942	
alpha	6.5560	6.5688	6.5815	6.6419	6.6533	6.7072	6.7072	6.7172	6.6863	6.6533	6.6302	6.6063	
util living area	0.9996	0.9988	0.9953	0.9701	0.8627	0.6475	0.4772	0.5523	0.8507	0.9885	0.9988	0.9997	(86)
MIT	19.9265	20.0689	20.2995	20.6357	20.8921	20.9868	20.9985	20.9962	20.9279	20.5866	20.2026	19.9072	(87)
Th 2	19.7974	19.7998	19.8022	19.8134	19.8155	19.8253	19.8253	19.8271	19.8215	19.8155	19.8113	19.8068	(88)
util rest of house	0.9994	0.9980	0.9924	0.9517	0.7953	0.5366	0.3509	0.4145	0.7524	0.9783	0.9980	0.9995	(89)
MIT 2	18.8378	18.9819	19.2129	19.5456	19.7588	19.8217	19.8251	19.8266	19.7932	19.5070	19.1248	18.8262	(90)
Living area fraction									fLA = Living area / (4) =			0.4400	(91)
MIT	19.3169	19.4602	19.6910	20.0252	20.2574	20.3343	20.3414	20.3413	20.2925	19.9820	19.5990	19.3018	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3169	19.4602	19.6910	20.0252	20.2574	20.3343	20.3414	20.3413	20.2925	19.9820	19.5990	19.3018	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9992	0.9978	0.9920	0.9557	0.8230	0.5859	0.4067	0.4757	0.7961	0.9802	0.9978	0.9994	(94)
Useful gains	364.2856	422.8540	476.3167	539.7190	517.6065	373.6960	246.5503	258.6861	379.6175	394.7073	360.4022	348.1536	(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	1017.9697	984.7281	890.1038	742.6777	570.1063	378.4237	246.9047	259.6347	410.1563	625.0414	836.1147	1014.5390	(97)
Space heating kWh	486.3410	377.5794	307.8575	146.1303	39.0598	0.0000	0.0000	0.0000	0.0000	171.3686	342.5130	495.7907	(98a)
Space heating requirement - total per year (kWh/year)												2366.6404	
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	486.3410	377.5794	307.8575	146.1303	39.0598	0.0000	0.0000	0.0000	0.0000	171.3686	342.5130	495.7907	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2366.6404	
Space heating per m2											(98c) / (4) =	47.3328	(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	620.3292	488.3443	500.6580	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9250	0.9677	0.9401	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	573.7967	472.5537	470.6821	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	719.0840	683.6525	612.1672	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	104.6068	157.0575	105.2649	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	26.1517	39.2644	26.3162	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												91.7323	(107)
Energy for space heating												47.3328	(99)
Energy for space cooling												1.8346	(108)
Total												49.1675	(109)
Fabric Energy Efficiency (DFEE)												49.2	(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	50.0000 (1b)	x	2.4000 (2b)	=	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(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	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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			1.9000	1.0000	1.9000			(26)
TER Opening Type (Uw = 1.20)			10.6000	1.1450	12.1374			(27)
Ground Floor			50.0000	0.1300	6.5000			(28a)
Wall (external)	61.5000	10.6000	50.9000	0.1800	9.1620			(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1800	1.4580			(29a)
Roof	4.0000		4.0000	0.1100	0.4400			(30)
Total net area of external elements Aum(A, m2)			125.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.5974			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 406.7600 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.4000	0.0500	0.4700
E3 Sill	8.5000	0.0500	0.4250
E4 Jamb	15.0000	0.0500	0.7500
E5 Ground floor (normal)	29.8000	0.1600	4.7680
E16 Corner (normal)	19.2000	0.0900	1.7280
E7 Party floor between dwellings (in blocks of flats)	28.7000	0.0700	2.0090
E15 Flat roof with parapet	12.2000	0.5600	6.8320

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.9820	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	48.5794	(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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	72.4168	72.2600	72.1063	71.3846	71.2495	70.6208	70.6208	70.5044	70.8630	71.2495	71.5227	71.8083	(39)
Average = Sum(39)m / 12 =												71.3839	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4483	1.4452	1.4421	1.4277	1.4250	1.4124	1.4124	1.4101	1.4173	1.4250	1.4305	1.4362	(40)
HLP (average)												1.4277	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6901	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												50.1040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)
Energy content (annual)											Total = Sum(45)m =	832.1197	
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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)
										Total per year (kWh/year) = Sum(64)m =		707.3017	(64)
12Total per year (kWh/year)												707	(64)
Electric shower(s)													
	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					478.7637	(64a)
Heat gains from water heating, kWh/month													
	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.4194	82.3929	74.4194	76.9000	74.4194	76.9000	74.4194	74.4194	76.9000	74.4194	76.9000	74.4194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542	(72)
Total internal gains													
	308.8744	317.3971	304.0626	295.5312	280.8472	271.6977	261.7848	261.3992	269.0143	276.8247	292.3734	302.0627	(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	
Northeast	2.8500	11.2829	0.6300	0.7000	0.7700	9.8274	(75)
Southwest	1.6900	36.7938	0.6300	0.7000	0.7700	19.0035	(79)
Northwest	6.0600	11.2829	0.6300	0.7000	0.7700	20.8962	(81)

Solar gains	49.7271	94.9087	156.9650	239.9221	310.2036	326.2020	306.9022	251.6802	185.2529	112.2030	61.4200	41.3535	(83)
Total gains	358.6015	412.3058	461.0275	535.4532	591.0508	597.8997	568.6870	513.0794	454.2672	389.0278	353.7934	343.4162	(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	78.0129	78.1822	78.3488	79.1410	79.2910	79.9968	79.9968	80.1289	79.7235	79.2910	78.9881	78.6740	
alpha	6.2009	6.2121	6.2233	6.2761	6.2861	6.3331	6.3331	6.3419	6.3149	6.2861	6.2659	6.2449	
util living area													
	0.9996	0.9990	0.9966	0.9805	0.9068	0.7199	0.5409	0.6190	0.8929	0.9917	0.9990	0.9997	(86)
MIT	19.8231	19.9602	20.1887	20.5303	20.8244	20.9701	20.9957	20.9906	20.8843	20.5073	20.1119	19.8045	(87)
Th 2	19.7265	19.7288	19.7312	19.7422	19.7442	19.7538	19.7538	19.7556	19.7501	19.7442	19.7401	19.7357	(88)
util rest of house													
	0.9994	0.9984	0.9944	0.9672	0.8491	0.5982	0.3910	0.4593	0.8033	0.9839	0.9983	0.9996	(89)
MIT 2	18.6770	18.8158	19.0452	19.3871	19.6454	19.7451	19.7533	19.7543	19.7009	19.3715	18.9765	18.6659	(90)
Living area fraction										fLA = Living area / (4) =		0.4400	(91)
MIT	19.1813	19.3193	19.5483	19.8901	20.1641	20.2841	20.3000	20.2983	20.2216	19.8712	19.4761	19.1669	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1813	19.3193	19.5483	19.8901	20.1641	20.2841	20.3000	20.2983	20.2216	19.8712	19.4761	19.1669	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9993	0.9981	0.9939	0.9692	0.8713	0.6527	0.4577	0.5309	0.8426	0.9849	0.9981	0.9995	(94)
Useful gains	358.3410	411.5191	458.2360	518.9653	514.9689	390.2340	260.2658	272.3855	382.7644	383.1696	353.1140	343.2281	(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													
	1077.6547	1041.9394	940.8683	784.5264	603.0653	401.4150	261.2948	274.8465	433.7934	660.5713	885.1721	1074.7496	(97)
Space heating kWh													
	535.1694	423.6425	359.0785	191.2040	65.5437	0.0000	0.0000	0.0000	0.0000	206.3868	383.0818	544.2521	(98a)
Space heating requirement - total per year (kWh/year)												2708.3588	
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													
	535.1694	423.6425	359.0785	191.2040	65.5437	0.0000	0.0000	0.0000	0.0000	206.3868	383.0818	544.2521	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2708.3588	

Space heating per m2 (98c) / (4) = 54.1672 (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	663.8360	522.5943	535.8337	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8691	0.9342	0.8930	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	576.9081	488.1903	478.4906	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	672.3172	639.6515	576.0778	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	68.6946	112.6871	72.6048	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	17.1737	28.1718	18.1512	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												63.4966	(107)
Energy for space heating												54.1672	(99)
Energy for space cooling												1.2699	(108)
Total												55.4371	(109)
Fabric Energy Efficiency (TFEE)												55.4	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4167 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			11.9000	1.2357	14.7053			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	61.5000	11.9000	49.6000	0.1900	9.4240	60.0000	2976.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Roof	4.0000		4.0000	0.1400	0.5600	9.0000	36.0000	(30)
Total net area of external elements Aum(A, m2)			125.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4553			(33)
Party Ceiling			46.0000			40.0000	1840.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	20338.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		406.7600 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	9.4000	0.0600	0.5640	
E3 Sill	8.5000	0.0180	0.1530	
E4 Jamb	15.0000	0.0140	0.2100	
E5 Ground floor (normal)	29.8000	0.1110	3.3078	
E16 Corner (normal)	19.2000	0.0490	0.9408	
E7 Party floor between dwellings (in blocks of flats)	28.7000	0.0230	0.6601	
E15 Flat roof with parapet	12.2000	0.3000	3.6600	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4957 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.9510 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	67.7884	67.6316	67.4780	66.7562	66.6211	65.9925	65.9925	65.8760	66.2346	66.6211	66.8943	67.1799	(39)

Average = Sum(39)m / 12 = 66.7555

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3558	1.3526	1.3496	1.3351	1.3324	1.3198	1.3198	1.3175	1.3247	1.3324	1.3379	1.3436	(40)
HLP (average)												1.3351	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)

Energy content (annual) Total = Sum(45)m = 1637.0557

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

25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:

Store volume 173.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 1.0368 (55)

Total storage loss

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)

If cylinder contains dedicated solar storage

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)

Total per year (kWh/year) = Sum(64)m = 2015.4877 (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

56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0371	16.0204	13.0286	9.8635	7.3731	6.2247	6.7260	8.7427	11.7344	14.8995	17.3900	18.5384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	394.3114	392.6175	380.1079	356.4425	333.4462	312.4913	300.0454	302.4674	314.3542	335.6255	361.4831	384.0596	(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	
Northeast	3.2000	11.2829	0.6300	0.7000	0.7700	11.0343	(75)
Southwest	1.9000	36.7938	0.6300	0.7000	0.7700	21.3649	(79)
Northwest	6.8000	11.2829	0.6300	0.7000	0.7700	23.4479	(81)

Solar gains	55.8470	106.5817	176.2525	269.3785	348.2706	366.2253	344.5602	282.5732	208.0081	125.9982	68.9777	46.4437	(83)
Total gains	450.1584	499.1992	556.3604	625.8210	681.7168	678.7166	644.6057	585.0406	522.3623	461.6237	430.4607	430.5033	(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	83.3394	83.5326	83.7228	84.6280	84.7996	85.6074	85.6074	85.7587	85.2944	84.7996	84.4533	84.0942	
alpha	6.5560	6.5688	6.5815	6.6419	6.6533	6.7072	6.7072	6.7172	6.6863	6.6533	6.6302	6.6063	
util living area													
	0.9986	0.9968	0.9894	0.9518	0.8243	0.6123	0.4493	0.5149	0.8051	0.9766	0.9967	0.9989	(86)
MIT	20.0455	20.1729	20.4011	20.7027	20.9192	20.9905	20.9989	20.9975	20.9489	20.6606	20.2982	20.0217	(87)
Th 2	19.7974	19.7998	19.8022	19.8134	19.8155	19.8253	19.8253	19.8271	19.8215	19.8155	19.8113	19.8068	(88)
util rest of house													
	0.9978	0.9950	0.9832	0.9252	0.7508	0.5054	0.3301	0.3855	0.7000	0.9581	0.9946	0.9984	(89)
MIT 2	18.7183	18.8826	19.1727	19.5445	19.7637	19.8220	19.8252	19.8267	19.7976	19.5066	19.0521	18.6951	(90)
Living area fraction										fLA = Living area / (4) =		0.4400	(91)
MIT	19.3023	19.4503	19.7132	20.0541	20.2721	20.3361	20.3416	20.3419	20.3041	20.0144	19.6004	19.2788	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3023	19.4503	19.7132	20.0541	20.2721	20.3361	20.3416	20.3419	20.3041	20.0144	19.6004	19.2788	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9943	0.9826	0.9316	0.7813	0.5528	0.3827	0.4428	0.7466	0.9620	0.9940	0.9980	(94)
Useful gains	448.9563	496.3332	546.7022	582.9967	532.6379	375.1702	246.6746	259.0568	389.9965	444.0873	427.8868	429.6340	(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													
	1016.9817	984.0600	891.5983	744.6032	571.0829	378.5422	246.9189	259.6746	410.9293	627.1946	836.2058	1012.9940	(97)
Space heating kWh													
	422.6109	327.7524	256.6027	116.3567	28.6031	0.0000	0.0000	0.0000	0.0000	136.2319	293.9897	434.0199	(98a)
Space heating requirement - total per year (kWh/year)												2016.1672	
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													
	422.6109	327.7524	256.6027	116.3567	28.6031	0.0000	0.0000	0.0000	0.0000	136.2319	293.9897	434.0199	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2016.1672	
Space heating per m2											(98c) / (4) =	40.3233	(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 %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	422.6109	327.7524	256.6027	116.3567	28.6031	0.0000	0.0000	0.0000	0.0000	136.2319	293.9897	434.0199	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	422.6109	327.7524	256.6027	116.3567	28.6031	0.0000	0.0000	0.0000	0.0000	136.2319	293.9897	434.0199	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month													
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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												2016.1672	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												302.9550	
Water heating fuel used												665.2763	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												127.4161	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000	(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	2808.8596	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2016.1672	16.4900	332.4660	(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)	665.2763	16.4900	109.7041	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	127.4161	16.4900	21.0109	(250)
Additional standing charges			0.0000	(251)
Total energy cost			463.1810	(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] =	1.7552	(257)
SAP value		71.5480	
SAP rating (Section 12)		72	(258)
SAP band		C	

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	2016.1672	0.1561	314.6660	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			408.4966	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)
Total CO2, kg/year			426.8867	(272)
CO2 emissions per m2			8.5400	(273)
EI value			93.9787	
EI rating			94	(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		50.0000 (1b)	x	2.4000 (2b)	=	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate													
	0.3807	0.3630	0.3630	0.3276	0.3187	0.3010	0.3010	0.2833	0.2833	0.3010	0.3010	0.3276	(22b)
Effective ac	0.5725	0.5659	0.5659	0.5537	0.5508	0.5453	0.5453	0.5401	0.5401	0.5453	0.5453	0.5537	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			11.9000	1.2357	14.7053			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	61.5000	11.9000	49.6000	0.1900	9.4240	60.0000	2976.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Roof	4.0000		4.0000	0.1400	0.5600	9.0000	36.0000	(30)
Total net area of external elements Aum(A, m2)			125.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4553			(33)
Party Ceiling			46.0000			40.0000	1840.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20338.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 406.7600 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.4000	0.0600	0.5640
E3 Sill	8.5000	0.0180	0.1530
E4 Jamb	15.0000	0.0140	0.2100
E5 Ground floor (normal)	29.8000	0.1110	3.3078
E16 Corner (normal)	19.2000	0.0490	0.9408
E7 Party floor between dwellings (in blocks of flats)	28.7000	0.0230	0.6601
E15 Flat roof with parapet	12.2000	0.3000	3.6600

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4957 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.9510 (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	22.6701	22.4093	22.4093	21.9250	21.8117	21.5944	21.5944	21.3895	21.3895	21.5944	21.5944	21.9250	(38)
Heat transfer coeff													
	66.6211	66.3603	66.3603	65.8760	65.7627	65.5454	65.5454	65.3405	65.3405	65.5454	65.5454	65.8760	(39)
Average = Sum(39)m / 12 =												65.8099	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3324	1.3272	1.3272	1.3175	1.3153	1.3109	1.3109	1.3068	1.3068	1.3109	1.3109	1.3175	(40)
HLP (average)												1.3162	
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 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)											Total = Sum(45)m =	1637.0557	
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss													
	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage													
	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
											Total per year (kWh/year) = Sum(64)m =	2015.4877	(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

56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)

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

	18.0371	16.0204	13.0286	9.8635	7.3731	6.2247	6.7260	8.7427	11.7344	14.8995	17.3900	18.5384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains													
	394.3114	392.6175	380.1079	356.4425	333.4462	312.4913	300.0454	302.4674	314.3542	335.6255	361.4831	384.0596	(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	
Northeast	3.2000	13.3408	0.6300	0.7000	0.7700	13.0468	(75)
Southwest	1.9000	41.5040	0.6300	0.7000	0.7700	24.0999	(79)
Northwest	6.8000	13.3408	0.6300	0.7000	0.7700	27.7245	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	64.8712	106.5322	180.2940	283.9663	355.3406	401.3571	373.8198	310.4341	228.7873	141.0828	79.5778	51.6145	(83)
Total gains	459.1826	499.1497	560.4019	640.4088	688.7867	713.8484	673.8653	612.9015	543.1415	476.7083	441.0609	435.6741	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	84.7996	85.1328	85.1328	85.7587	85.9065	86.1913	86.1913	86.4616	86.4616	86.1913	86.1913	85.7587	
alpha	6.6533	6.6755	6.6755	6.7172	6.7271	6.7461	6.7461	6.7641	6.7641	6.7461	6.7461	6.7172	
util living area													
	0.9982	0.9964	0.9876	0.9404	0.7961	0.5551	0.3983	0.4467	0.7696	0.9684	0.9958	0.9987	(86)
MIT	20.1106	20.2174	20.4451	20.7448	20.9389	20.9950	20.9995	20.9991	20.9630	20.7091	20.3550	20.0843	(87)
Th 2	19.8155	19.8196	19.8196	19.8271	19.8289	19.8323	19.8323	19.8355	19.8355	19.8323	19.8323	19.8271	(88)
util rest of house													
	0.9972	0.9944	0.9805	0.9091	0.7177	0.4517	0.2852	0.3235	0.6614	0.9445	0.9930	0.9980	(89)
MIT 2	18.8155	18.9546	19.2414	19.6027	19.7919	19.8308	19.8322	19.8354	19.8193	19.5765	19.1405	18.7909	(90)
Living area fraction									fLA = Living area / (4) =			0.4400	(91)
MIT	19.3853	19.5102	19.7710	20.1052	20.2966	20.3430	20.3459	20.3474	20.3225	20.0748	19.6749	19.3600	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3853	19.5102	19.7710	20.1052	20.2966	20.3430	20.3459	20.3474	20.3225	20.0748	19.6749	19.3600	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9937	0.9801	0.9177	0.7510	0.4974	0.3350	0.3779	0.7095	0.9506	0.9924	0.9976	(94)
Useful gains	457.6502	496.0177	549.2741	587.6994	517.2742	355.1002	225.7658	231.5887	385.3592	453.1759	437.7293	434.6208	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W													
	985.0160	956.2674	867.3968	724.9820	545.6055	356.7655	225.8600	231.7893	400.0476	607.9238	811.1182	978.9171	(97)
Space heating kWh													
	392.3601	309.2878	236.6833	98.8434	21.0785	0.0000	0.0000	0.0000	0.0000	115.1324	268.8400	404.9564	(98a)
Space heating requirement - total per year (kWh/year)												1847.1820	
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													
	392.3601	309.2878	236.6833	98.8434	21.0785	0.0000	0.0000	0.0000	0.0000	115.1324	268.8400	404.9564	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1847.1820	
Space heating per m2											(98c) / (4) =	36.9436	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	392.3601	309.2878	236.6833	98.8434	21.0785	0.0000	0.0000	0.0000	0.0000	115.1324	268.8400	404.9564	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	392.3601	309.2878	236.6833	98.8434	21.0785	0.0000	0.0000	0.0000	0.0000	115.1324	268.8400	404.9564	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month													

	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)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 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	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	1847.1820 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	302.9550
Water heating fuel used	665.2763 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	127.4161 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	2639.8744 (238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1847.1820	25.1600	464.7510	(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)	665.2763	25.1600	167.3835	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	127.4161	25.1600	32.0579	(250)
Additional standing charges			0.0000	(251)
Total energy cost			664.1924	(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	1847.1820	0.1564	288.8310	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			382.6616	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)
Total CO2, kg/year			401.0517	(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	1847.1820	1.5789	2916.5120	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			3928.7443	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	127.4161	1.5338	195.4351	(282)
Total Primary energy kWh/year			4124.1795	(286)

SAP 10 EPC IMPROVEMENTS

ZA0902

Current energy efficiency rating:	C 72
Current environmental impact rating:	A 94

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

Recommended measures:	SAP change	Cost change	CO2 change

(none)

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

Potential energy efficiency rating: C 72
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£664	£664	£0
Space heating	£465	£465	£0
Water heating	£167	£167	£0
Lighting	£32	£32	£0
Total cost of fuels	£664	£664	£0
Total cost of uses	£664	£664	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	82 kWh/m²	82 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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4167 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			11.9000	1.2357	14.7053			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	61.5000	11.9000	49.6000	0.1900	9.4240	60.0000	2976.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Roof	4.0000		4.0000	0.1400	0.5600	9.0000	36.0000	(30)
Total net area of external elements Aum(A, m2)			125.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4553			(33)
Party Ceiling			46.0000			40.0000	1840.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		20338.0000	(34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 406.7600 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	9.4000	0.0600	0.5640
E3	Sill	8.5000	0.0180	0.1530
E4	Jamb	15.0000	0.0140	0.2100
E5	Ground floor (normal)	29.8000	0.1110	3.3078
E16	Corner (normal)	19.2000	0.0490	0.9408
E7	Party floor between dwellings (in blocks of flats)	28.7000	0.0230	0.6601
E15	Flat roof with parapet	12.2000	0.3000	3.6600

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4957 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.9510 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	67.7884	67.6316	67.4780	66.7562	66.6211	65.9925	65.9925	65.8760	66.2346	66.6211	66.8943	67.1799	(39)
Average = Sum(39)m / 12 =												66.7555	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3558	1.3526	1.3496	1.3351	1.3324	1.3198	1.3198	1.3175	1.3247	1.3324	1.3379	1.3436	(40)
HLP (average)												1.3351	
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 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	

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

25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:
Store volume 173.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0368 (55)
Total storage loss

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)

If cylinder contains dedicated solar storage

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(57)
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)
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)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
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)
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)
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)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)

Total per year (kWh/year) = Sum(64)m = 2015.4877 (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

56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0371	16.0204	13.0286	9.8635	7.3731	6.2247	6.7260	8.7427	11.7344	14.8995	17.3900	18.5384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	394.3114	392.6175	380.1079	356.4425	333.4462	312.4913	300.0454	302.4674	314.3542	335.6255	361.4831	384.0596	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.2000	11.2829	0.6300	0.7000	0.7700	11.0343	(75)
Southwest	1.9000	36.7938	0.6300	0.7000	0.7700	21.3649	(79)
Northwest	6.8000	11.2829	0.6300	0.7000	0.7700	23.4479	(81)

Solar gains	55.8470	106.5817	176.2525	269.3785	348.2706	366.2253	344.5602	282.5732	208.0081	125.9982	68.9777	46.4437	(83)

Total gains	450.1584	499.1992	556.3604	625.8210	681.7168	678.7166	644.6057	585.0406	522.3623	461.6237	430.4607	430.5033	(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	83.3394	83.5326	83.7228	84.6280	84.7996	85.6074	85.6074	85.7587	85.2944	84.7996	84.4533	84.0942	
alpha	6.5560	6.5688	6.5815	6.6419	6.6533	6.7072	6.7072	6.7172	6.6863	6.6533	6.6302	6.6063	
util living area													
	0.9986	0.9968	0.9894	0.9518	0.8243	0.6123	0.4493	0.5149	0.8051	0.9766	0.9967	0.9989	(86)
MIT	20.0455	20.1729	20.4011	20.7027	20.9192	20.9905	20.9989	20.9975	20.9489	20.6606	20.2982	20.0217	(87)
Th 2	19.7974	19.7998	19.8022	19.8134	19.8155	19.8253	19.8253	19.8271	19.8215	19.8155	19.8113	19.8068	(88)
util rest of house													
	0.9978	0.9950	0.9832	0.9252	0.7508	0.5054	0.3301	0.3855	0.7000	0.9581	0.9946	0.9984	(89)
MIT 2	18.7183	18.8826	19.1727	19.5445	19.7637	19.8220	19.8252	19.8267	19.7976	19.5066	19.0521	18.6951	(90)
Living area fraction										fLA = Living area / (4) =		0.4400	(91)
MIT	19.3023	19.4503	19.7132	20.0541	20.2721	20.3361	20.3416	20.3419	20.3041	20.0144	19.6004	19.2788	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3023	19.4503	19.7132	20.0541	20.2721	20.3361	20.3416	20.3419	20.3041	20.0144	19.6004	19.2788	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9943	0.9826	0.9316	0.7813	0.5528	0.3827	0.4428	0.7466	0.9620	0.9940	0.9980	(94)
Useful gains	448.9563	496.3332	546.7022	582.9967	532.6379	375.1702	246.6746	259.0568	389.9965	444.0873	427.8868	429.6340	(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													
	1016.9817	984.0600	891.5983	744.6032	571.0829	378.5422	246.9189	259.6746	410.9293	627.1946	836.2058	1012.9940	(97)
Space heating kWh													
	422.6109	327.7524	256.6027	116.3567	28.6031	0.0000	0.0000	0.0000	0.0000	136.2319	293.9897	434.0199	(98a)
Space heating requirement - total per year (kWh/year)												2016.1672	
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													
	422.6109	327.7524	256.6027	116.3567	28.6031	0.0000	0.0000	0.0000	0.0000	136.2319	293.9897	434.0199	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2016.1672	
Space heating per m2											(98c) / (4) =	40.3233	(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 %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	422.6109	327.7524	256.6027	116.3567	28.6031	0.0000	0.0000	0.0000	0.0000	136.2319	293.9897	434.0199	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	422.6109	327.7524	256.6027	116.3567	28.6031	0.0000	0.0000	0.0000	0.0000	136.2319	293.9897	434.0199	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month													
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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												2016.1672	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												302.9550	
Water heating fuel used												665.2763	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	127.4161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	2808.8596	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2016.1672	16.4900	332.4660	(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)	665.2763	16.4900	109.7041	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	127.4161	16.4900	21.0109	(250)
Additional standing charges			0.0000	(251)
Total energy cost			463.1810	(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] =	1.7552	(257)
SAP value		71.5480	
SAP rating (Section 12)		72	(258)
SAP band		C	

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	2016.1672	0.1561	314.6660	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			408.4966	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)
Total CO2, kg/year			426.8867	(272)
CO2 emissions per m2			8.5400	(273)
EI value			93.9787	
EI rating			94	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000 (1b)	x	2.4000 (2b)	=	120.0000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate	0.3807	0.3630	0.3630	0.3276	0.3187	0.3010	0.3010	0.2833	0.2833	0.3010	0.3010	0.3276	(22b)
Effective ac	0.5725	0.5659	0.5659	0.5537	0.5508	0.5453	0.5453	0.5401	0.5401	0.5453	0.5453	0.5537	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			11.9000	1.2357	14.7053			(27)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	61.5000	11.9000	49.6000	0.1900	9.4240	60.0000	2976.0000	(29a)
Wall (common)	10.0000	1.9000	8.1000	0.1600	1.2960	60.0000	486.0000	(29a)
Roof	4.0000		4.0000	0.1400	0.5600	9.0000	36.0000	(30)
Total net area of external elements Aum(A, m2)			125.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4553			(33)
Party Ceiling			46.0000			40.0000	1840.0000	(32b)
Internal Wall			75.0000			75.0000	5625.0000	(32c)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20338.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 406.7600 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.4000	0.0600	0.5640
E3 Sill	8.5000	0.0180	0.1530
E4 Jamb	15.0000	0.0140	0.2100
E5 Ground floor (normal)	29.8000	0.1110	3.3078
E16 Corner (normal)	19.2000	0.0490	0.9408
E7 Party floor between dwellings (in blocks of flats)	28.7000	0.0230	0.6601
E15 Flat roof with parapet	12.2000	0.3000	3.6600

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4957 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.9510 (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	22.6701	22.4093	22.4093	21.9250	21.8117	21.5944	21.5944	21.3895	21.3895	21.5944	21.5944	21.9250	(38)
Heat transfer coeff	66.6211	66.3603	66.3603	65.8760	65.7627	65.5454	65.5454	65.3405	65.3405	65.5454	65.5454	65.8760	(39)
Average = Sum(39)m / 12 =												65.8099	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3324	1.3272	1.3272	1.3175	1.3153	1.3109	1.3109	1.3068	1.3068	1.3109	1.3109	1.3175	(40)
HLP (average)												1.3162	
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 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(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

56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.0371	16.0204	13.0286	9.8635	7.3731	6.2247	6.7260	8.7427	11.7344	14.8995	17.3900	18.5384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains													
	394.3114	392.6175	380.1079	356.4425	333.4462	312.4913	300.0454	302.4674	314.3542	335.6255	361.4831	384.0596	(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	
Northeast	3.2000	13.3408	0.6300	0.7000	0.7700	13.0468	(75)
Southwest	1.9000	41.5040	0.6300	0.7000	0.7700	24.0999	(79)
Northwest	6.8000	13.3408	0.6300	0.7000	0.7700	27.7245	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	64.8712	106.5322	180.2940	283.9663	355.3406	401.3571	373.8198	310.4341	228.7873	141.0828	79.5778	51.6145	(83)
Total gains	459.1826	499.1497	560.4019	640.4088	688.7867	713.8484	673.8653	612.9015	543.1415	476.7083	441.0609	435.6741	(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	84.7996	85.1328	85.1328	85.7587	85.9065	86.1913	86.1913	86.4616	86.4616	86.1913	86.1913	85.7587	
alpha	6.6533	6.6755	6.6755	6.7172	6.7271	6.7461	6.7461	6.7641	6.7641	6.7461	6.7461	6.7172	
util living area													
	0.9982	0.9964	0.9876	0.9404	0.7961	0.5551	0.3983	0.4467	0.7696	0.9684	0.9958	0.9987	(86)
MIT	20.1106	20.2174	20.4451	20.7448	20.9389	20.9950	20.9995	20.9991	20.9630	20.7091	20.3550	20.0843	(87)
Th 2	19.8155	19.8196	19.8196	19.8271	19.8289	19.8323	19.8323	19.8355	19.8355	19.8323	19.8323	19.8271	(88)
util rest of house													
	0.9972	0.9944	0.9805	0.9091	0.7177	0.4517	0.2852	0.3235	0.6614	0.9445	0.9930	0.9980	(89)
MIT 2	18.8155	18.9546	19.2414	19.6027	19.7919	19.8308	19.8322	19.8354	19.8193	19.5765	19.1405	18.7909	(90)
Living area fraction									fLA = Living area / (4) =			0.4400	(91)
MIT	19.3853	19.5102	19.7710	20.1052	20.2966	20.3430	20.3459	20.3474	20.3225	20.0748	19.6749	19.3600	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3853	19.5102	19.7710	20.1052	20.2966	20.3430	20.3459	20.3474	20.3225	20.0748	19.6749	19.3600	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9937	0.9801	0.9177	0.7510	0.4974	0.3350	0.3779	0.7095	0.9506	0.9924	0.9976	(94)
Useful gains	457.6502	496.0177	549.2741	587.6994	517.2742	355.1002	225.7658	231.5887	385.3592	453.1759	437.7293	434.6208	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W													
	985.0160	956.2674	867.3968	724.9820	545.6055	356.7655	225.8600	231.7893	400.0476	607.9238	811.1182	978.9171	(97)
Space heating kWh													
	392.3601	309.2878	236.6833	98.8434	21.0785	0.0000	0.0000	0.0000	0.0000	115.1324	268.8400	404.9564	(98a)
Space heating requirement - total per year (kWh/year)												1847.1820	
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													
	392.3601	309.2878	236.6833	98.8434	21.0785	0.0000	0.0000	0.0000	0.0000	115.1324	268.8400	404.9564	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1847.1820	
Space heating per m2											(98c) / (4) =	36.9436	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	392.3601	309.2878	236.6833	98.8434	21.0785	0.0000	0.0000	0.0000	0.0000	115.1324	268.8400	404.9564	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	392.3601	309.2878	236.6833	98.8434	21.0785	0.0000	0.0000	0.0000	0.0000	115.1324	268.8400	404.9564	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)

Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month													
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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	1847.1820	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	127.4161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	2639.8744	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1847.1820	25.1600	464.7510	(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)	665.2763	25.1600	167.3835	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	127.4161	25.1600	32.0579	(250)
Additional standing charges			0.0000	(251)
Total energy cost			664.1924	(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	1847.1820	0.1564	288.8310	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			382.6616	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)
Total CO2, kg/year			401.0517	(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	1847.1820	1.5789	2916.5120	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			3928.7443	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	127.4161	1.5338	195.4351	(282)
Total Primary energy kWh/year			4124.1795	(286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 09 Feb 2024 13:06:23

Project Information			
Assessed By	Joe Solti	Building Type	Flat, Semi-detached
OCDEA Registration	EES/003578	Assessment Date	2024-02-09

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m^2
Site Reference	ZA0903	Plot Reference	ZA0903
Address	Unit 3 255 Guildford Road, Effingham, KT24 5NP		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.25 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.06 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.36 kWh_{PE}/m^2*	
Dwelling primary energy	62.75 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*29.1 kWh/m^2*	
Dwelling fabric energy efficiency	28.5 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.18	Walls (1) (0.19)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.14	Roof (2) (0.16)	**OK**
Windows, doors, and roof windows	*1.6*	1.3	Front Door (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	27.4	0.19
Sheltered wall: Walls (2)	9.1	0.16
Party wall: Party Wall (1)	3	0 **(!)**
Exposed roof: Roof (1)	25	0.11
Exposed roof: Roof (2)	34	0.16

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front Door, Front Door	1.9	North West	N/A	1.3
Windows (NE), Windows	1.6	North East	0.7	1.3
Windows (SE), Windows	3.2	South East	0.7	1.3
Windows (SW), Windows	0.8	South West	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.018 **(!)**	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.014 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.049	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.023 **(!)**	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.018 **(!)**	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.051	
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.046	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	5 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	Auer
Model	EDL170-520RF
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and appliance thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	

Main heating 2 - type: Not applicable		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	ZA0903	**Issued on Date**	09/02/2024
Assessment Reference	ZA0903	**Prop Type Ref**	ZA0903
Property	Unit 3, 255 Guildford Road, Effingham, Surrey, KT24 5NP		

SAP Rating	81 B	**DER**	6.06	**TER**	12.25
Environmental	96 A	**% DER < TER**			50.53
CO_2 Emissions (t/year)	0.27	**DFEE**	28.55	**TFEE**	29.07
Compliance Check	See BREL	**% DFEE < TFEE**			1.81
% DPER < TPER	2.51	**DPER**	62.75	**TPER**	64.36

Assessor Details	Mr. Joe Solti	**Assessor ID**	5122-0001
Client	Vieo Projects, .		

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	50.0000	(1b)	x 2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.0000	(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) =	0.1818 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4318 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670 (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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	33.0000	5.6000	27.4000	0.1900	5.2060	110.0000	3014.0000	(29a)
Wall (common)	11.0000	1.9000	9.1000	0.1600	1.4560	110.0000	1001.0000	(29a)
Roof (loft)	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000	(30)
Roof (skeiling)	34.0000		34.0000	0.1600	5.4400	9.0000	306.0000	(30)
Total net area of external elements Aum(A, m2)			103.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.2422			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12501.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0200 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	14.4000	0.0490	0.7056

E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923	
E11 Eaves (insulation at rafter level)	30.1000	0.0180	0.5418	
E18 Party wall between dwellings	2.4000	0.0510	0.1224	
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.7289 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 26.9711 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	49.0960	48.9417	48.7904	48.0798	47.9468	47.3279	47.3279	47.2132	47.5663	47.9468	48.2158	48.4970	(39)
Average = Sum(39)m / 12 =												48.0791	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9819	0.9788	0.9758	0.9616	0.9589	0.9466	0.9466	0.9443	0.9513	0.9589	0.9643	0.9699	(40)
HLP (average)												0.9616	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(64)
12Total per year (kWh/year)												2015	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.6906	92.6575	83.6906	86.4803	83.6906	86.4803	83.6906	83.6906	86.4803	83.6906	86.4803	83.6906	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	355.1655	363.7027	347.1143	333.4407	315.2411	303.0139	290.4767	291.6344	301.4229	312.7024	333.7632	347.6121	(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	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southeast	3.2000	36.7938	0.6300	0.7000	0.7700	35.9830	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Solar gains	50.4958	87.8457	125.0619	163.1167	190.1513	192.0520	183.7954	163.1255	138.1618	98.4006	60.8161	42.9980	(83)
Total gains	405.6613	451.5483	472.1762	496.5574	505.3924	495.0658	474.2721	454.7599	439.5847	411.1030	394.5793	390.6101	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	70.7287	70.9518	71.1718	72.2237	72.4240	73.3712	73.3712	73.5493	73.0034	72.4240	72.0200	71.6024	
alpha	5.7152	5.7301	5.7448	5.8149	5.8283	5.8914	5.8914	5.9033	5.8669	5.8283	5.8013	5.7735	
util living area	0.9909	0.9820	0.9651	0.9117	0.7952	0.5982	0.4371	0.4744	0.7073	0.9222	0.9804	0.9925	(86)
MIT	20.0757	20.2376	20.4426	20.7135	20.9022	20.9850	20.9980	20.9968	20.9615	20.7345	20.3713	20.0534	(87)
Th 2	20.0984	20.1010	20.1035	20.1155	20.1177	20.1281	20.1281	20.1300	20.1241	20.1177	20.1132	20.1085	(88)
util rest of house	0.9881	0.9767	0.9546	0.8860	0.7433	0.5226	0.3516	0.3864	0.6324	0.8942	0.9737	0.9902	(89)
MIT 2	19.0348	19.2409	19.4985	19.8326	20.0381	20.1198	20.1274	20.1289	20.0997	19.8648	19.4206	19.0142	(90)
Living area fraction										fLA = Living area / (4) =		0.4800	(91)
MIT	19.5344	19.7193	19.9517	20.2554	20.4529	20.5351	20.5453	20.5455	20.5134	20.2822	19.8770	19.5130	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5344	19.7193	19.9517	20.2554	20.4529	20.5351	20.5453	20.5455	20.5134	20.2822	19.8770	19.5130	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9859	0.9739	0.9525	0.8905	0.7641	0.5585	0.3927	0.4287	0.6669	0.9001	0.9715	0.9882	(94)
Useful gains	399.9428	439.7851	449.7646	442.1876	386.1579	276.4946	186.2549	194.9501	293.1421	370.0171	383.3363	386.0162	(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	747.9510	725.2815	656.3122	545.9667	419.6729	280.8950	186.7222	195.7211	305.0594	464.2324	616.0512	742.6352	(97)
Space heating kWh	258.9181	191.8536	153.6714	74.7210	24.9352	0.0000	0.0000	0.0000	0.0000	70.0962	167.5548	265.3246	(98a)
Space heating requirement - total per year (kWh/year)												1207.0747	
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	258.9181	191.8536	153.6714	74.7210	24.9352	0.0000	0.0000	0.0000	0.0000	70.0962	167.5548	265.3246	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1207.0747	
Space heating per m2										(98c) / (4) =		24.1415	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	258.9181	191.8536	153.6714	74.7210	24.9352	0.0000	0.0000	0.0000	0.0000	70.0962	167.5548	265.3246	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	258.9181	191.8536	153.6714	74.7210	24.9352	0.0000	0.0000	0.0000	0.0000	70.0962	167.5548	265.3246	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	17.7921	14.2735	12.8517	9.4157	7.2729	5.9421	6.6346	8.6239	11.2016	14.6972	16.6004	18.2866	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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	1207.0747	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	143.5922	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000	(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	2015.9432	(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	1207.0747	0.1561	188.4702	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			282.3008	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			303.0256	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.0600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1207.0747	1.5780	1904.8236	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			2917.0559	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	143.5922	1.5338	220.2466	(282)
Total Primary energy kWh/year			3137.3025	(286)
Dwelling Primary energy Rate (DPER)			62.7500	(287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000	(1b)	x 2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.0000	(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) =	0.1818	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4318	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670	(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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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			1.9000	1.0000	1.9000			(26)

TER Opening Type (Uw = 1.20)			5.6000	1.1450	6.4122	(27)
Wall (external)	33.0000	5.6000	27.4000	0.1800	4.9320	(29a)
Wall (common)	11.0000	1.9000	9.1000	0.1800	1.6380	(29a)
Roof (loft)	25.0000		25.0000	0.1100	2.7500	(30)
Roof (skeiling)	34.0000		34.0000	0.1100	3.7400	(30)
Total net area of external elements Aum(A, m2)			103.0000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.3722	(33)
Party Wall			3.0000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0200 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0500	0.2650
E3 Sill	4.4000	0.0500	0.2200
E4 Jamb	14.0000	0.0500	0.7000
E16 Corner (normal)	14.4000	0.0900	1.2960
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0700	2.1070
E11 Eaves (insulation at rafter level)	30.1000	0.0400	1.2040
E18 Party wall between dwellings	2.4000	0.0600	0.1440
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0800	0.1280

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0640 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 27.4362 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	49.5612	49.4069	49.2556	48.5449	48.4120	47.7930	47.7930	47.6784	48.0314	48.4120	48.6809	48.9621	(39)
Average = Sum(39)m / 12 =												48.5443	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9912	0.9881	0.9851	0.9709	0.9682	0.9559	0.9559	0.9536	0.9606	0.9682	0.9736	0.9792	(40)
HLP (average)												0.9709	
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 1.6901 (42)

Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(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	216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
										Total per year (kWh/year) = Sum(64)m =		1962.4258	(64)
12Total per year (kWh/year)												1962	(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	93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.6906	92.6575	83.6906	86.4803	83.6906	86.4803	83.6906	83.6906	86.4803	83.6906	86.4803	83.6906	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344	(72)
Total internal gains	408.2676	416.8047	400.2163	386.5427	368.3431	353.1159	340.5787	341.7365	351.5249	365.8044	386.8653	400.7142	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southeast	3.2000	36.7938	0.6300	0.7000	0.7700	35.9830	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Solar gains	50.4958	87.8457	125.0619	163.1167	190.1513	192.0520	183.7954	163.1255	138.1618	98.4006	60.8161	42.9980	(83)
Total gains	458.7634	504.6504	525.2782	549.6594	558.4945	545.1679	524.3741	504.8620	489.6868	464.2050	447.6814	443.7121	(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	70.0649	70.2838	70.4997	71.5317	71.7281	72.6571	72.6571	72.8317	72.2964	71.7281	71.3318	70.9222	
alpha	5.6710	5.6856	5.7000	5.7688	5.7819	5.8438	5.8438	5.8554	5.8198	5.7819	5.7555	5.7281	
util living area	0.9840	0.9711	0.9474	0.8790	0.7476	0.5525	0.3999	0.4325	0.6525	0.8848	0.9666	0.9864	(86)
MIT	20.1694	20.3254	20.5213	20.7690	20.9275	20.9896	20.9987	20.9979	20.9736	20.7944	20.4596	20.1484	(87)
Th 2	20.0907	20.0932	20.0958	20.1077	20.1099	20.1203	20.1203	20.1222	20.1163	20.1099	20.1054	20.1007	(88)
util rest of house	0.9794	0.9631	0.9328	0.8479	0.6930	0.4803	0.3206	0.3510	0.5786	0.8490	0.9559	0.9824	(89)
MIT 2	19.1465	19.3432	19.5861	19.8858	20.0527	20.1147	20.1199	20.1215	20.1002	19.9213	19.5222	19.1279	(90)
Living area fraction									fLA = Living area / (4) =			0.4800	(91)
MIT	19.6375	19.8147	20.0350	20.3097	20.4726	20.5346	20.5417	20.5422	20.5194	20.3404	19.9722	19.6177	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6375	19.8147	20.0350	20.3097	20.4726	20.5346	20.5417	20.5422	20.5194	20.3404	19.9722	19.6177	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9766	0.9602	0.9317	0.8555	0.7161	0.5147	0.3587	0.3902	0.6132	0.8592	0.9540	0.9798	(94)
Useful gains	448.0151	484.5703	489.3790	470.2366	399.9522	280.6111	188.0799	196.9976	300.2547	398.8249	427.1025	434.7456	(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	760.1439	736.8877	666.6752	553.8837	424.6996	283.6341	188.3847	197.4918	308.3343	471.5513	626.6303	754.8848	(97)
Space heating kWh	232.2238	169.5573	131.9084	60.2259	18.4120	0.0000	0.0000	0.0000	0.0000	54.1084	143.6600	238.1835	(98a)
Space heating requirement - total per year (kWh/year)												1048.2794	
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	232.2238	169.5573	131.9084	60.2259	18.4120	0.0000	0.0000	0.0000	0.0000	54.1084	143.6600	238.1835	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1048.2794	
Space heating per m2											(98c) / (4) =	20.9656	(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	232.2238	169.5573	131.9084	60.2259	18.4120	0.0000	0.0000	0.0000	0.0000	54.1084	143.6600	238.1835	(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)	251.5967	183.7024	142.9127	65.2502	19.9480	0.0000	0.0000	0.0000	0.0000	58.6223	155.6446	258.0536	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.4830	84.0506	83.3577	82.0675	80.6601	79.8000	79.8000	79.8000	79.8000	81.8688	83.6607	84.5624	(217)
Fuel for water heating, kWh/month	227.7119	202.5644	217.5375	195.8046	194.1308	177.9421	176.5248	182.9609	184.3137	198.9932	205.4236	225.2272	(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	17.3893	13.9503	12.5607	9.2025	7.1083	5.8075	6.4844	8.4287	10.9480	14.3644	16.2246	17.8726	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-23.8823	-33.9182	-49.1214	-55.6860	-60.4758	-56.6574	-56.0238	-52.7240	-46.8967	-39.0680	-26.3703	-20.6239	(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	-12.7226	-26.8579	-53.5384	-80.6147	-106.7578	-107.2759	-105.9484	-89.5705	-65.5179	-38.3989	-16.9886	-10.0481	(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	1135.7306	(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	2389.1346	(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)	140.3413	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1235.6876	(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	2515.5189	(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	1135.7306	0.2100	238.5034	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2389.1346	0.2100	501.7183	(264)
Space and water heating			740.2217	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	140.3413	0.1443	20.2556	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-521.4479	0.1344	-70.0821	
PV Unit electricity exported	-714.2398	0.1258	-89.8768	
Total			-159.9589	(269)
Total CO2, kg/year			612.4477	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.2500	(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	1135.7306	1.1300	1283.3756	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2389.1346	1.1300	2699.7221	(278)
Space and water heating			3983.0977	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	140.3413	1.5338	215.2601	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-521.4479	1.4967	-780.4538	
PV Unit electricity exported	-714.2398	0.4619	-329.9085	
Total			-1110.3623	(283)
Total Primary energy kWh/year			3218.0963	(286)
Target Primary Energy Rate (TPER)			64.3600	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000 (1b)	x	2.2000 (2b)	=	110.0000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.0000	(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) =	0.1818	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4318	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3670 (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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(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	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	33.0000	5.6000	27.4000	0.1900	5.2060	110.0000	3014.0000	(29a)
Wall (common)	11.0000	1.9000	9.1000	0.1600	1.4560	110.0000	1001.0000	(29a)
Roof (loft)	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000	(30)
Roof (skeiling)	34.0000		34.0000	0.1600	5.4400	9.0000	306.0000	(30)
Total net area of external elements Aum(A, m2)			103.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.2422			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12501.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0200 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	14.4000	0.0490	0.7056
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	30.1000	0.0180	0.5418
E18 Party wall between dwellings	2.4000	0.0510	0.1224
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.7289 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 26.9711 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	49.0960	48.9417	48.7904	48.0798	47.9468	47.3279	47.3279	47.2132	47.5663	47.9468	48.2158	48.4970	(39)

Average = Sum(39)m / 12 = 48.0791

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9819	0.9788	0.9758	0.9616	0.9589	0.9466	0.9466	0.9443	0.9513	0.9589	0.9643	0.9699	(40)
HLP (average)												0.9616	
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 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 50.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)

Energy content (annual) Total = Sum(45)m = 832.1197
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

	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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

	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)

Total per year (kWh/year) = Sum(64)m = 707.3017 (64)
12Total per year (kWh/year) 707 (64)
Electric shower(s)

	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 478.7637 (64a)
Heat gains from water heating, kWh/month

	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	83.6906	92.6575	83.6906	86.4803	83.6906	86.4803	83.6906	83.6906	86.4803	83.6906	86.4803	83.6906	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542	(72)
Total internal gains													
	318.1457	327.6617	313.3338	305.1114	290.1185	281.2780	271.0560	270.6704	278.5946	286.0960	301.9537	311.3340	(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	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southeast	3.2000	36.7938	0.6300	0.7000	0.7700	35.9830	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Solar gains	50.4958	87.8457	125.0619	163.1167	190.1513	192.0520	183.7954	163.1255	138.1618	98.4006	60.8161	42.9980	(83)
Total gains	368.6415	415.5074	438.3957	468.2281	480.2698	473.3299	454.8514	433.7959	416.7564	384.4966	362.7698	354.3319	(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	70.7287	70.9518	71.1718	72.2237	72.4240	73.3712	73.3712	73.5493	73.0034	72.4240	72.0200	71.6024	
alpha	5.7152	5.7301	5.7448	5.8149	5.8283	5.8914	5.8914	5.9033	5.8669	5.8283	5.8013	5.7735	
util living area													
	0.9943	0.9878	0.9747	0.9285	0.8201	0.6225	0.4553	0.4964	0.7364	0.9394	0.9868	0.9954	(86)
MIT	19.9974	20.1646	20.3797	20.6736	20.8844	20.9817	20.9975	20.9959	20.9526	20.6947	20.3072	19.9758	(87)
Th 2	20.0984	20.1010	20.1035	20.1155	20.1177	20.1281	20.1281	20.1300	20.1241	20.1177	20.1132	20.1085	(88)
util rest of house													
	0.9925	0.9840	0.9666	0.9062	0.7703	0.5451	0.3665	0.4048	0.6617	0.9159	0.9820	0.9939	(89)
MIT 2	19.1922	19.3595	19.5723	19.8604	20.0430	20.1200	20.1275	20.1289	20.1002	19.8863	19.5114	19.1790	(90)
Living area fraction									fLA = Living area / (4) =			0.4800	(91)
MIT	19.5787	19.7459	19.9598	20.2507	20.4469	20.5336	20.5451	20.5451	20.5093	20.2743	19.8934	19.5615	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5787	19.7459	19.9598	20.2507	20.4469	20.5336	20.5451	20.5451	20.5093	20.2743	19.8934	19.5615	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9912	0.9822	0.9651	0.9101	0.7900	0.5818	0.4092	0.4489	0.6960	0.9206	0.9805	0.9928	(94)
Useful gains	365.3807	408.1005	423.0939	426.1122	379.4194	275.4050	186.1302	194.7196	290.0620	353.9865	355.7089	351.7700	(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													
	750.1228	726.5853	656.7103	545.7405	419.3837	280.8254	186.7115	195.7016	304.8680	463.8532	616.8436	744.9857	(97)
Space heating kWh													
	286.2482	214.0218	173.8106	86.1324	29.7334	0.0000	0.0000	0.0000	0.0000	81.7409	188.0170	292.5525	(98a)
Space heating requirement - total per year (kWh/year)												1352.2567	
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													
	286.2482	214.0218	173.8106	86.1324	29.7334	0.0000	0.0000	0.0000	0.0000	81.7409	188.0170	292.5525	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1352.2567	
Space heating per m2										(98c) / (4) =		27.0451	(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	444.8818	350.2261	358.8206	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9103	0.9586	0.9448	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	404.9882	335.7314	339.0268	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	516.3297	496.6369	473.7116	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	80.1659	119.7137	100.2055	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	20.0415	29.9284	25.0514	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												75.0213	(107)
Energy for space heating												27.0451	(99)
Energy for space cooling												1.5004	(108)
Total												28.5456	(109)
Fabric Energy Efficiency (DFEE)												28.5	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.0000	(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) =	0.1818 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4318 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670 (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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(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	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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			1.9000	1.0000	1.9000			(26)
TER Opening Type (Uw = 1.20)			5.6000	1.1450	6.4122			(27)
Wall (external)	33.0000	5.6000	27.4000	0.1800	4.9320			(29a)
Wall (common)	11.0000	1.9000	9.1000	0.1800	1.6380			(29a)
Roof (loft)	25.0000		25.0000	0.1100	2.7500			(30)
Roof (skeiling)	34.0000		34.0000	0.1100	3.7400			(30)
Total net area of external elements Aum(A, m2)			103.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.3722			(33)
Party Wall			3.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K: 250.0200 (35)

List of Thermal Bridges

		Length	Psi-value	Total
K1	Element			
E2	Other lintels (including other steel lintels)	5.3000	0.0500	0.2650
E3	Sill	4.4000	0.0500	0.2200
E4	Jamb	14.0000	0.0500	0.7000
E16	Corner (normal)	14.4000	0.0900	1.2960
E7	Party floor between dwellings (in blocks of flats)	30.1000	0.0700	2.1070
E11	Eaves (insulation at rafter level)	30.1000	0.0400	1.2040
E18	Party wall between dwellings	2.4000	0.0600	0.1440
P5	Party wall - Roof (insulation at rafter level)	1.6000	0.0800	0.1280

Thermal bridges (Sum(L x Psi) calculated using Appendix K): 6.0640 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 27.4362 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	49.5612	49.4069	49.2556	48.5449	48.4120	47.7930	47.7930	47.6784	48.0314	48.4120	48.6809	48.9621	(39)
Average = Sum(39)m / 12 =												48.5443	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9912	0.9881	0.9851	0.9709	0.9682	0.9559	0.9559	0.9536	0.9606	0.9682	0.9736	0.9792	(40)
HLP (average)												0.9709	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy: 1.6901 (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

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)
Average daily hot water use (litres/day)												50.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)
Energy content (annual)											Total = Sum(45)m =	832.1197	
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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)
										Total per year (kWh/year) = Sum(64)m =		707.3017	(64)
12Total per year (kWh/year)												707	(64)
Electric shower(s)													
	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						478.7637	(64a)
Heat gains from water heating, kWh/month													
	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	83.6906	92.6575	83.6906	86.4803	83.6906	86.4803	83.6906	83.6906	86.4803	83.6906	86.4803	83.6906	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542	(72)
Total internal gains													
	318.1457	327.6617	313.3338	305.1114	290.1185	281.2780	271.0560	270.6704	278.5946	286.0960	301.9537	311.3340	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southeast	3.2000	36.7938	0.6300	0.7000	0.7700	35.9830	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Solar gains	50.4958	87.8457	125.0619	163.1167	190.1513	192.0520	183.7954	163.1255	138.1618	98.4006	60.8161	42.9980	(83)
Total gains	368.6415	415.5074	438.3957	468.2281	480.2698	473.3299	454.8514	433.7959	416.7564	384.4966	362.7698	354.3319	(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	70.0649	70.2838	70.4997	71.5317	71.7281	72.6571	72.6571	72.8317	72.2964	71.7281	71.3318	70.9222	
alpha	5.6710	5.6856	5.7000	5.7688	5.7819	5.8438	5.8438	5.8554	5.8198	5.7819	5.7555	5.7281	
util living area													
	0.9943	0.9879	0.9751	0.9301	0.8237	0.6275	0.4596	0.5009	0.7409	0.9408	0.9870	0.9954	(86)
MIT	19.9820	20.1497	20.3663	20.6634	20.8788	20.9803	20.9972	20.9955	20.9498	20.6857	20.2943	19.9604	(87)
Th 2	20.0907	20.0932	20.0958	20.1077	20.1099	20.1203	20.1203	20.1222	20.1163	20.1099	20.1054	20.1007	(88)
util rest of house													
	0.9925	0.9842	0.9672	0.9081	0.7740	0.5491	0.3692	0.4078	0.6659	0.9175	0.9823	0.9940	(89)
MIT 2	19.1707	19.3385	19.5528	19.8442	20.0314	20.1116	20.1196	20.1210	20.0908	19.8713	19.4923	19.1574	(90)
Living area fraction										fLA = Living area / (4) =		0.4800	(91)
MIT	19.5601	19.7278	19.9433	20.2374	20.4382	20.5286	20.5408	20.5407	20.5031	20.2622	19.8773	19.5428	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5601	19.7278	19.9433	20.2374	20.4382	20.5286	20.5408	20.5407	20.5031	20.2622	19.8773	19.5428	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9912	0.9824	0.9656	0.9117	0.7935	0.5863	0.4127	0.4526	0.7002	0.9221	0.9808	0.9928	(94)
Useful gains	365.4049	408.1871	423.3240	426.8772	381.0879	277.4990	187.7048	196.3482	291.8212	354.5333	355.7982	351.7870	(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													
	756.3105	732.5968	662.1579	550.3737	423.0316	283.3433	188.3448	197.4241	307.5505	467.7660	622.0090	751.2166	(97)
Space heating kWh													
	290.8337	218.0033	177.6924	88.9175	31.2061	0.0000	0.0000	0.0000	0.0000	84.2451	191.6718	297.1756	(98a)
Space heating requirement - total per year (kWh/year)												1379.7454	

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

290.8337	218.0033	177.6924	88.9175	31.2061	0.0000	0.0000	0.0000	0.0000	84.2451	191.6718	297.1756	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1379.7454

Space heating per m2 (98c) / (4) = 27.5949 (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	449.2544	353.6683	362.3558	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9062	0.9561	0.9418	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	407.1167	338.1469	341.2582	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	516.3297	496.6369	473.7116	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	78.6333	117.9166	98.5454	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	19.6583	29.4791	24.6363	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 73.7738 (107)

Energy for space heating 27.5949 (99)

Energy for space cooling 1.4755 (108)

Total 29.0704 (109)

Fabric Energy Efficiency (TFEE) 29.1 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.0000	(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) =	0.1818 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4318 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670 (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													
	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	33.0000	5.6000	27.4000	0.1900	5.2060	110.0000	3014.0000	(29a)
Wall (common)	11.0000	1.9000	9.1000	0.1600	1.4560	110.0000	1001.0000	(29a)
Roof (loft)	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000	(30)
Roof (skeiling)	34.0000		34.0000	0.1600	5.4400	9.0000	306.0000	(30)
Total net area of external elements Aum(A, m2)			103.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.2422			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)

Internal Wall	75.0000	75.0000	5625.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12501.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0200 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	14.4000	0.0490	0.7056
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	30.1000	0.0180	0.5418
E18 Party wall between dwellings	2.4000	0.0510	0.1224
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.7289 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 26.9711 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	49.0960	48.9417	48.7904	48.0798	47.9468	47.3279	47.3279	47.2132	47.5663	47.9468	48.2158	48.4970	(39)
Average = Sum(39)m / 12 =												48.0791	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9819	0.9788	0.9758	0.9616	0.9589	0.9466	0.9466	0.9443	0.9513	0.9589	0.9643	0.9699	(40)
HLP (average)												0.9616	
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 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	

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

25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:
Store volume 173.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0368 (55)
Total storage loss

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)

If cylinder contains dedicated solar storage

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)

Total per year (kWh/year) = Sum(64)m = 2015.4877 (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

56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3270	18.0542	14.6827	11.1157	8.3091	7.0149	7.5799	9.8526	13.2242	16.7911	19.5977	20.8919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	396.6013	394.6514	381.7620	357.6948	334.3822	313.2816	300.8993	303.5773	315.8439	337.5171	363.6908	386.4131	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southeast	3.2000	36.7938	0.6300	0.7000	0.7700	35.9830	(77)

Southwest			0.8000		36.7938		0.6300		0.7000		0.7700		8.9957 (79)
Solar gains	50.4958	87.8457	125.0619	163.1167	190.1513	192.0520	183.7954	163.1255	138.1618	98.4006	60.8161	42.9980 (83)	
Total gains	447.0971	482.4970	506.8239	520.8114	524.5336	505.3336	484.6947	466.7028	454.0058	435.9177	424.5069	429.4111 (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	70.7287	70.9518	71.1718	72.2237	72.4240	73.3712	73.3712	73.5493	73.0034	72.4240	72.0200	71.6024	
alpha	5.7152	5.7301	5.7448	5.8149	5.8283	5.8914	5.8914	5.9033	5.8669	5.8283	5.8013	5.7735	
util living area													
	0.9855	0.9758	0.9533	0.8961	0.7763	0.5873	0.4279	0.4626	0.6895	0.9043	0.9729	0.9881 (86)	
MIT	20.1612	20.2982	20.5034	20.7445	20.9140	20.9864	20.9982	20.9972	20.9662	20.7681	20.4293	20.1346 (87)	
Th 2	20.0984	20.1010	20.1035	20.1155	20.1177	20.1281	20.1281	20.1300	20.1241	20.1177	20.1132	20.1085 (88)	
util rest of house													
	0.9814	0.9689	0.9401	0.8677	0.7232	0.5125	0.3441	0.3766	0.6148	0.8724	0.9639	0.9847 (89)	
MIT 2	19.1424	19.3160	19.5715	19.8667	20.0486	20.1206	20.1275	20.1290	20.1029	19.9009	19.4918	19.1167 (90)	
Living area fraction									fLA = Living area / (4) =			0.4800 (91)	
MIT	19.6315	19.7875	20.0188	20.2880	20.4640	20.5361	20.5454	20.5457	20.5173	20.3171	19.9418	19.6053 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.6315	19.7875	20.0188	20.2880	20.4640	20.5361	20.5454	20.5457	20.5173	20.3171	19.9418	19.6053 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9787	0.9660	0.9386	0.8737	0.7450	0.5481	0.3844	0.4180	0.6494	0.8804	0.9619	0.9822 (94)	
Useful gains	437.5617	466.1134	475.7216	455.0481	390.7850	276.9488	186.3120	195.0594	294.8246	383.7685	408.3248	421.7686 (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													
	752.7146	728.6180	659.5887	547.5336	420.2052	280.9451	186.7289	195.7337	305.2471	465.9053	619.1773	747.1106 (97)	
Space heating kWh													
	234.4738	176.4031	136.7971	66.5895	21.8887	0.0000	0.0000	0.0000	0.0000	61.1098	151.8137	242.0545 (98a)	
Space heating requirement - total per year (kWh/year)												1091.1301	
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													
	234.4738	176.4031	136.7971	66.5895	21.8887	0.0000	0.0000	0.0000	0.0000	61.1098	151.8137	242.0545 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1091.1301	
Space heating per m2										(98c) / (4) =		21.8226 (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 %)												100.0000 (206)	
Efficiency of main space heating system 2 (in %)												0.0000 (207)	
Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	234.4738	176.4031	136.7971	66.5895	21.8887	0.0000	0.0000	0.0000	0.0000	61.1098	151.8137	242.0545 (98)	
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)	
Space heating fuel (main heating system)													
	234.4738	176.4031	136.7971	66.5895	21.8887	0.0000	0.0000	0.0000	0.0000	61.1098	151.8137	242.0545 (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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853 (64)	
Efficiency of water heater												302.9550 (216)	
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550 (217)	
Fuel for water heating, kWh/month													
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	17.7921	14.2735	12.8517	9.4157	7.2729	5.9421	6.6346	8.6239	11.2016	14.6972	16.6004	18.2866 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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												1091.1301 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	

Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	143.5922	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	1899.9986	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1091.1301	16.4900	179.9274	(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)	665.2763	16.4900	109.7041	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	143.5922	16.4900	23.6784	(250)
Additional standing charges			0.0000	(251)
Total energy cost			313.3098	(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] =	1.1873	(257)
SAP value		80.7542	
SAP rating (Section 12)		81	(258)
SAP band		B	

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	1091.1301	0.1562	170.4750	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			264.3055	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			285.0303	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.9796	
EI rating			96	(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		50.0000 (1b)	x	2.2000 (2b)	=	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.0000	(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) =	0.1818 (8)
Pressure test		Yes
Pressure Test Method		Blower Door

Measured/design AP50	5.0000	(17)
Infiltration rate	0.4318	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.3670	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate	0.3946	0.3762	0.3762	0.3395	0.3303	0.3120	0.3120	0.2936	0.2936	0.3120	0.3120	0.3395	(22b)
Effective ac	0.5778	0.5708	0.5708	0.5576	0.5546	0.5487	0.5487	0.5431	0.5431	0.5487	0.5487	0.5576	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	33.0000	5.6000	27.4000	0.1900	5.2060	110.0000	3014.0000	(29a)
Wall (common)	11.0000	1.9000	9.1000	0.1600	1.4560	110.0000	1001.0000	(29a)
Roof (loft)	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000	(30)
Roof (skeiling)	34.0000		34.0000	0.1600	5.4400	9.0000	306.0000	(30)
Total net area of external elements Aum(A, m2)			103.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.2422			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	12501.0000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0200	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	14.4000	0.0490	0.7056
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	30.1000	0.0180	0.5418
E18 Party wall between dwellings	2.4000	0.0510	0.1224
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.7289	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	26.9711	(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	20.9757	20.7190	20.7190	20.2422	20.1306	19.9167	19.9167	19.7149	19.7149	19.9167	19.9167	20.2422	(38)
Heat transfer coeff	47.9468	47.6901	47.6901	47.2132	47.1017	46.8877	46.8877	46.6860	46.6860	46.8877	46.8877	47.2132	(39)
Average = Sum(39)m / 12 =												47.1482	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9589	0.9538	0.9538	0.9443	0.9420	0.9378	0.9378	0.9337	0.9337	0.9378	0.9378	0.9443	(40)
HLP (average)												0.9430	
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	1.6901	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:		
Store volume	173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.9200	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	1.0368	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Total per year (kWh/year) = Sum(64)m =												2015.4877	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)

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

	20.3270	18.0542	14.6827	11.1157	8.3091	7.0149	7.5799	9.8526	13.2242	16.7911	19.5977	20.8919	(67)

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

	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)

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

	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)

	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)

Water heating gains (Table 5)

	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)

Total internal gains

	396.6013	394.6514	381.7620	357.6948	334.3822	313.2816	300.8993	303.5773	315.8439	337.5171	363.6908	386.4131	(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	
Northeast	1.6000	13.3408	0.6300	0.7000	0.7700	6.5234	(75)
Southeast	3.2000	41.5040	0.6300	0.7000	0.7700	40.5893	(77)
Southwest	0.8000	41.5040	0.6300	0.7000	0.7700	10.1473	(79)

Solar gains	57.2601	85.3363	124.0210	167.2956	189.8998	206.6857	195.5303	174.7759	147.4245	106.9165	68.3950	46.7184	(83)
Total gains	453.8614	479.9877	505.7830	524.9903	524.2820	519.9673	496.4296	478.3531	463.2684	444.4336	432.0858	433.1316	(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	72.4240	72.8139	72.8139	73.5493	73.7235	74.0599	74.0599	74.3799	74.3799	74.0599	74.0599	73.5493	
alpha	5.8283	5.8543	5.8543	5.9033	5.9149	5.9373	5.9373	5.9587	5.9587	5.9373	5.9373	5.9033	
util living area	0.9824	0.9736	0.9484	0.8825	0.7514	0.5428	0.3864	0.4087	0.6608	0.8853	0.9668	0.9859	(86)
MIT	20.2438	20.3531	20.5503	20.7805	20.9332	20.9916	20.9991	20.9987	20.9747	20.8109	20.4991	20.2160	(87)
Th 2	20.1177	20.1220	20.1220	20.1300	20.1319	20.1355	20.1355	20.1389	20.1389	20.1355	20.1355	20.1300	(88)
util rest of house	0.9774	0.9662	0.9340	0.8517	0.6959	0.4692	0.3054	0.3256	0.5869	0.8493	0.9562	0.9818	(89)
MIT 2	19.2614	19.4013	19.6436	19.9195	20.0799	20.1312	20.1353	20.1386	20.1235	19.9630	19.5956	19.2363	(90)
Living area fraction									fLA = Living area / (4) =			0.4800	(91)
MIT	19.7330	19.8582	20.0788	20.3328	20.4895	20.5442	20.5499	20.5514	20.5321	20.3700	20.0293	19.7066	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7330	19.8582	20.0788	20.3328	20.4895	20.5442	20.5499	20.5514	20.5321	20.3700	20.0293	19.7066	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9635	0.9332	0.8594	0.7196	0.5044	0.3443	0.3655	0.6215	0.8599	0.9546	0.9793	(94)
Useful gains	442.3589	462.4795	471.9964	451.1968	377.2853	262.2651	170.9334	174.8605	287.9245	382.1785	412.4779	424.1585	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W	725.5774	703.8176	638.0374	530.3375	399.8685	264.6436	171.1348	175.1396	295.6206	448.7152	596.8466	717.9506	(97)
Space heating kWh	210.7146	162.1792	123.5345	56.9813	16.8019	0.0000	0.0000	0.0000	0.0000	49.5033	132.7455	218.5813	(98a)
Space heating requirement - total per year (kWh/year)												971.0416	
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	210.7146	162.1792	123.5345	56.9813	16.8019	0.0000	0.0000	0.0000	0.0000	49.5033	132.7455	218.5813	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												971.0416	
Space heating per m2											(98c) / (4) =	19.4208	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	210.7146	162.1792	123.5345	56.9813	16.8019	0.0000	0.0000	0.0000	0.0000	49.5033	132.7455	218.5813	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	210.7146	162.1792	123.5345	56.9813	16.8019	0.0000	0.0000	0.0000	0.0000	49.5033	132.7455	218.5813	(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

	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853 (64)
Efficiency of water heater												302.9550 (216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550 (217)
Fuel for water heating, kWh/month												
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	17.7921	14.2735	12.8517	9.4157	7.2729	5.9421	6.6346	8.6239	11.2016	14.6972	16.6004	18.2866 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)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 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	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 1 971.0416 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 302.9550
Water heating fuel used 665.2763 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
Total electricity for the above, kWh/year 0.0000 (231)
Electricity for lighting (calculated in Appendix L) 143.5922 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (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 1779.9100 (238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	971.0416	25.1600	244.3141	(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)	665.2763	25.1600	167.3835	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	143.5922	25.1600	36.1278	(250)
Additional standing charges			0.0000	(251)
Total energy cost			447.8254	(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	971.0416	0.1565	151.9679	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			245.7984	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			266.5232	(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	971.0416	1.5794	1533.6590	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			2545.8913	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	143.5922	1.5338	220.2466	(282)
Total Primary energy kWh/year			2766.1378	(286)

SAP 10 EPC IMPROVEMENTS

ZA0903

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

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

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

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

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£448	£448	£0
Space heating	£244	£244	£0
Water heating	£167	£167	£0
Lighting	£36	£36	£0
Total cost of fuels	£448	£448	£0
Total cost of uses	£447	£447	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	55 kWh/m²	55 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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.0000	(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) =	0.1818 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4318 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670 (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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	33.0000	5.6000	27.4000	0.1900	5.2060	110.0000	3014.0000	(29a)
Wall (common)	11.0000	1.9000	9.1000	0.1600	1.4560	110.0000	1001.0000	(29a)
Roof (loft)	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000	(30)

Roof (skeiling)	34.0000	34.0000	0.1600	5.4400	9.0000	306.0000	(30)
Total net area of external elements Aum(A, m2)		103.0000					(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		24.2422			(33)
Party Wall		3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor		50.0000			40.0000	2000.0000	(32d)
Internal Wall		75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12501.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0200 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	14.4000	0.0490	0.7056
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	30.1000	0.0180	0.5418
E18 Party wall between dwellings	2.4000	0.0510	0.1224
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.7289 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 26.9711 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	49.0960	48.9417	48.7904	48.0798	47.9468	47.3279	47.3279	47.2132	47.5663	47.9468	48.2158	48.4970	(39)
Average = Sum(39)m / 12 =												48.0791	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9819	0.9788	0.9758	0.9616	0.9589	0.9466	0.9466	0.9443	0.9513	0.9589	0.9643	0.9699	(40)
HLP (average)												0.9616	
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 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3270	18.0542	14.6827	11.1157	8.3091	7.0149	7.5799	9.8526	13.2242	16.7911	19.5977	20.8919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	396.6013	394.6514	381.7620	357.6948	334.3822	313.2816	300.8993	303.5773	315.8439	337.5171	363.6908	386.4131	(73)

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6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southeast	3.2000	36.7938	0.6300	0.7000	0.7700	35.9830	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	50.4958	87.8457	125.0619	163.1167	190.1513	192.0520	183.7954	163.1255	138.1618	98.4006	60.8161	42.9980	(83)
Total gains	447.0971	482.4970	506.8239	520.8114	524.5336	505.3336	484.6947	466.7028	454.0058	435.9177	424.5069	429.4111	(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	70.7287	70.9518	71.1718	72.2237	72.4240	73.3712	73.3712	73.5493	73.0034	72.4240	72.0200	71.6024	
alpha	5.7152	5.7301	5.7448	5.8149	5.8283	5.8914	5.8914	5.9033	5.8669	5.8283	5.8013	5.7735	
util living area	0.9855	0.9758	0.9533	0.8961	0.7763	0.5873	0.4279	0.4626	0.6895	0.9043	0.9729	0.9881	(86)
MIT	20.1612	20.2982	20.5034	20.7445	20.9140	20.9864	20.9982	20.9972	20.9662	20.7681	20.4293	20.1346	(87)
Th 2	20.0984	20.1010	20.1035	20.1155	20.1177	20.1281	20.1281	20.1300	20.1241	20.1177	20.1132	20.1085	(88)
util rest of house	0.9814	0.9689	0.9401	0.8677	0.7232	0.5125	0.3441	0.3766	0.6148	0.8724	0.9639	0.9847	(89)
MIT 2	19.1424	19.3160	19.5715	19.8667	20.0486	20.1206	20.1275	20.1290	20.1029	19.9009	19.4918	19.1167	(90)
Living area fraction									fLA = Living area / (4) =			0.4800	(91)
MIT	19.6315	19.7875	20.0188	20.2880	20.4640	20.5361	20.5454	20.5457	20.5173	20.3171	19.9418	19.6053	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6315	19.7875	20.0188	20.2880	20.4640	20.5361	20.5454	20.5457	20.5173	20.3171	19.9418	19.6053	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9787	0.9660	0.9386	0.8737	0.7450	0.5481	0.3844	0.4180	0.6494	0.8804	0.9619	0.9822	(94)
Useful gains	437.5617	466.1134	475.7216	455.0481	390.7850	276.9488	186.3120	195.0594	294.8246	383.7685	408.3248	421.7686	(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	752.7146	728.6180	659.5887	547.5336	420.2052	280.9451	186.7289	195.7337	305.2471	465.9053	619.1773	747.1106	(97)
Space heating kWh	234.4738	176.4031	136.7971	66.5895	21.8887	0.0000	0.0000	0.0000	0.0000	61.1098	151.8137	242.0545	(98a)
Space heating requirement - total per year (kWh/year)												1091.1301	
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	234.4738	176.4031	136.7971	66.5895	21.8887	0.0000	0.0000	0.0000	0.0000	61.1098	151.8137	242.0545	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1091.1301	
Space heating per m2											(98c) / (4) =	21.8226	(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 %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	234.4738	176.4031	136.7971	66.5895	21.8887	0.0000	0.0000	0.0000	0.0000	61.1098	151.8137	242.0545	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	234.4738	176.4031	136.7971	66.5895	21.8887	0.0000	0.0000	0.0000	0.0000	61.1098	151.8137	242.0545	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	17.7921	14.2735	12.8517	9.4157	7.2729	5.9421	6.6346	8.6239	11.2016	14.6972	16.6004	18.2866	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1091.1301	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	143.5922	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	1899.9986	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1091.1301	16.4900	179.9274	(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)	665.2763	16.4900	109.7041	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	143.5922	16.4900	23.6784	(250)
Additional standing charges			0.0000	(251)
Total energy cost			313.3098	(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] =	1.1873	(257)
SAP value		80.7542	
SAP rating (Section 12)		81	(258)
SAP band		B	

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	1091.1301	0.1562	170.4750	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			264.3055	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			285.0303	(272)
CO2 emissions per m2			5.7000	(273)
EI value			95.9796	
EI rating			96	(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		50.0000	(1b)	x 2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.0000	(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) =	0.1818	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4318	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate	0.3946	0.3762	0.3762	0.3395	0.3303	0.3120	0.3120	0.2936	0.2936	0.3120	0.3120	0.3395	(22b)
Effective ac	0.5778	0.5708	0.5708	0.5576	0.5546	0.5487	0.5487	0.5431	0.5431	0.5487	0.5487	0.5576	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	33.0000	5.6000	27.4000	0.1900	5.2060	110.0000	3014.0000	(29a)
Wall (common)	11.0000	1.9000	9.1000	0.1600	1.4560	110.0000	1001.0000	(29a)
Roof (loft)	25.0000		25.0000	0.1100	2.7500	9.0000	225.0000	(30)
Roof (skeiling)	34.0000		34.0000	0.1600	5.4400	9.0000	306.0000	(30)
Total net area of external elements Aum(A, m2)			103.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.2422			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12501.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0200 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	14.4000	0.0490	0.7056
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	30.1000	0.0180	0.5418
E18 Party wall between dwellings	2.4000	0.0510	0.1224
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.7289 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	26.9711 (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	20.9757	20.7190	20.7190	20.2422	20.1306	19.9167	19.9167	19.7149	19.7149	19.9167	19.9167	20.2422	(38)
Heat transfer coeff	47.9468	47.6901	47.6901	47.2132	47.1017	46.8877	46.8877	46.6860	46.6860	46.8877	46.8877	47.2132	(39)
Average = Sum(39)m / 12 =												47.1482	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9589	0.9538	0.9538	0.9443	0.9420	0.9378	0.9378	0.9337	0.9337	0.9378	0.9378	0.9443	(40)
HLP (average)												0.9430	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(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

	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753 (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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)

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

	20.3270	18.0542	14.6827	11.1157	8.3091	7.0149	7.5799	9.8526	13.2242	16.7911	19.5977	20.8919 (67)

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

	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561 (68)

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

	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307 (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)

	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)

Water heating gains (Table 5)

	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324 (72)

Total internal gains

	396.6013	394.6514	381.7620	357.6948	334.3822	313.2816	300.8993	303.5773	315.8439	337.5171	363.6908	386.4131 (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	
Northeast	1.6000	13.3408	0.6300	0.7000	0.7700	6.5234	(75)
Southeast	3.2000	41.5040	0.6300	0.7000	0.7700	40.5893	(77)
Southwest	0.8000	41.5040	0.6300	0.7000	0.7700	10.1473	(79)

Solar gains	57.2601	85.3363	124.0210	167.2956	189.8998	206.6857	195.5303	174.7759	147.4245	106.9165	68.3950	46.7184	(83)
Total gains	453.8614	479.9877	505.7830	524.9903	524.2820	519.9673	496.4296	478.3531	463.2684	444.4336	432.0858	433.1316	(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	72.4240	72.8139	72.8139	73.5493	73.7235	74.0599	74.0599	74.3799	74.3799	74.0599	74.0599	73.5493	
alpha	5.8283	5.8543	5.8543	5.9033	5.9149	5.9373	5.9373	5.9587	5.9587	5.9373	5.9373	5.9033	
util living area	0.9824	0.9736	0.9484	0.8825	0.7514	0.5428	0.3864	0.4087	0.6608	0.8853	0.9668	0.9859	(86)
MIT	20.2438	20.3531	20.5503	20.7805	20.9332	20.9916	20.9991	20.9987	20.9747	20.8109	20.4991	20.2160	(87)
Th 2	20.1177	20.1220	20.1220	20.1300	20.1319	20.1355	20.1355	20.1389	20.1389	20.1355	20.1355	20.1300	(88)
util rest of house	0.9774	0.9662	0.9340	0.8517	0.6959	0.4692	0.3054	0.3256	0.5869	0.8493	0.9562	0.9818	(89)
MIT 2	19.2614	19.4013	19.6436	19.9195	20.0799	20.1312	20.1353	20.1386	20.1235	19.9630	19.5956	19.2363	(90)
Living area fraction									fLA = Living area / (4) =			0.4800	(91)
MIT	19.7330	19.8582	20.0788	20.3328	20.4895	20.5442	20.5499	20.5514	20.5321	20.3700	20.0293	19.7066	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7330	19.8582	20.0788	20.3328	20.4895	20.5442	20.5499	20.5514	20.5321	20.3700	20.0293	19.7066	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9635	0.9332	0.8594	0.7196	0.5044	0.3443	0.3655	0.6215	0.8599	0.9546	0.9793	(94)
Useful gains	442.3589	462.4795	471.9964	451.1968	377.2853	262.2651	170.9334	174.8605	287.9245	382.1785	412.4779	424.1585	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W	725.5774	703.8176	638.0374	530.3375	399.8685	264.6436	171.1348	175.1396	295.6206	448.7152	596.8466	717.9506	(97)
Space heating kWh	210.7146	162.1792	123.5345	56.9813	16.8019	0.0000	0.0000	0.0000	0.0000	49.5033	132.7455	218.5813	(98a)
Space heating requirement - total per year (kWh/year)												971.0416	
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	210.7146	162.1792	123.5345	56.9813	16.8019	0.0000	0.0000	0.0000	0.0000	49.5033	132.7455	218.5813	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												971.0416	
Space heating per m2											(98c) / (4) =	19.4208	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	210.7146	162.1792	123.5345	56.9813	16.8019	0.0000	0.0000	0.0000	0.0000	49.5033	132.7455	218.5813	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	210.7146	162.1792	123.5345	56.9813	16.8019	0.0000	0.0000	0.0000	0.0000	49.5033	132.7455	218.5813	(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	(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	(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	(215)
Space heating fuel used, main system 2											0.0000	(213)
Water heating												
Water heating requirement												
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853 (64)
Efficiency of water heater												302.9550 (216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550 (217)
Fuel for water heating, kWh/month												
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	17.7921	14.2735	12.8517	9.4157	7.2729	5.9421	6.6346	8.6239	11.2016	14.6972	16.6004	18.2866 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)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 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	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	971.0416 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	302.9550
Water heating fuel used	665.2763 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	143.5922 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	1779.9100 (238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	971.0416	25.1600	244.3141	(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)	665.2763	25.1600	167.3835	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	143.5922	25.1600	36.1278	(250)
Additional standing charges			0.0000	(251)
Total energy cost			447.8254	(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	971.0416	0.1565	151.9679	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			245.7984	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			266.5232	(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	971.0416	1.5794	1533.6590	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			2545.8913	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	143.5922	1.5338	220.2466	(282)
Total Primary energy kWh/year			2766.1378	(286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 09 Feb 2024 13:07:15

Project Information			
Assessed By	Joe Solti	Building Type	Flat, Semi-detached
OCDEA Registration	EES/003578	Assessment Date	2024-02-09

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m^2
Site Reference	ZA0904	Plot Reference	ZA0904
Address	Unit 4 255 Guildford Road, Effingham, KT24 5NP		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*13.13 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.68 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*69.08 kWh_{PE}/m^2*	
Dwelling primary energy	69.08 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*33.5 kWh/m^2*	
Dwelling fabric energy efficiency	32.6 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.18	Walls (1) (0.19)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.13	Roof (2) (0.16)	**OK**
Windows, doors, and roof windows	*1.6*	1.3	Front Door (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	34.9	0.19
Sheltered wall: Walls (2)	14.1	0.16
Party wall: Party Wall (1)	3	0 **(!)**
Exposed roof: Roof (1)	29	0.11
Exposed roof: Roof (2)	27.5	0.16

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front Door, Front Door	1.9	South East	N/A	1.3
Windows (NE), Windows	1.6	North East	0.7	1.3
Windows (NW), Windows	3.2	North West	0.7	1.3
Windows (SW), Windows	0.8	South West	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.06	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.018 **(!)**	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.014 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.049	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.023 **(!)**	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.018 **(!)**	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.051	
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.046	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	5 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	Auer
Model	EDL170-520RF
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and appliance thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	

Main heating 2 - type: Not applicable		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	ZA0904	**Issued on Date**	09/02/2024
Assessment Reference	ZA0904	**Prop Type Ref**	ZA0904
Property	Unit 4, 255 Guildford Road, Effingham, Surrey, KT24 5NP		

SAP Rating	79 C	**DER**	6.68	**TER**	13.13
Environmental	96 A	**% DER < TER**			49.12
CO_2 Emissions (t/year)	0.29	**DFEE**	32.58	**TFEE**	33.51
Compliance Check	See BREL	**% DFEE < TFEE**			2.77
% DPER < TPER	-0.00	**DPER**	69.08	**TPER**	69.08

Assessor Details	Mr. Joe Solti	**Assessor ID**	5122-0001
Client	Vieo Projects, .		

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	50.0000	(1b)	x 2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.0000	(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) =	0.1818 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4318 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670 (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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	40.5000	5.6000	34.9000	0.1900	6.6310	110.0000	3839.0000	(29a)
Wall (common)	16.0000	1.9000	14.1000	0.1600	2.2560	110.0000	1551.0000	(29a)
Roof (loft)	29.0000		29.0000	0.1100	3.1900	9.0000	261.0000	(30)
Roof (skeiling)	27.5000		27.5000	0.1600	4.4000	9.0000	247.5000	(30)
Total net area of external elements Aum(A, m2)			113.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.8672			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13853.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		277.0700 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	12.0000	0.0490	0.5880

E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923	
E11 Eaves (insulation at rafter level)	33.0000	0.0180	0.5940	
E18 Party wall between dwellings	4.8000	0.0510	0.2448	
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.7859 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 28.6531 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	50.7780	50.6237	50.4724	49.7618	49.6288	49.0099	49.0099	48.8952	49.2483	49.6288	49.8978	50.1790	(39)

Average = Sum(39)m / 12 = 49.7611

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0156	1.0125	1.0094	0.9952	0.9926	0.9802	0.9802	0.9779	0.9850	0.9926	0.9980	1.0036	(40)
HLP (average)												0.9952	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)

Energy content (annual) Total = Sum(45)m = 1637.0557

Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:
Store volume 173.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0368 (55)

Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)

Total per year (kWh/year) = Sum(64)m = 2015.4877 (64)
12Total per year (kWh/year) 2015 (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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.6906	92.6575	83.6906	86.4803	83.6906	86.4803	83.6906	83.6906	86.4803	83.6906	86.4803	83.6906	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	355.1655	363.7027	347.1143	333.4407	315.2411	303.0139	290.4767	291.6344	301.4229	312.7024	333.7632	347.6121	(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	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)
Northwest	3.2000	11.2829	0.6300	0.7000	0.7700	11.0343	(81)

Solar gains	25.5472	49.0140	81.6660	125.6648	163.0963	171.7440	161.4900	132.0620	96.6657	58.1082	31.6008	21.2152	(83)
Total gains	380.7127	412.7166	428.7802	459.1055	478.3374	474.7579	451.9666	423.6964	398.0886	370.8106	365.3640	368.8273	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	75.7846	76.0157	76.2435	77.3324	77.5395	78.5188	78.5188	78.7029	78.1387	77.5395	77.1216	76.6894	
alpha	6.0523	6.0677	6.0829	6.1555	6.1693	6.2346	6.2346	6.2469	6.2092	6.1693	6.1414	6.1126	
util living area	0.9957	0.9920	0.9836	0.9477	0.8447	0.6429	0.4746	0.5260	0.7849	0.9596	0.9907	0.9964	(86)
MIT	20.0525	20.1800	20.3728	20.6614	20.8834	20.9828	20.9977	20.9959	20.9444	20.6748	20.3279	20.0373	(87)
Th 2	20.0704	20.0730	20.0755	20.0873	20.0895	20.0999	20.0999	20.1018	20.0959	20.0895	20.0850	20.0804	(88)
util rest of house	0.9941	0.9892	0.9776	0.9285	0.7944	0.5604	0.3790	0.4260	0.7079	0.9407	0.9868	0.9951	(89)
MIT 2	18.9755	19.1395	19.3850	19.7480	19.9949	20.0908	20.0992	20.1005	20.0607	19.7716	19.3377	18.9637	(90)
Living area fraction									fLA = Living area / (4) =			0.4000	(91)
MIT	19.4063	19.5557	19.7801	20.1133	20.3503	20.4476	20.4586	20.4586	20.4142	20.1329	19.7338	19.3931	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4063	19.5557	19.7801	20.1133	20.3503	20.4476	20.4586	20.4586	20.4142	20.1329	19.7338	19.3931	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9872	0.9752	0.9291	0.8100	0.5931	0.4173	0.4662	0.7368	0.9417	0.9849	0.9939	(94)
Useful gains	377.9296	407.4175	418.1284	426.5578	387.4438	281.5778	188.6280	197.5194	293.3046	349.2079	359.8624	366.5650	(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	767.0691	741.9252	670.2808	557.9950	429.3021	286.5905	189.1099	198.4467	310.9630	473.1056	630.3996	762.3748	(97)
Space heating kWh	289.5199	224.7891	187.6013	94.6348	31.1426	0.0000	0.0000	0.0000	0.0000	92.1799	194.7868	294.4825	(98a)
Space heating requirement - total per year (kWh/year)												1409.1368	
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	289.5199	224.7891	187.6013	94.6348	31.1426	0.0000	0.0000	0.0000	0.0000	92.1799	194.7868	294.4825	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1409.1368	
Space heating per m2											(98c) / (4) =	28.1827	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	289.5199	224.7891	187.6013	94.6348	31.1426	0.0000	0.0000	0.0000	0.0000	92.1799	194.7868	294.4825	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	289.5199	224.7891	187.6013	94.6348	31.1426	0.0000	0.0000	0.0000	0.0000	92.1799	194.7868	294.4825	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	17.7921	14.2735	12.8517	9.4157	7.2729	5.9421	6.6346	8.6239	11.2016	14.6972	16.6004	18.2866	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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	1409.1368	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	143.5922	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000	(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	2218.0053	(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	1409.1368	0.1557	219.4545	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			313.2851	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			334.0099	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.6800	(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	1409.1368	1.5766	2221.6252	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			3233.8576	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	143.5922	1.5338	220.2466	(282)
Total Primary energy kWh/year			3454.1041	(286)
Dwelling Primary energy Rate (DPER)			69.0800	(287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000	(1b) x	2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.0000	(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) =	0.1818	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4318	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670	(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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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			1.9000	1.0000	1.9000			(26)

TER Opening Type (Uw = 1.20)			5.6000	1.1450	6.4122	(27)
Wall (external)	40.5000	5.6000	34.9000	0.1800	6.2820	(29a)
Wall (common)	16.0000	1.9000	14.1000	0.1800	2.5380	(29a)
Roof (loft)	29.0000		29.0000	0.1100	3.1900	(30)
Roof (skeiling)	27.5000		27.5000	0.1100	3.0250	(30)
Total net area of external elements Aum(A, m2)			113.0000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.3472	(33)
Party Wall			3.0000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 277.0700 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0500	0.2650
E3 Sill	4.4000	0.0500	0.2200
E4 Jamb	14.0000	0.0500	0.7000
E16 Corner (normal)	12.0000	0.0900	1.0800
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0700	2.1070
E11 Eaves (insulation at rafter level)	33.0000	0.0400	1.3200
E18 Party wall between dwellings	4.8000	0.0600	0.2880
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0800	0.1280

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.1080 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	29.4552 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	51.5802	51.4259	51.2746	50.5639	50.4310	49.8120	49.8120	49.6974	50.0504	50.4310	50.6999	50.9811	(39)
Average = Sum(39)m / 12 =												50.5633	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0316	1.0285	1.0255	1.0113	1.0086	0.9962	0.9962	0.9939	1.0010	1.0086	1.0140	1.0196	(40)
HLP (average)												1.0113	
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											1.6901	(42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(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	216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
										Total per year (kWh/year) = Sum(64)m =		1962.4258	(64)
12Total per year (kWh/year)												1962	(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	93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.6906	92.6575	83.6906	86.4803	83.6906	86.4803	83.6906	83.6906	86.4803	83.6906	86.4803	83.6906	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344	(72)
Total internal gains	408.2676	416.8047	400.2163	386.5427	368.3431	353.1159	340.5787	341.7365	351.5249	365.8044	386.8653	400.7142	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)
Northwest	3.2000	11.2829	0.6300	0.7000	0.7700	11.0343	(81)

Solar gains	25.5472	49.0140	81.6660	125.6648	163.0963	171.7440	161.4900	132.0620	96.6657	58.1082	31.6008	21.2152 (83)
Total gains	433.8147	465.8187	481.8823	512.2076	531.4394	524.8599	502.0687	473.7985	448.1906	423.9127	418.4661	421.9294 (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	74.6060	74.8300	75.0508	76.1055	76.3062	77.2543	77.2543	77.4325	76.8863	76.3062	75.9014	75.4827	
alpha	5.9737	5.9887	6.0034	6.0737	6.0871	6.1503	6.1503	6.1622	6.1258	6.0871	6.0601	6.0322	
util living area	0.9917	0.9858	0.9726	0.9227	0.8001	0.5960	0.4350	0.4797	0.7281	0.9326	0.9823	0.9929	(86)
MIT	20.1312	20.2566	20.4458	20.7185	20.9114	20.9878	20.9985	20.9973	20.9615	20.7388	20.4065	20.1165	(87)
Th 2	20.0571	20.0596	20.0621	20.0739	20.0762	20.0865	20.0865	20.0884	20.0825	20.0762	20.0717	20.0670	(88)
util rest of house	0.9889	0.9811	0.9632	0.8971	0.7447	0.5161	0.3456	0.3862	0.6482	0.9049	0.9755	0.9905	(89)
MIT 2	19.0649	19.2251	19.4637	19.8002	20.0070	20.0803	20.0860	20.0875	20.0594	19.8313	19.4248	19.0540	(90)
Living area fraction										fLA = Living area / (4) =		0.4000	(91)
MIT	19.4914	19.6377	19.8565	20.1675	20.3687	20.4433	20.4510	20.4514	20.4202	20.1943	19.8175	19.4790	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4914	19.6377	19.8565	20.1675	20.3687	20.4433	20.4510	20.4514	20.4202	20.1943	19.8175	19.4790	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9867	0.9784	0.9607	0.9000	0.7633	0.5479	0.3814	0.4237	0.6790	0.9090	0.9732	0.9885	(94)
Useful gains	428.0581	455.7528	462.9567	460.9897	405.6462	287.5628	191.5071	200.7512	304.3148	385.3170	407.2405	417.0751	(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	783.5760	757.8987	684.8488	569.7303	437.1715	291.0658	191.8265	201.3461	316.3289	483.8508	644.7746	778.9405	(97)
Space heating kWh	264.5054	203.0421	165.0877	78.2932	23.4548	0.0000	0.0000	0.0000	0.0000	73.3091	171.0246	269.2279	(98a)
Space heating requirement - total per year (kWh/year)												1247.9448	
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	264.5054	203.0421	165.0877	78.2932	23.4548	0.0000	0.0000	0.0000	0.0000	73.3091	171.0246	269.2279	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1247.9448	
Space heating per m2											(98c) / (4) =	24.9589	(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	264.5054	203.0421	165.0877	78.2932	23.4548	0.0000	0.0000	0.0000	0.0000	73.3091	171.0246	269.2279	(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)	286.5713	219.9806	178.8599	84.8248	25.4115	0.0000	0.0000	0.0000	0.0000	79.4249	185.2921	291.6878	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.7742	84.4557	83.8499	82.5406	80.8677	79.8000	79.8000	79.8000	79.8000	82.3915	84.0489	84.8358	(217)
Fuel for water heating, kWh/month	226.9297	201.5926	216.2605	194.6823	193.6323	177.9421	176.5248	182.9609	184.3137	197.7307	204.4747	224.5014	(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	17.3893	13.9503	12.5607	9.2025	7.1083	5.8075	6.4844	8.4287	10.9480	14.3644	16.2246	17.8726	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-23.8823	-33.9182	-49.1214	-55.6860	-60.4758	-56.6574	-56.0238	-52.7240	-46.8967	-39.0680	-26.3703	-20.6239	(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	-12.7226	-26.8579	-53.5384	-80.6147	-106.7578	-107.2759	-105.9484	-89.5705	-65.5179	-38.3989	-16.9886	-10.0481	(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	1352.0529	(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	2381.5458	(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)	140.3413	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1235.6876	(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	2724.2523	(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	1352.0529	0.2100	283.9311	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2381.5458	0.2100	500.1246	(264)
Space and water heating			784.0557	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	140.3413	0.1443	20.2556	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-521.4479	0.1344	-70.0821	
PV Unit electricity exported	-714.2398	0.1258	-89.8768	
Total			-159.9589	(269)
Total CO2, kg/year			656.2817	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1300	(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	1352.0529	1.1300	1527.8197	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2381.5458	1.1300	2691.1467	(278)
Space and water heating			4218.9665	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	140.3413	1.5338	215.2601	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-521.4479	1.4967	-780.4538	
PV Unit electricity exported	-714.2398	0.4619	-329.9085	
Total			-1110.3623	(283)
Total Primary energy kWh/year			3453.9651	(286)
Target Primary Energy Rate (TPER)			69.0800	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.2000	(2b)	= 110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 110.0000	(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) =	0.1818	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4318	(18)
Number of sides sheltered		2	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3670 (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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(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	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	40.5000	5.6000	34.9000	0.1900	6.6310	110.0000	3839.0000	(29a)
Wall (common)	16.0000	1.9000	14.1000	0.1600	2.2560	110.0000	1551.0000	(29a)
Roof (loft)	29.0000		29.0000	0.1100	3.1900	9.0000	261.0000	(30)
Roof (skeiling)	27.5000		27.5000	0.1600	4.4000	9.0000	247.5000	(30)
Total net area of external elements Aum(A, m2)			113.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.8672			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13853.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 277.0700 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	12.0000	0.0490	0.5880
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	33.0000	0.0180	0.5940
E18 Party wall between dwellings	4.8000	0.0510	0.2448
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.7859 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 28.6531 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	50.7780	50.6237	50.4724	49.7618	49.6288	49.0099	49.0099	48.8952	49.2483	49.6288	49.8978	50.1790	(39)
Average = Sum(39)m / 12 =												49.7611	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0156	1.0125	1.0094	0.9952	0.9926	0.9802	0.9802	0.9779	0.9850	0.9926	0.9980	1.0036	(40)
HLP (average)												0.9952	
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 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												50.1040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)
Energy content (annual)										Total = Sum(45)m =		832.1197	
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	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)
									Total per year (kWh/year) = Sum(64)m =			707.3017	(64)
12Total per year (kWh/year)												707	(64)
Electric shower(s)	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						478.7637	(64a)
Heat gains from water heating, kWh/month	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	83.6906	92.6575	83.6906	86.4803	83.6906	86.4803	83.6906	83.6906	86.4803	83.6906	86.4803	83.6906	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542	(72)
Total internal gains													
	318.1457	327.6617	313.3338	305.1114	290.1185	281.2780	271.0560	270.6704	278.5946	286.0960	301.9537	311.3340	(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	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)
Northwest	3.2000	11.2829	0.6300	0.7000	0.7700	11.0343	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	25.5472	49.0140	81.6660	125.6648	163.0963	171.7440	161.4900	132.0620	96.6657	58.1082	31.6008	21.2152	(83)
Total gains	343.6928	376.6757	394.9998	430.7763	453.2148	453.0220	432.5460	402.7324	375.2603	344.2042	333.5545	332.5492	(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	75.7846	76.0157	76.2435	77.3324	77.5395	78.5188	78.5188	78.7029	78.1387	77.5395	77.1216	76.6894	
alpha	6.0523	6.0677	6.0829	6.1555	6.1693	6.2346	6.2346	6.2469	6.2092	6.1693	6.1414	6.1126	
util living area													
	0.9975	0.9950	0.9891	0.9601	0.8682	0.6692	0.4953	0.5519	0.8151	0.9711	0.9942	0.9979	(86)
MIT	19.9793	20.1100	20.3099	20.6178	20.8620	20.9787	20.9971	20.9946	20.9311	20.6310	20.2664	19.9651	(87)
Th 2	20.0704	20.0730	20.0755	20.0873	20.0895	20.0999	20.0999	20.1018	20.0959	20.0895	20.0850	20.0804	(88)
util rest of house													
	0.9966	0.9932	0.9848	0.9445	0.8215	0.5853	0.3958	0.4478	0.7408	0.9565	0.9917	0.9972	(89)
MIT 2	19.1445	19.2765	19.4764	19.7835	20.0002	20.0909	20.0992	20.1004	20.0608	19.8020	19.4423	19.1384	(90)
Living area fraction									fLA = Living area / (4) =			0.4000	(91)
MIT	19.4784	19.6099	19.8098	20.1172	20.3449	20.4460	20.4584	20.4581	20.4089	20.1336	19.7720	19.4691	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4784	19.6099	19.8098	20.1172	20.3449	20.4460	20.4584	20.4581	20.4089	20.1336	19.7720	19.4691	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9920	0.9833	0.9451	0.8359	0.6186	0.4358	0.4897	0.7686	0.9574	0.9906	0.9965	(94)
Useful gains	342.2525	373.6741	388.4107	407.1182	378.8211	280.2326	188.4848	197.2053	288.4418	329.5295	330.4194	331.4008	(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													
	770.7300	744.6692	671.7793	558.1883	429.0359	286.5135	189.0982	198.4214	310.7028	473.1431	632.3034	766.1877	(97)
Space heating kWh													
	318.7872	249.3087	210.8262	108.7704	37.3599	0.0000	0.0000	0.0000	0.0000	106.8485	217.3564	323.4815	(98a)
Space heating requirement - total per year (kWh/year)												1572.7388	
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													
	318.7872	249.3087	210.8262	108.7704	37.3599	0.0000	0.0000	0.0000	0.0000	106.8485	217.3564	323.4815	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1572.7388	
Space heating per m2										(98c) / (4) =		31.4548	(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	460.6926	362.6729	371.6038	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8889	0.9467	0.9216	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	409.5009	343.3395	342.4768	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	492.5931	470.5656	437.4036	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	59.8264	94.6562	70.6255	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	14.9566	23.6640	17.6564	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												56.2770	(107)
Energy for space heating												31.4548	(99)
Energy for space cooling												1.1255	(108)
Total												32.5803	(109)
Fabric Energy Efficiency (DFEE)												32.6	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.0000	(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) =	0.1818 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4318 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670 (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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(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	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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			1.9000	1.0000	1.9000			(26)
TER Opening Type (Uw = 1.20)			5.6000	1.1450	6.4122			(27)
Wall (external)	40.5000	5.6000	34.9000	0.1800	6.2820			(29a)
Wall (common)	16.0000	1.9000	14.1000	0.1800	2.5380			(29a)
Roof (loft)	29.0000		29.0000	0.1100	3.1900			(30)
Roof (skeiling)	27.5000		27.5000	0.1100	3.0250			(30)
Total net area of external elements Aum(A, m2)			113.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.3472			(33)
Party Wall			3.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K: 277.0700 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	5.3000	0.0500	0.2650
E2 Other lintels (including other steel lintels)	4.4000	0.0500	0.2200
E3 Sill	14.0000	0.0500	0.7000
E4 Jamb	12.0000	0.0900	1.0800
E16 Corner (normal)	30.1000	0.0700	2.1070
E7 Party floor between dwellings (in blocks of flats)	33.0000	0.0400	1.3200
E11 Eaves (insulation at rafter level)	4.8000	0.0600	0.2880
E18 Party wall between dwellings	1.6000	0.0800	0.1280
P5 Party wall - Roof (insulation at rafter level)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K): 6.1080 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.4552 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	51.5802	51.4259	51.2746	50.5639	50.4310	49.8120	49.8120	49.6974	50.0504	50.4310	50.6999	50.9811	(39)
Average = Sum(39)m / 12 =												50.5633	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0316	1.0285	1.0255	1.0113	1.0086	0.9962	0.9962	0.9939	1.0010	1.0086	1.0140	1.0196	(40)
HLP (average)												1.0113	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy: 1.6901 (42)

Hot water usage for mixer showers

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

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)

Average daily hot water use (litres/day) 50.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)
Energy content (annual)											Total = Sum(45)m =	832.1197	
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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)
											Total per year (kWh/year) = Sum(64)m =	707.3017	(64)
12Total per year (kWh/year)												707	(64)
Electric shower(s)													
	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 478.7637 (64a)

Heat gains from water heating, kWh/month

	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844 (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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	83.6906	92.6575	83.6906	86.4803	83.6906	86.4803	83.6906	83.6906	86.4803	83.6906	86.4803	83.6906	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542	(72)
Total internal gains													
	318.1457	327.6617	313.3338	305.1114	290.1185	281.2780	271.0560	270.6704	278.5946	286.0960	301.9537	311.3340	(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	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)
Northwest	3.2000	11.2829	0.6300	0.7000	0.7700	11.0343	(81)

Solar gains	25.5472	49.0140	81.6660	125.6648	163.0963	171.7440	161.4900	132.0620	96.6657	58.1082	31.6008	21.2152	(83)
Total gains	343.6928	376.6757	394.9998	430.7763	453.2148	453.0220	432.5460	402.7324	375.2603	344.2042	333.5545	332.5492	(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	74.6060	74.8300	75.0508	76.1055	76.3062	77.2543	77.2543	77.4325	76.8863	76.3062	75.9014	75.4827	
alpha	5.9737	5.9887	6.0034	6.0737	6.0871	6.1503	6.1503	6.1622	6.1258	6.0871	6.0601	6.0322	
util living area													
	0.9975	0.9951	0.9894	0.9617	0.8732	0.6776	0.5029	0.5600	0.8216	0.9721	0.9943	0.9980	(86)
MIT	19.9552	20.0865	20.2886	20.6005	20.8518	20.9760	20.9966	20.9938	20.9250	20.6159	20.2460	19.9408	(87)
Th 2	20.0571	20.0596	20.0621	20.0739	20.0762	20.0865	20.0865	20.0884	20.0825	20.0762	20.0717	20.0670	(88)
util rest of house													
	0.9966	0.9933	0.9852	0.9464	0.8270	0.5923	0.4006	0.4532	0.7473	0.9579	0.9919	0.9972	(89)
MIT 2	19.1096	19.2423	19.4445	19.7559	19.9798	20.0764	20.0857	20.0868	20.0441	19.7764	19.4112	19.1033	(90)
Living area fraction									fLA = Living area / (4) =			0.4000	(91)
MIT	19.4478	19.5800	19.7821	20.0937	20.3286	20.4362	20.4501	20.4496	20.3964	20.1122	19.7451	19.4383	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4478	19.5800	19.7821	20.0937	20.3286	20.4362	20.4501	20.4496	20.3964	20.1122	19.7451	19.4383	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9921	0.9837	0.9468	0.8408	0.6260	0.4417	0.4962	0.7749	0.9586	0.9908	0.9966	(94)
Useful gains	342.2631	373.7176	388.5538	407.8471	381.0820	283.6116	191.0599	199.8429	290.7996	329.9587	330.4723	331.4076	(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													
	781.3285	754.9303	681.0358	565.9989	435.1485	290.7141	191.7797	201.2538	315.1384	479.7105	641.1066	776.8666	(97)
Space heating kWh													
	326.6647	256.1750	217.6066	113.8693	40.2255	0.0000	0.0000	0.0000	0.0000	111.4154	223.6567	331.4215	(98a)
Space heating requirement - total per year (kWh/year)												1621.0346	

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

326.6647	256.1750	217.6066	113.8693	40.2255	0.0000	0.0000	0.0000	0.0000	111.4154	223.6567	331.4215	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1621.0346

Space heating per m2 (98c) / (4) = 32.4207 (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	468.2330	368.6089	377.7002	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8810	0.9415	0.9151	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	412.5049	347.0635	345.6148	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	492.5931	470.5656	437.4036	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	57.6635	91.8856	68.2909	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	14.4159	22.9714	17.0727	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 54.4600 (107)

Energy for space heating 32.4207 (99)

Energy for space cooling 1.0892 (108)

Total 33.5099 (109)

Fabric Energy Efficiency (TFEE) 33.5 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.2000	(2b) =	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		110.0000	(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) =	0.1818 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4318 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670 (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													
	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	40.5000	5.6000	34.9000	0.1900	6.6310	110.0000	3839.0000	(29a)
Wall (common)	16.0000	1.9000	14.1000	0.1600	2.2560	110.0000	1551.0000	(29a)
Roof (loft)	29.0000		29.0000	0.1100	3.1900	9.0000	261.0000	(30)
Roof (skeiling)	27.5000		27.5000	0.1600	4.4000	9.0000	247.5000	(30)
Total net area of external elements Aum(A, m2)			113.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.8672			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)

Internal Wall	75.0000	75.0000	5625.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13853.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 277.0700 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	12.0000	0.0490	0.5880
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	33.0000	0.0180	0.5940
E18 Party wall between dwellings	4.8000	0.0510	0.2448
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.7859 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 28.6531 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	50.7780	50.6237	50.4724	49.7618	49.6288	49.0099	49.0099	48.8952	49.2483	49.6288	49.8978	50.1790	(39)

Average = Sum(39)m / 12 = 49.7611

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0156	1.0125	1.0094	0.9952	0.9926	0.9802	0.9802	0.9779	0.9850	0.9926	0.9980	1.0036	(40)
HLP (average)												0.9952	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)

Energy content (annual) Total = Sum(45)m = 1637.0557

Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:
Store volume 173.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0368 (55)

Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)

Total per year (kWh/year) = Sum(64)m = 2015.4877 (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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3270	18.0542	14.6827	11.1157	8.3091	7.0149	7.5799	9.8526	13.2242	16.7911	19.5977	20.8919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	396.6013	394.6514	381.7620	357.6948	334.3822	313.2816	300.8993	303.5773	315.8439	337.5171	363.6908	386.4131	(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	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)

Northwest				3.2000		11.2829		0.6300		0.7000		0.7700	11.0343 (81)
Solar gains	25.5472	49.0140	81.6660	125.6648	163.0963	171.7440	161.4900	132.0620	96.6657	58.1082	31.6008	21.2152 (83)	
Total gains	422.1484	443.6653	463.4279	483.3596	497.4785	485.0256	462.3893	435.6393	412.5096	395.6253	395.2916	407.6283 (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	75.7846	76.0157	76.2435	77.3324	77.5395	78.5188	78.5188	78.7029	78.1387	77.5395	77.1216	76.6894	
alpha	6.0523	6.0677	6.0829	6.1555	6.1693	6.2346	6.2346	6.2469	6.2092	6.1693	6.1414	6.1126	
util living area	0.9926	0.9885	0.9763	0.9356	0.8263	0.6309	0.4642	0.5122	0.7659	0.9468	0.9861	0.9939	(86)
MIT	20.1333	20.2389	20.4349	20.6961	20.8976	20.9845	20.9980	20.9964	20.9515	20.7129	20.3844	20.1135	(87)
Th 2	20.0704	20.0730	20.0755	20.0873	20.0895	20.0999	20.0999	20.1018	20.0959	20.0895	20.0850	20.0804	(88)
util rest of house	0.9901	0.9846	0.9680	0.9132	0.7738	0.5493	0.3705	0.4145	0.6878	0.9235	0.9807	0.9918	(89)
MIT 2	19.0778	19.2136	19.4614	19.7873	20.0078	20.0917	20.0993	20.1006	20.0657	19.8147	19.4082	19.0605	(90)
Living area fraction										fLA = Living area / (4) =		0.4000	(91)
MIT	19.5000	19.6237	19.8508	20.1508	20.3637	20.4488	20.4588	20.4589	20.4200	20.1739	19.7987	19.4817	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5000	19.6237	19.8508	20.1508	20.3637	20.4488	20.4588	20.4589	20.4200	20.1739	19.7987	19.4817	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9881	0.9822	0.9655	0.9150	0.7907	0.5817	0.4081	0.4537	0.7174	0.9260	0.9785	0.9900	(94)
Useful gains	417.1159	435.7520	447.4573	442.2628	393.3786	282.1336	188.6926	197.6651	295.9516	366.3639	386.8004	403.5705	(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	771.8271	745.3685	673.8476	559.8618	429.9689	286.6501	189.1175	198.4633	311.2515	475.1436	633.6360	766.8185	(97)
Space heating kWh	263.9051	208.0623	168.4344	84.6713	27.2232	0.0000	0.0000	0.0000	0.0000	80.9321	177.7216	270.2565	(98a)
Space heating requirement - total per year (kWh/year)												1281.2066	
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	263.9051	208.0623	168.4344	84.6713	27.2232	0.0000	0.0000	0.0000	0.0000	80.9321	177.7216	270.2565	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1281.2066	
Space heating per m2											(98c) / (4) =	25.6241	(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 %)	100.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	263.9051	208.0623	168.4344	84.6713	27.2232	0.0000	0.0000	0.0000	0.0000	80.9321	177.7216	270.2565	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	263.9051	208.0623	168.4344	84.6713	27.2232	0.0000	0.0000	0.0000	0.0000	80.9321	177.7216	270.2565	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	17.7921	14.2735	12.8517	9.4157	7.2729	5.9421	6.6346	8.6239	11.2016	14.6972	16.6004	18.2866	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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												1281.2066	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	143.5922	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	2090.0751	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1281.2066	16.4900	211.2710	(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)	665.2763	16.4900	109.7041	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	143.5922	16.4900	23.6784	(250)
Additional standing charges			0.0000	(251)
Total energy cost			344.6534	(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] =	1.3061	(257)
SAP value		78.8289	
SAP rating (Section 12)		79	(258)
SAP band		C	

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	1281.2066	0.1558	199.6730	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			293.5035	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			314.2283	(272)
CO2 emissions per m2			6.2800	(273)
EI value			95.5677	
EI rating			96	(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		50.0000 (1b)	x	2.2000 (2b)	=	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.0000	(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) =	0.1818	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	

Measured/design AP50	5.0000	(17)
Infiltration rate	0.4318	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.3670	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate	0.3946	0.3762	0.3762	0.3395	0.3303	0.3120	0.3120	0.2936	0.2936	0.3120	0.3120	0.3395	(22b)
Effective ac	0.5778	0.5708	0.5708	0.5576	0.5546	0.5487	0.5487	0.5431	0.5431	0.5487	0.5487	0.5576	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	40.5000	5.6000	34.9000	0.1900	6.6310	110.0000	3839.0000	(29a)
Wall (common)	16.0000	1.9000	14.1000	0.1600	2.2560	110.0000	1551.0000	(29a)
Roof (loft)	29.0000		29.0000	0.1100	3.1900	9.0000	261.0000	(30)
Roof (skeiling)	27.5000		27.5000	0.1600	4.4000	9.0000	247.5000	(30)
Total net area of external elements Aum(A, m2)			113.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.8672			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	13853.5000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	277.0700	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	12.0000	0.0490	0.5880
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	33.0000	0.0180	0.5940
E18 Party wall between dwellings	4.8000	0.0510	0.2448
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.7859	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	28.6531	(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	20.9757	20.7190	20.7190	20.2422	20.1306	19.9167	19.9167	19.7149	19.7149	19.9167	19.9167	20.2422	(38)
Heat transfer coeff	49.6288	49.3721	49.3721	48.8952	48.7837	48.5697	48.5697	48.3680	48.3680	48.5697	48.5697	48.8952	(39)
Average = Sum(39)m / 12 =												48.8302	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9926	0.9874	0.9874	0.9779	0.9757	0.9714	0.9714	0.9674	0.9674	0.9714	0.9714	0.9779	(40)
HLP (average)												0.9766	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6901	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:		
Store volume	173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.9200	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	1.0368	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Total per year (kWh/year) = Sum(64)m =												2015.4877	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)

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

	20.3270	18.0542	14.6827	11.1157	8.3091	7.0149	7.5799	9.8526	13.2242	16.7911	19.5977	20.8919	(67)

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

	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)

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

	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)

	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)

Water heating gains (Table 5)

	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)

Total internal gains

	396.6013	394.6514	381.7620	357.6948	334.3822	313.2816	300.8993	303.5773	315.8439	337.5171	363.6908	386.4131	(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	
Northeast	1.6000	13.3408	0.6300	0.7000	0.7700	6.5234	(75)
Southwest	0.8000	41.5040	0.6300	0.7000	0.7700	10.1473	(79)
Northwest	3.2000	13.3408	0.6300	0.7000	0.7700	13.0468	(81)

Solar gains	29.7176	49.0660	83.6570	132.6111	166.5318	188.3342	175.3208	145.2173	106.4598	65.1639	36.5106	23.6095	(83)
Total gains	426.3188	443.7174	465.4190	490.3058	500.9140	501.6157	476.2202	448.7946	422.3037	402.6810	400.2014	410.0227	(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	77.5395	77.9428	77.9428	78.7029	78.8828	79.2303	79.2303	79.5608	79.5608	79.2303	79.2303	78.7029	
alpha	6.1693	6.1962	6.1962	6.2469	6.2589	6.2820	6.2820	6.3041	6.3041	6.2820	6.2820	6.2469	
util living area													
	0.9911	0.9871	0.9729	0.9240	0.7995	0.5816	0.4171	0.4510	0.7364	0.9346	0.9832	0.9928	(86)
MIT	20.2061	20.2955	20.4859	20.7381	20.9215	20.9908	20.9990	20.9985	20.9635	20.7576	20.4464	20.1871	(87)
Th 2	20.0895	20.0938	20.0938	20.1018	20.1037	20.1072	20.1072	20.1106	20.1106	20.1072	20.1072	20.1018	(88)
util rest of house													
	0.9881	0.9828	0.9635	0.8986	0.7431	0.5008	0.3269	0.3564	0.6571	0.9072	0.9767	0.9903	(89)
MIT 2	19.1851	19.3013	19.5393	19.8477	20.0434	20.1028	20.1070	20.1102	20.0887	19.8807	19.5034	19.1707	(90)
Living area fraction									fLA = Living area / (4) =			0.4000	(91)
MIT	19.5935	19.6990	19.9179	20.2039	20.3947	20.4580	20.4638	20.4655	20.4386	20.2314	19.8806	19.5773	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5935	19.6990	19.9179	20.2039	20.3947	20.4580	20.4638	20.4655	20.4386	20.2314	19.8806	19.5773	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9804	0.9613	0.9018	0.7625	0.5330	0.3631	0.3944	0.6877	0.9116	0.9747	0.9885	(94)
Useful gains	420.3491	435.0117	447.3983	442.1791	381.9582	267.3777	172.9017	176.9859	290.4269	367.0901	390.0625	405.2949	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W													
	744.1080	720.7806	652.5957	542.9266	409.5219	269.9490	173.0928	177.2936	301.7492	458.0826	611.0354	737.2078	(97)
Space heating kWh													
	240.8766	192.0367	152.6669	72.5382	20.5074	0.0000	0.0000	0.0000	0.0000	67.6984	159.1005	246.9432	(98a)
Space heating requirement - total per year (kWh/year)												1152.3678	
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													
	240.8766	192.0367	152.6669	72.5382	20.5074	0.0000	0.0000	0.0000	0.0000	67.6984	159.1005	246.9432	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1152.3678	
Space heating per m2											(98c) / (4) =	23.0474	(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 %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	240.8766	192.0367	152.6669	72.5382	20.5074	0.0000	0.0000	0.0000	0.0000	67.6984	159.1005	246.9432	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	240.8766	192.0367	152.6669	72.5382	20.5074	0.0000	0.0000	0.0000	0.0000	67.6984	159.1005	246.9432	(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
201.9505 178.4507 189.1314 165.1291 159.3034 142.7036 140.1856 146.1949 148.2972 166.3814 178.1746 199.5853 (64)
Efficiency of water heater 302.9550 (216)
(217)m 302.9550 302.9550 302.9550 302.9550 302.9550 302.9550 302.9550 302.9550 302.9550 302.9550 302.9550 302.9550 (217)
Fuel for water heating, kWh/month
66.6602 58.9034 62.4289 54.5062 52.5832 47.1039 46.2728 48.2563 48.9502 54.9195 58.8122 65.8795 (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 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (231)
Lighting 17.7921 14.2735 12.8517 9.4157 7.2729 5.9421 6.6346 8.6239 11.2016 14.6972 16.6004 18.2866 (232)
Electricity generated by PVs (Appendix M) (negative quantity)
(233a)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 (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 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)
(234b)m 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 1152.3678 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 302.9550
Water heating fuel used 665.2763 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
Total electricity for the above, kWh/year 0.0000 (231)
Electricity for lighting (calculated in Appendix L) 143.5922 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (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 1961.2363 (238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1152.3678	25.1600	289.9357	(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)	665.2763	25.1600	167.3835	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	143.5922	25.1600	36.1278	(250)
Additional standing charges			0.0000	(251)
Total energy cost			493.4471	(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	1152.3678	0.1561	179.9096	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			273.7402	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			294.4650	(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	1152.3678	1.5780	1818.4522	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			2830.6845	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	143.5922	1.5338	220.2466	(282)
Total Primary energy kWh/year			3050.9311	(286)

SAP 10 EPC IMPROVEMENTS

ZA0904

Current energy efficiency rating: C 79
Current environmental impact rating: A 96

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

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

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

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£493	£493	£0
Space heating	£290	£290	£0
Water heating	£167	£167	£0
Lighting	£36	£36	£0
Total cost of fuels	£493	£493	£0
Total cost of uses	£493	£493	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000 (1b)	x	2.2000 (2b)	=	110.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	110.0000	(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) =	0.1818 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4318 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670 (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	0.4680	0.4588	0.4496	0.4037	0.3946	0.3487	0.3487	0.3395	0.3670	0.3946	0.4129	0.4313	(22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5778	0.5608	0.5608	0.5576	0.5674	0.5778	0.5853	0.5930	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	40.5000	5.6000	34.9000	0.1900	6.6310	110.0000	3839.0000	(29a)
Wall (common)	16.0000	1.9000	14.1000	0.1600	2.2560	110.0000	1551.0000	(29a)
Roof (loft)	29.0000		29.0000	0.1100	3.1900	9.0000	261.0000	(30)

Roof (skeiling)	27.5000	27.5000	0.1600	4.4000	9.0000	247.5000	(30)
Total net area of external elements Aum(A, m2)		113.0000					(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		25.8672			(33)
Party Wall		3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor		50.0000			40.0000	2000.0000	(32d)
Internal Wall		75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13853.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 277.0700 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	12.0000	0.0490	0.5880
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	33.0000	0.0180	0.5940
E18 Party wall between dwellings	4.8000	0.0510	0.2448
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.7859 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 28.6531 (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	22.1250	21.9706	21.8193	21.1087	20.9757	20.3568	20.3568	20.2422	20.5952	20.9757	21.2447	21.5259	(38)
Heat transfer coeff	50.7780	50.6237	50.4724	49.7618	49.6288	49.0099	49.0099	48.8952	49.2483	49.6288	49.8978	50.1790	(39)

Average = Sum(39)m / 12 = 49.7611

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0156	1.0125	1.0094	0.9952	0.9926	0.9802	0.9802	0.9779	0.9850	0.9926	0.9980	1.0036	(40)
HLP (average)												0.9952	
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 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	

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

25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:
Store volume 173.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0368 (55)
Total storage loss

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)

If cylinder contains dedicated solar storage

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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

201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)

Total per year (kWh/year) = Sum(64)m = 2015.4877 (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

56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3270	18.0542	14.6827	11.1157	8.3091	7.0149	7.5799	9.8526	13.2242	16.7911	19.5977	20.8919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	396.6013	394.6514	381.7620	357.6948	334.3822	313.2816	300.8993	303.5773	315.8439	337.5171	363.6908	386.4131	(73)

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6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W	
Northeast	1.6000	11.2829	0.6300	0.7000	0.7700	5.5171	(75)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)
Northwest	3.2000	11.2829	0.6300	0.7000	0.7700	11.0343	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	25.5472	49.0140	81.6660	125.6648	163.0963	171.7440	161.4900	132.0620	96.6657	58.1082	31.6008	21.2152	(83)
Total gains	422.1484	443.6653	463.4279	483.3596	497.4785	485.0256	462.3893	435.6393	412.5096	395.6253	395.2916	407.6283	(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	75.7846	76.0157	76.2435	77.3324	77.5395	78.5188	78.5188	78.7029	78.1387	77.5395	77.1216	76.6894	
alpha	6.0523	6.0677	6.0829	6.1555	6.1693	6.2346	6.2346	6.2469	6.2092	6.1693	6.1414	6.1126	
util living area	0.9926	0.9885	0.9763	0.9356	0.8263	0.6309	0.4642	0.5122	0.7659	0.9468	0.9861	0.9939	(86)
MIT	20.1333	20.2389	20.4349	20.6961	20.8976	20.9845	20.9980	20.9964	20.9515	20.7129	20.3844	20.1135	(87)
Th 2	20.0704	20.0730	20.0755	20.0873	20.0895	20.0999	20.0999	20.1018	20.0959	20.0895	20.0850	20.0804	(88)
util rest of house	0.9901	0.9846	0.9680	0.9132	0.7738	0.5493	0.3705	0.4145	0.6878	0.9235	0.9807	0.9918	(89)
MIT 2	19.0778	19.2136	19.4614	19.7873	20.0078	20.0917	20.0993	20.1006	20.0657	19.8147	19.4082	19.0605	(90)
Living area fraction										fLA = Living area / (4) =		0.4000	(91)
MIT	19.5000	19.6237	19.8508	20.1508	20.3637	20.4488	20.4588	20.4589	20.4200	20.1739	19.7987	19.4817	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5000	19.6237	19.8508	20.1508	20.3637	20.4488	20.4588	20.4589	20.4200	20.1739	19.7987	19.4817	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9881	0.9822	0.9655	0.9150	0.7907	0.5817	0.4081	0.4537	0.7174	0.9260	0.9785	0.9900	(94)
Useful gains	417.1159	435.7520	447.4573	442.2628	393.3786	282.1336	188.6926	197.6651	295.9516	366.3639	386.8004	403.5705	(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	771.8271	745.3685	673.8476	559.8618	429.9689	286.6501	189.1175	198.4633	311.2515	475.1436	633.6360	766.8185	(97)
Space heating kWh	263.9051	208.0623	168.4344	84.6713	27.2232	0.0000	0.0000	0.0000	0.0000	80.9321	177.7216	270.2565	(98a)
Space heating requirement - total per year (kWh/year)												1281.2066	
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	263.9051	208.0623	168.4344	84.6713	27.2232	0.0000	0.0000	0.0000	0.0000	80.9321	177.7216	270.2565	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1281.2066	
Space heating per m2											(98c) / (4) =	25.6241	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	263.9051	208.0623	168.4344	84.6713	27.2232	0.0000	0.0000	0.0000	0.0000	80.9321	177.7216	270.2565	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	263.9051	208.0623	168.4344	84.6713	27.2232	0.0000	0.0000	0.0000	0.0000	80.9321	177.7216	270.2565	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	17.7921	14.2735	12.8517	9.4157	7.2729	5.9421	6.6346	8.6239	11.2016	14.6972	16.6004	18.2866	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	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	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1281.2066	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	143.5922	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	2090.0751	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1281.2066	16.4900	211.2710	(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)	665.2763	16.4900	109.7041	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	143.5922	16.4900	23.6784	(250)
Additional standing charges			0.0000	(251)
Total energy cost			344.6534	(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] =	1.3061	(257)
SAP value		78.8289	
SAP rating (Section 12)		79	(258)
SAP band		C	

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	1281.2066	0.1558	199.6730	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			293.5035	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			314.2283	(272)
CO2 emissions per m2			6.2800	(273)
EI value			95.5677	
EI rating			96	(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		50.0000 (1b)	x	2.2000 (2b)	=	110.0000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =				110.0000	(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) =	0.1818	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4318	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3670	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate	0.3946	0.3762	0.3762	0.3395	0.3303	0.3120	0.3120	0.2936	0.2936	0.3120	0.3120	0.3395	(22b)
Effective ac	0.5778	0.5708	0.5708	0.5576	0.5546	0.5487	0.5487	0.5431	0.5431	0.5487	0.5487	0.5576	(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	
Front Door			1.9000	1.3000	2.4700			(26)
Windows (Uw = 1.30)			5.6000	1.2357	6.9202			(27)
Wall (external)	40.5000	5.6000	34.9000	0.1900	6.6310	110.0000	3839.0000	(29a)
Wall (common)	16.0000	1.9000	14.1000	0.1600	2.2560	110.0000	1551.0000	(29a)
Roof (loft)	29.0000		29.0000	0.1100	3.1900	9.0000	261.0000	(30)
Roof (skeiling)	27.5000		27.5000	0.1600	4.4000	9.0000	247.5000	(30)
Total net area of external elements Aum(A, m2)			113.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.8672			(33)
Party Wall			3.0000	0.0000	0.0000	110.0000	330.0000	(32)
Party Floor			50.0000			40.0000	2000.0000	(32d)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13853.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		277.0700 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.3000	0.0600	0.3180
E3 Sill	4.4000	0.0180	0.0792
E4 Jamb	14.0000	0.0140	0.1960
E16 Corner (normal)	12.0000	0.0490	0.5880
E7 Party floor between dwellings (in blocks of flats)	30.1000	0.0230	0.6923
E11 Eaves (insulation at rafter level)	33.0000	0.0180	0.5940
E18 Party wall between dwellings	4.8000	0.0510	0.2448
P5 Party wall - Roof (insulation at rafter level)	1.6000	0.0460	0.0736

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.7859 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	28.6531 (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	20.9757	20.7190	20.7190	20.2422	20.1306	19.9167	19.9167	19.7149	19.7149	19.9167	19.9167	20.2422	(38)
Heat transfer coeff	49.6288	49.3721	49.3721	48.8952	48.7837	48.5697	48.5697	48.3680	48.3680	48.5697	48.5697	48.8952	(39)
Average = Sum(39)m / 12 =												48.8302	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9926	0.9874	0.9874	0.9779	0.9757	0.9714	0.9714	0.9674	0.9674	0.9714	0.9714	0.9779	(40)
HLP (average)												0.9766	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(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													
	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.3270	18.0542	14.6827	11.1157	8.3091	7.0149	7.5799	9.8526	13.2242	16.7911	19.5977	20.8919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains													
	396.6013	394.6514	381.7620	357.6948	334.3822	313.2816	300.8993	303.5773	315.8439	337.5171	363.6908	386.4131	(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	
Northeast	1.6000	13.3408	0.6300	0.7000	0.7700	6.5234	(75)
Southwest	0.8000	41.5040	0.6300	0.7000	0.7700	10.1473	(79)
Northwest	3.2000	13.3408	0.6300	0.7000	0.7700	13.0468	(81)

Solar gains	29.7176	49.0660	83.6570	132.6111	166.5318	188.3342	175.3208	145.2173	106.4598	65.1639	36.5106	23.6095	(83)
Total gains	426.3188	443.7174	465.4190	490.3058	500.9140	501.6157	476.2202	448.7946	422.3037	402.6810	400.2014	410.0227	(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	77.5395	77.9428	77.9428	78.7029	78.8828	79.2303	79.2303	79.5608	79.5608	79.2303	79.2303	78.7029	
alpha	6.1693	6.1962	6.1962	6.2469	6.2589	6.2820	6.2820	6.3041	6.3041	6.2820	6.2820	6.2469	
util living area													
	0.9911	0.9871	0.9729	0.9240	0.7995	0.5816	0.4171	0.4510	0.7364	0.9346	0.9832	0.9928	(86)
MIT	20.2061	20.2955	20.4859	20.7381	20.9215	20.9908	20.9990	20.9985	20.9635	20.7576	20.4464	20.1871	(87)
Th 2	20.0895	20.0938	20.0938	20.1018	20.1037	20.1072	20.1072	20.1106	20.1106	20.1072	20.1072	20.1018	(88)
util rest of house													
	0.9881	0.9828	0.9635	0.8986	0.7431	0.5008	0.3269	0.3564	0.6571	0.9072	0.9767	0.9903	(89)
MIT 2	19.1851	19.3013	19.5393	19.8477	20.0434	20.1028	20.1070	20.1102	20.0887	19.8807	19.5034	19.1707	(90)
Living area fraction									fLA = Living area / (4) =			0.4000	(91)
MIT	19.5935	19.6990	19.9179	20.2039	20.3947	20.4580	20.4638	20.4655	20.4386	20.2314	19.8806	19.5773	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5935	19.6990	19.9179	20.2039	20.3947	20.4580	20.4638	20.4655	20.4386	20.2314	19.8806	19.5773	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9804	0.9613	0.9018	0.7625	0.5330	0.3631	0.3944	0.6877	0.9116	0.9747	0.9885	(94)
Useful gains	420.3491	435.0117	447.3983	442.1791	381.9582	267.3777	172.9017	176.9859	290.4269	367.0901	390.0625	405.2949	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W													
	744.1080	720.7806	652.5957	542.9266	409.5219	269.9490	173.0928	177.2936	301.7492	458.0826	611.0354	737.2078	(97)
Space heating kWh													
	240.8766	192.0367	152.6669	72.5382	20.5074	0.0000	0.0000	0.0000	0.0000	67.6984	159.1005	246.9432	(98a)
Space heating requirement - total per year (kWh/year)												1152.3678	
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													
	240.8766	192.0367	152.6669	72.5382	20.5074	0.0000	0.0000	0.0000	0.0000	67.6984	159.1005	246.9432	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1152.3678	
Space heating per m2											(98c) / (4) =	23.0474	(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 %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	240.8766	192.0367	152.6669	72.5382	20.5074	0.0000	0.0000	0.0000	0.0000	67.6984	159.1005	246.9432	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	240.8766	192.0367	152.6669	72.5382	20.5074	0.0000	0.0000	0.0000	0.0000	67.6984	159.1005	246.9432	(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	(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	(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	(215)
Space heating fuel used, main system 2											0.0000	(213)
Water heating												
Water heating requirement												
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853 (64)
Efficiency of water heater												302.9550 (216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550 (217)
Fuel for water heating, kWh/month												
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	17.7921	14.2735	12.8517	9.4157	7.2729	5.9421	6.6346	8.6239	11.2016	14.6972	16.6004	18.2866 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)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 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	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	1152.3678 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	302.9550
Water heating fuel used	665.2763 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	143.5922 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	1961.2363 (238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1152.3678	25.1600	289.9357	(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)	665.2763	25.1600	167.3835	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	143.5922	25.1600	36.1278	(250)
Additional standing charges			0.0000	(251)
Total energy cost			493.4471	(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	1152.3678	0.1561	179.9096	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			273.7402	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	143.5922	0.1443	20.7248	(268)
Total CO2, kg/year			294.4650	(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	1152.3678	1.5780	1818.4522	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			2830.6845	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	143.5922	1.5338	220.2466	(282)
Total Primary energy kWh/year			3050.9311	(286)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 09 Feb 2024 13:08:03

Project Information			
Assessed By	Joe Solti	Building Type	Bungalow, Detached
OCDEA Registration	EES/003578	Assessment Date	2024-02-09

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m^2
Site Reference	ZA0905	Plot Reference	ZA0905
Address	Unit 5 255 Guildford Road, Effingham, KT24 5NP		

Client Details	
Name	.
Company	.
Address	., ., .

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*16.41 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	8.2 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*87.77 kWh_{PE}/m^2*	
Dwelling primary energy	87.48 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*64.3 kWh/m^2*	
Dwelling fabric energy efficiency	56.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.19	Walls (1) (0.19)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.12	Ground Floor (0.12)	OK
Roofs	*0.16*	0.14	Roof (1) (0.14)	OK
Windows, doors, and roof windows	*1.6*	1.3	Front Door (1.3)	OK
Rooflights	*2.2*	1.3	Rooflights, East (1.3)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	58.4	0.19
Ground floor: Ground Floor, Ground Floor	50	0.12
Exposed roof: Roof (1)	47	0.14

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front Door, Front Door	3.6	North East	1.0	1.3
Windows (NW), Windows	1	North East	0.7	1.3
Windows (SE), Windows	7	South East	0.7	1.3
Windows (SW), Windows	1	South West	0.7	1.3
Rooflights, Rooflights	3	East	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.06	
External wall	E3: Sill	Calculated by person with suitable expertise	0.018 **(!)**	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.014 **(!)**	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.111	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.049	
External wall	E15: Flat roof with parapet	SAP table default	0.3	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	5 m^3/hm^2, Design value	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	Auer
Model	EDL170-520RF
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and appliance thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Main heating 2 - type: Not applicable	
Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.9 kWp
Orientation	East
Pitch	Horizontal
Overshading	None or very little
Manufacturer	
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	ZA0905	**Issued on Date**	09/02/2024
Assessment Reference	ZA0905	**Prop Type Ref**	ZA0905
Property	Unit 5, 255 Guildford Road, Effingham, Surrey, KT24 5NP		

SAP Rating	73 C	**DER**	8.20	**TER**	16.41
Environmental	95 A	**% DER < TER**			50.03
CO_2 Emissions (t/year)	0.36	**DFEE**	56.93	**TFEE**	64.28
Compliance Check	See BREL	**% DFEE < TFEE**			11.43
% DPER < TPER	0.33	**DPER**	87.48	**TPER**	87.77

Assessor Details	Mr. Joe Solti	**Assessor ID**	5122-0001
Client	Vieo Projects, .		

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	50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door (Uw = 1.30)			3.6000	1.2357	4.4487			(27)
Windows (Uw = 1.30)			9.0000	1.2357	11.1217			(27)
Rooflights			3.0000	1.2357	3.7072			(27a)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	71.0000	12.6000	58.4000	0.1900	11.0960	60.0000	3504.0000	(29a)
Roof	50.0000	3.0000	47.0000	0.1400	6.5800	9.0000	423.0000	(30)
Total net area of external elements Aum(A, m2)			171.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.9536			(33)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13302.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		266.0400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7000	0.0600	0.4620
E3 Sill	1.9000	0.0180	0.0342
E4 Jamb	18.0000	0.0140	0.2520
E5 Ground floor (normal)	29.5000	0.1110	3.2745
E16 Corner (normal)	12.0000	0.0490	0.5880
E15 Flat roof with parapet	29.5000	0.3000	8.8500

R1 Head of roof window	3.0000	0.2400	0.7200		
R2 Sill of roof window	3.0000	0.2400	0.7200		
R3 Jamb of roof window	7.8000	0.2400	1.8720		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				16.7727	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	59.7263	(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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	83.5637	83.4069	83.2532	82.5314	82.3964	81.7677	81.7677	81.6513	82.0099	82.3964	82.6696	82.9552	(39)
Average = Sum(39)m / 12 =												82.5308	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6713	1.6681	1.6651	1.6506	1.6479	1.6354	1.6354	1.6330	1.6402	1.6479	1.6534	1.6591	(40)
HLP (average)												1.6506	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901	(42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(64)
12Total per year (kWh/year)												2015	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	345.7375	353.2645	337.6863	323.6984	305.8131	293.2716	281.0487	282.2064	291.6806	303.2744	324.0210	338.1841	(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	
Northeast	3.6000	11.2829	0.6300	1.0000	0.7700	17.7337	(75)
Northeast	1.0000	11.2829	0.6300	0.7000	0.7700	3.4482	(75)
Southeast	7.0000	36.7938	0.6300	0.7000	0.7700	78.7127	(77)
Southwest	1.0000	36.7938	0.6300	0.7000	0.7700	11.2447	(79)
East	3.0000	26.0000	0.6300	0.7000	1.0000	30.9582	(82)

Solar gains	142.0975	260.6449	401.6461	565.9562	691.0714	709.8292	674.5673	578.5098	458.6013	300.6304	173.6936	119.2877	(83)
Total gains	487.8350	613.9094	739.3323	889.6546	996.8845	1003.1008	955.6159	860.7162	750.2819	603.9048	497.7146	457.4718	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	44.2178	44.3009	44.3827	44.7708	44.8442	45.1890	45.1890	45.2534	45.0556	44.8442	44.6960	44.5421	
alpha	3.9479	3.9534	3.9588	3.9847	3.9896	4.0126	4.0126	4.0169	4.0037	3.9896	3.9797	3.9695	
util living area	0.9897	0.9749	0.9390	0.8427	0.6835	0.5026	0.3718	0.4274	0.6750	0.9115	0.9794	0.9919	(86)
MIT	19.2920	19.6063	20.0392	20.5327	20.8405	20.9640	20.9916	20.9855	20.8882	20.4243	19.7583	19.2377	(87)
Th 2	19.5615	19.5638	19.5660	19.5764	19.5784	19.5875	19.5875	19.5892	19.5840	19.5784	19.5744	19.5703	(88)
util rest of house	0.9860	0.9662	0.9185	0.7955	0.6047	0.4000	0.2548	0.3008	0.5659	0.8716	0.9707	0.9890	(89)
MIT 2	17.6541	18.0505	18.5837	19.1587	19.4667	19.5715	19.5857	19.5856	19.5233	19.0640	18.2545	17.5911	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	18.5058	18.8595	19.3405	19.8732	20.1811	20.2956	20.3167	20.3136	20.2330	19.7714	19.0365	18.4474	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5058	18.8595	19.3405	19.8732	20.1811	20.2956	20.3167	20.3136	20.2330	19.7714	19.0365	18.4474	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9822	0.9607	0.9147	0.8064	0.6398	0.4526	0.3158	0.3669	0.6188	0.8780	0.9664	0.9857	(94)
Useful gains	479.1436	589.7865	676.2334	717.4508	637.8051	453.9868	301.8121	315.7672	464.3089	530.2582	480.9727	450.9343	(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	1187.0900	1164.3215	1069.0144	905.6314	698.8099	465.7184	303.9085	319.5469	502.9694	755.6880	986.7829	1181.8921	(97)
Space heating kWh	526.7121	386.0875	292.2290	135.4901	45.3876	0.0000	0.0000	0.0000	0.0000	167.7197	364.1834	543.8326	(98a)
Space heating requirement - total per year (kWh/year)												2461.6419	
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	526.7121	386.0875	292.2290	135.4901	45.3876	0.0000	0.0000	0.0000	0.0000	167.7197	364.1834	543.8326	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2461.6419	
Space heating per m2											(98c) / (4) =	49.2328	(99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
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 %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	526.7121	386.0875	292.2290	135.4901	45.3876	0.0000	0.0000	0.0000	0.0000	167.7197	364.1834	543.8326	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	526.7121	386.0875	292.2290	135.4901	45.3876	0.0000	0.0000	0.0000	0.0000	167.7197	364.1834	543.8326	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.2225	-21.3173	-37.7894	-48.6450	-54.2933	-49.0819	-48.1015	-42.8977	-34.0322	-26.1121	-14.4662	-10.0134	(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	-1.7052	-4.8100	-13.6358	-29.1150	-48.5573	-54.5981	-53.1420	-41.2040	-25.5838	-9.2428	-2.6410	-1.2358	(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												2461.6419	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												302.9550	
Water heating fuel used												665.2763	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												127.4161	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-684.4435	(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	2569.8908	(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	2461.6419	0.1561	384.1516	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			477.9822	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-398.9726	0.1325	-52.8612	
PV Unit electricity exported	-285.4710	0.1178	-33.6408	
Total			-86.5020	(269)
Total CO2, kg/year			409.8703	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.2000	(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	2461.6419	1.5777	3883.7920	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			4896.0243	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	127.4161	1.5338	195.4351	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-398.9726	1.4896	-594.3034	
PV Unit electricity exported	-285.4710	0.4321	-123.3413	
Total			-717.6447	(283)
Total Primary energy kWh/year			4373.8147	(286)
Dwelling Primary energy Rate (DPER)			87.4800	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000 (1b)	x	2.4000 (2b)	=	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)

Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			10.0900	1.1450	11.5534			(27)
Rooflights			2.4000	2.0221	4.8529			(27a)
Ground Floor			50.0000	0.1300	6.5000			(28a)
Wall (external)	71.0000	10.0900	60.9100	0.1800	10.9638			(29a)
Roof	50.0000	2.4000	47.6000	0.1100	5.2360			(30)
Total net area of external elements Aum(A, m2)			171.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.1062			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 266.0400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7000	0.0500	0.3850
E3 Sill	1.9000	0.0500	0.0950
E4 Jamb	18.0000	0.0500	0.9000
E5 Ground floor (normal)	29.5000	0.1600	4.7200
E16 Corner (normal)	12.0000	0.0900	1.0800
E15 Flat roof with parapet	29.5000	0.5600	16.5200
R1 Head of roof window	3.0000	0.0800	0.2400
R2 Sill of roof window	3.0000	0.0600	0.1800
R3 Jamb of roof window	7.8000	0.0800	0.6240

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		24.7440 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.8502 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	87.6876	87.5308	87.3771	86.6553	86.5203	85.8916	85.8916	85.7752	86.1338	86.5203	86.7935	87.0791	(39)
Average = Sum(39)m / 12 =												86.6547	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.7538	1.7506	1.7475	1.7331	1.7304	1.7178	1.7178	1.7155	1.7227	1.7304	1.7359	1.7416	(40)
HLP (average)												1.7331	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901	(42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(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	216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
										Total per year (kWh/year) = Sum(64)m =		1962.4258	(64)
12Total per year (kWh/year)												1962	(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	93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)

Water heating gains (Table 5)

	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344 (72)

Total internal gains

	398.8396	406.3666	390.7883	376.8005	358.9151	343.3736	331.1507	332.3085	341.7827	356.3764	377.1230	391.2862 (73)

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6. Solar gains

[Jan]

	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.6800	11.2829	0.6300	0.7000	0.7700	12.6894	(75)
Southeast	5.6100	36.7938	0.6300	0.7000	0.7700	63.0826	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)
East	2.4000	26.0000	0.6300	0.7000	1.0000	24.7666	(82)

Solar gains	109.5343	200.0440	305.9703	427.4558	518.7639	531.4896	505.6373	435.7310	348.1454	230.1286	133.7343	92.0506	(83)
Total gains	508.3739	606.4106	696.7586	804.2562	877.6790	874.8633	836.7880	768.0395	689.9281	586.5051	510.8573	483.3368	(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	42.1382	42.2137	42.2880	42.6402	42.7068	43.0193	43.0193	43.0777	42.8984	42.7068	42.5723	42.4327	
alpha	3.8092	3.8142	3.8192	3.8427	3.8471	3.8680	3.8680	3.8718	3.8599	3.8471	3.8382	3.8288	
util living area	0.9883	0.9768	0.9514	0.8837	0.7579	0.5851	0.4399	0.4940	0.7313	0.9233	0.9784	0.9903	(86)
MIT	19.2232	19.4903	19.8831	20.3741	20.7414	20.9298	20.9818	20.9719	20.8333	20.3357	19.6911	19.1784	(87)
Th 2	19.5026	19.5048	19.5069	19.5172	19.5191	19.5281	19.5281	19.5297	19.5246	19.5191	19.5152	19.5112	(88)
util rest of house	0.9841	0.9686	0.9340	0.8432	0.6803	0.4683	0.2985	0.3456	0.6201	0.8865	0.9692	0.9868	(89)
MIT 2	17.5287	17.8661	18.3546	18.9420	19.3301	19.4957	19.5241	19.5226	19.4307	18.9202	18.1308	17.4776	(90)
Living area fraction									fLA = Living area / (4) =			0.5200	(91)
MIT	18.4098	18.7107	19.1494	19.6867	20.0640	20.2414	20.2821	20.2762	20.1600	19.6563	18.9422	18.3620	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4098	18.7107	19.1494	19.6867	20.0640	20.2414	20.2821	20.2762	20.1600	19.6563	18.9422	18.3620	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9628	0.9289	0.8485	0.7111	0.5272	0.3724	0.4231	0.6720	0.8906	0.9644	0.9830	(94)
Useful gains	498.1164	583.8422	647.1857	682.4335	624.1602	461.2455	311.6567	324.9838	463.6514	522.3502	492.6806	475.1067	(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	1237.2561	1208.8592	1105.2711	934.7223	723.6560	484.5524	316.2616	332.4825	521.9749	783.5505	1027.8231	1233.2181	(97)
Space heating kWh	549.9199	420.0114	340.8156	181.6479	74.0248	0.0000	0.0000	0.0000	0.0000	194.3330	385.3026	564.0349	(98a)
Space heating requirement - total per year (kWh/year)												2710.0902	
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	549.9199	420.0114	340.8156	181.6479	74.0248	0.0000	0.0000	0.0000	0.0000	194.3330	385.3026	564.0349	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2710.0902	
Space heating per m2											(98c) / (4) =	54.2018	(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	549.9199	420.0114	340.8156	181.6479	74.0248	0.0000	0.0000	0.0000	0.0000	194.3330	385.3026	564.0349	(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)	595.7962	455.0503	369.2476	196.8017	80.2003	0.0000	0.0000	0.0000	0.0000	210.5450	417.4459	611.0888	(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	192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2782	86.0023	85.4530	84.3354	82.4835	79.8000	79.8000	79.8000	79.8000	84.4563	85.8147	86.3419	(217)
Fuel for water heating, kWh/month	222.9739	197.9674	212.2033	190.5393	189.8394	177.9421	176.5248	182.9609	184.3137	192.8965	200.2673	220.5854	(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	15.4303	12.3788	11.1457	8.1658	6.3075	5.1533	5.7539	7.4792	9.7147	12.7462	14.3968	15.8592	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.7165	-52.7492	-71.5395	-75.8386	-78.2238	-71.9006	-71.0902	-68.8337	-64.3529	-58.1340	-42.5340	-34.7413	(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	-33.4934	-68.8031	-133.7800	-196.7629	-256.2435	-255.9660	-252.8542	-215.7553	-160.4764	-96.7998	-44.1838	-26.6027	(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	2936.1757	(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	2349.0141	(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)	124.5314	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2471.3753	(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	3024.3459	(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	2936.1757	0.2100	616.5969	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2349.0141	0.2100	493.2930	(264)
Space and water heating			1109.8898	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	124.5314	0.1443	17.9737	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-729.6542	0.1358	-99.1009	
PV Unit electricity exported	-1741.7210	0.1265	-220.3877	
Total			-319.4886	(269)
Total CO2, kg/year			820.3043	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.4100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2936.1757	1.1300	3317.8785	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2349.0141	1.1300	2654.3859	(278)
Space and water heating			5972.2644	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	124.5314	1.5338	191.0104	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-729.6542	1.5020	-1095.9628	
PV Unit electricity exported	-1741.7210	0.4645	-809.0255	
Total			-1904.9883	(283)
Total Primary energy kWh/year			4388.3873	(286)
Target Primary Energy Rate (TPER)			87.7700	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.4000	(2b)	= 120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 120.0000	(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) =	0.1667 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4167 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(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	0.6020 0.5980 0.5941 0.5759 0.5725 0.5566 0.5566 0.5537 0.5627 0.5725 0.5794 0.5866	(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	
Front Door (Uw = 1.30)			3.6000	1.2357	4.4487			(27)
Windows (Uw = 1.30)			9.0000	1.2357	11.1217			(27)
Rooflights			3.0000	1.2357	3.7072			(27a)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	71.0000	12.6000	58.4000	0.1900	11.0960	60.0000	3504.0000	(29a)
Roof	50.0000	3.0000	47.0000	0.1400	6.5800	9.0000	423.0000	(30)
Total net area of external elements Aum(A, m2)			171.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.9536			(33)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13302.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		266.0400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7000	0.0600	0.4620
E3 Sill	1.9000	0.0180	0.0342
E4 Jamb	18.0000	0.0140	0.2520
E5 Ground floor (normal)	29.5000	0.1110	3.2745
E16 Corner (normal)	12.0000	0.0490	0.5880
E15 Flat roof with parapet	29.5000	0.3000	8.8500
R1 Head of roof window	3.0000	0.2400	0.7200
R2 Sill of roof window	3.0000	0.2400	0.7200
R3 Jamb of roof window	7.8000	0.2400	1.8720

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.7727 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.7263 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	83.5637	83.4069	83.2532	82.5314	82.3964	81.7677	81.7677	81.6513	82.0099	82.3964	82.6696	82.9552	(39)
Average = Sum(39)m / 12 =												82.5308	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6713	1.6681	1.6651	1.6506	1.6479	1.6354	1.6354	1.6330	1.6402	1.6479	1.6534	1.6591	(40)
HLP (average)												1.6506	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6901 (42)

Hot water usage for mixer showers

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

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day)		50.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)
Energy content (annual)										Total = Sum(45)m =		832.1197	

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

73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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

73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)
								Total per year (kWh/year) = Sum(64)m =			707.3017	(64)
12Total per year (kWh/year)											707	(64)

Electric shower(s)

42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 478.7637 (64a)

Heat gains from water heating, kWh/month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(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	
84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)m

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

74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)

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

147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)

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

31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
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)

Pumps, fans

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

-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)

Water heating gains (Table 5)

38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542	(72)
308.7177	317.2236	303.9058	295.3692	280.6905	271.5357	261.6280	261.2424	268.8523	276.6680	292.2114	301.9060	(73)

Total internal gains

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.6000	11.2829	0.6300	1.0000	0.7700	17.7337	(75)
Northeast	1.0000	11.2829	0.6300	0.7000	0.7700	3.4482	(75)
Southeast	7.0000	36.7938	0.6300	0.7000	0.7700	78.7127	(77)
Southwest	1.0000	36.7938	0.6300	0.7000	0.7700	11.2447	(79)
East	3.0000	26.0000	0.6300	0.7000	1.0000	30.9582	(82)

Solar gains	142.0975	260.6449	401.6461	565.9562	691.0714	709.8292	674.5673	578.5098	458.6013	300.6304	173.6936	119.2877	(83)
Total gains	450.8151	577.8684	705.5519	861.3253	971.7619	981.3649	936.1953	839.7523	727.4536	577.2983	465.9050	421.1936	(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	
44.2178	44.3009	44.3827	44.7708	44.8442	45.1890	45.1890	45.2534	45.0556	44.8442	44.6960	44.5421	tau
3.9479	3.9534	3.9588	3.9847	3.9896	4.0126	4.0126	4.0169	4.0037	3.9896	3.9797	3.9695	alpha
0.9922	0.9794	0.9467	0.8538	0.6955	0.5124	0.3792	0.4373	0.6895	0.9216	0.9835	0.9939	(86) util living area
19.2255	19.5454	19.9899	20.5058	20.8301	20.9615	20.9909	20.9843	20.8791	20.3897	19.7034	19.1719	(87) MIT
19.5615	19.5638	19.5660	19.5764	19.5784	19.5875	19.5875	19.5892	19.5840	19.5784	19.5744	19.5703	(88) Th 2
0.9893	0.9721	0.9283	0.8084	0.6168	0.4083	0.2601	0.3081	0.5804	0.8850	0.9763	0.9917	(89) util rest of house
18.0095	18.3256	18.7552	19.2293	19.4850	19.5741	19.5860	19.5861	19.5322	19.1484	18.4927	17.9628	(90) MIT 2

Living area fraction fLA = Living area / (4) = 0.5200 (91)

18.6418	18.9599	19.3973	19.8931	20.1844	20.2955	20.3166	20.3132	20.2326	19.7939	19.1223	18.5915	(92) MIT
											0.0000	Temperature adjustment
18.6418	18.9599	19.3973	19.8931	20.1844	20.2955	20.3166	20.3132	20.2326	19.7939	19.1223	18.5915	(93) adjusted MIT

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9868	0.9681	0.9257	0.8196	0.6521	0.4617	0.3222	0.3756	0.6336	0.8916	0.9733	0.9896	(94) Utilisation
444.8424	559.4531	653.1270	705.9467	633.7281	453.1166	301.6391	315.4020	460.8877	514.7095	453.4827	416.8092	(95) Useful gains
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) Ext temp.
1198.4571	1172.6919	1073.7399	907.2741	699.0864	465.7114	303.8938	319.5157	502.9359	757.5453	993.8761	1193.8513	(97) Heat loss rate W
560.6894	412.0965	312.9360	144.9557	48.6265	0.0000	0.0000	0.0000	0.0000	180.6698	389.0833	578.1193	(98a) Space heating kWh

Space heating requirement - total per year (kWh/year) 2627.1765

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

560.6894	412.0965	312.9360	144.9557	48.6265	0.0000	0.0000	0.0000	0.0000	180.6698	389.0833	578.1193	(98c) Space heating kWh

Space heating requirement after solar contribution - total per year (kWh/year) 2627.1765

Space heating per m2 (98c) / (4) = 52.5435 (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	
4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	Ext. temp.
0.0000	0.0000	0.0000	0.0000	0.0000	768.6165	605.0811	620.5498	0.0000	0.0000	0.0000	0.0000	(100) Heat loss rate W
0.0000	0.0000	0.0000	0.0000	0.0000	0.9101	0.9478	0.9238	0.0000	0.0000	0.0000	0.0000	(101) Utilisation
0.0000	0.0000	0.0000	0.0000	0.0000	699.5175	573.4703	573.2586	0.0000	0.0000	0.0000	0.0000	(102) Useful loss
0.0000	0.0000	0.0000	0.0000	0.0000	1080.4934	1031.3809	926.5059	0.0000	0.0000	0.0000	0.0000	(103) Total gains
0.0000	0.0000	0.0000	0.0000	0.0000	274.3027	340.6855	262.8160	0.0000	0.0000	0.0000	0.0000	(104) Space cooling kWh

Cooled fraction fC = cooled area / (4) = 1.0000 (105)

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) Intermittency factor (Table 10b)
0.0000	0.0000	0.0000	0.0000	0.0000	68.5757	85.1714	65.7040	0.0000	0.0000	0.0000	0.0000	(107) Space cooling kWh

Space cooling requirement	219.4510	(107)
Energy for space heating	52.5435	(99)
Energy for space cooling	4.3890	(108)
Total	56.9326	(109)
Fabric Energy Efficiency (DFEE)	56.9	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4167 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(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	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			10.0900	1.1450	11.5534			(27)
Rooflights			2.4000	2.0221	4.8529			(27a)
Ground Floor			50.0000	0.1300	6.5000			(28a)
Wall (external)	71.0000	10.0900	60.9100	0.1800	10.9638			(29a)
Roof	50.0000	2.4000	47.6000	0.1100	5.2360			(30)
Total net area of external elements Aum(A, m2)			171.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1062			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	266.0400	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7000	0.0500	0.3850
E3 Sill	1.9000	0.0500	0.0950
E4 Jamb	18.0000	0.0500	0.9000
E5 Ground floor (normal)	29.5000	0.1600	4.7200
E16 Corner (normal)	12.0000	0.0900	1.0800
E15 Flat roof with parapet	29.5000	0.5600	16.5200
R1 Head of roof window	3.0000	0.0800	0.2400
R2 Sill of roof window	3.0000	0.0600	0.1800
R3 Jamb of roof window	7.8000	0.0800	0.6240

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		24.7440	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	63.8502	(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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	87.6876	87.5308	87.3771	86.6553	86.5203	85.8916	85.8916	85.7752	86.1338	86.5203	86.7935	87.0791	(39)
Average = Sum(39)m / 12 =												86.6547	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.7538	1.7506	1.7475	1.7331	1.7304	1.7178	1.7178	1.7155	1.7227	1.7304	1.7359	1.7416	(40)
HLP (average)												1.7331	
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												1.6901	(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													
	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses													
	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												50.1040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)
Energy content (annual)										Total = Sum(45)m =		832.1197	
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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)
										Total per year (kWh/year) = Sum(64)m =		707.3017	(64)
12Total per year (kWh/year)												707	(64)
Electric shower(s)													
	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							478.7637	(64a)
Heat gains from water heating, kWh/month													
	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542	(72)
Total internal gains													
	308.7177	317.2236	303.9058	295.3692	280.6905	271.5357	261.6280	261.2424	268.8523	276.6680	292.2114	301.9060	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.6800	11.2829	0.6300	0.7000	0.7700	12.6894	(75)
Southeast	5.6100	36.7938	0.6300	0.7000	0.7700	63.0826	(77)
Southwest	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(79)
East	2.4000	26.0000	0.6300	0.7000	1.0000	24.7666	(82)

Solar gains	109.5343	200.0440	305.9703	427.4558	518.7639	531.4896	505.6373	435.7310	348.1454	230.1286	133.7343	92.0506	(83)
Total gains	418.2520	517.2676	609.8761	722.8249	799.4544	803.0253	767.2653	696.9734	616.9977	506.7966	425.9457	393.9566	(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	42.1382	42.2137	42.2880	42.6402	42.7068	43.0193	43.0193	43.0777	42.8984	42.7068	42.5723	42.4327	
alpha	3.8092	3.8142	3.8192	3.8427	3.8471	3.8680	3.8680	3.8718	3.8599	3.8471	3.8382	3.8288	
util living area													
	0.9939	0.9860	0.9673	0.9109	0.7962	0.6253	0.4759	0.5372	0.7791	0.9489	0.9880	0.9952	(86)
MIT	19.0630	19.3383	19.7482	20.2771	20.6884	20.9117	20.9762	20.9625	20.7891	20.2233	19.5448	19.0182	(87)
Th 2	19.5026	19.5048	19.5069	19.5172	19.5191	19.5281	19.5281	19.5297	19.5246	19.5191	19.5152	19.5112	(88)
util rest of house													
	0.9917	0.9809	0.9547	0.8769	0.7228	0.5052	0.3248	0.3792	0.6725	0.9217	0.9826	0.9934	(89)
MIT 2	17.8063	18.0799	18.4822	18.9869	19.3363	19.4954	19.5239	19.5220	19.4275	18.9545	18.2945	17.7680	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	18.4598	18.7343	19.1405	19.6578	20.0394	20.2319	20.2791	20.2711	20.1355	19.6143	18.9447	18.4181	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4598	18.7343	19.1405	19.6578	20.0394	20.2319	20.2791	20.2711	20.1355	19.6143	18.9447	18.4181	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9894	0.9773	0.9508	0.8807	0.7512	0.5655	0.4039	0.4619	0.7214	0.9239	0.9798	0.9915	(94)
Useful gains	413.8333	505.5173	579.8944	636.5840	600.5167	454.1419	309.9095	321.9213	445.0899	468.2244	417.3463	390.5936	(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													
	1241.6374	1210.9243	1104.4906	932.2188	721.5253	483.7298	316.0027	332.0429	519.8632	779.9177	1028.0423	1238.0970	(97)
Space heating kWh													
	615.8862	474.0335	390.2996	212.8570	90.0304	0.0000	0.0000	0.0000	0.0000	231.8998	439.7012	630.5425	(98a)
Space heating requirement - total per year (kWh/year)												3085.2502	
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													
	615.8862	474.0335	390.2996	212.8570	90.0304	0.0000	0.0000	0.0000	0.0000	231.8998	439.7012	630.5425	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3085.2502	
Space heating per m2											(98c) / (4) =	61.7050	(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	807.3812	635.5980	651.8915	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8273	0.8891	0.8534	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	667.9812	565.0851	556.3263	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	880.0857	841.5291	765.9338	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.7153	205.6743	155.9480	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	38.1788	51.4186	38.9870	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												128.5844	(107)
Energy for space heating												61.7050	(99)
Energy for space cooling												2.5717	(108)
Total												64.2767	(109)
Fabric Energy Efficiency (TFEE)												64.3	(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		50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4167 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3542 (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													
	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door (Uw = 1.30)			3.6000	1.2357	4.4487			(27)
Windows (Uw = 1.30)			9.0000	1.2357	11.1217			(27)
Rooflights			3.0000	1.2357	3.7072			(27a)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	71.0000	12.6000	58.4000	0.1900	11.0960	60.0000	3504.0000	(29a)
Roof	50.0000	3.0000	47.0000	0.1400	6.5800	9.0000	423.0000	(30)
Total net area of external elements Aum(A, m2)			171.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.9536			(33)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13302.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 266.0400 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7000	0.0600	0.4620
E3 Sill	1.9000	0.0180	0.0342
E4 Jamb	18.0000	0.0140	0.2520
E5 Ground floor (normal)	29.5000	0.1110	3.2745
E16 Corner (normal)	12.0000	0.0490	0.5880
E15 Flat roof with parapet	29.5000	0.3000	8.8500
R1 Head of roof window	3.0000	0.2400	0.7200
R2 Sill of roof window	3.0000	0.2400	0.7200
R3 Jamb of roof window	7.8000	0.2400	1.8720

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.7727 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.7263 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	83.5637	83.4069	83.2532	82.5314	82.3964	81.7677	81.7677	81.6513	82.0099	82.3964	82.6696	82.9552	(39)
Average = Sum(39)m / 12 =												82.5308	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6713	1.6681	1.6651	1.6506	1.6479	1.6354	1.6354	1.6330	1.6402	1.6479	1.6534	1.6591	(40)
HLP (average)												1.6506	
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 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.4877	(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	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0371	16.0204	13.0286	9.8635	7.3731	6.2247	6.7260	8.7427	11.7344	14.8995	17.3900	18.5384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains	394.3114	392.6175	380.1079	356.4425	333.4462	312.4913	300.0454	302.4674	314.3542	335.6255	361.4831	384.0596	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.6000	11.2829	0.6300	1.0000	0.7700	17.7337	(75)
Northeast	1.0000	11.2829	0.6300	0.7000	0.7700	3.4482	(75)
Southeast	7.0000	36.7938	0.6300	0.7000	0.7700	78.7127	(77)
Southwest	1.0000	36.7938	0.6300	0.7000	0.7700	11.2447	(79)
East	3.0000	26.0000	0.6300	0.7000	1.0000	30.9582	(82)

Solar gains	142.0975	260.6449	401.6461	565.9562	691.0714	709.8292	674.5673	578.5098	458.6013	300.6304	173.6936	119.2877	(83)
Total gains	536.4089	653.2624	781.7540	922.3987	1024.5176	1022.3205	974.6127	880.9772	772.9555	636.2559	535.1767	503.3473	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.2178	44.3009	44.3827	44.7708	44.8442	45.1890	45.1890	45.2534	45.0556	44.8442	44.6960	44.5421	
alpha	3.9479	3.9534	3.9588	3.9847	3.9896	4.0126	4.0126	4.0169	4.0037	3.9896	3.9797	3.9695	
util living area	0.9857	0.9694	0.9286	0.8298	0.6706	0.4943	0.3648	0.4183	0.6608	0.8985	0.9739	0.9887	(86)
MIT	19.3780	19.6715	20.0986	20.5621	20.8512	20.9661	20.9921	20.9866	20.8964	20.4642	19.8216	19.3201	(87)
Th 2	19.5615	19.5638	19.5660	19.5764	19.5784	19.5875	19.5875	19.5892	19.5840	19.5784	19.5744	19.5703	(88)
util rest of house	0.9808	0.9591	0.9056	0.7807	0.5917	0.3929	0.2499	0.2940	0.5520	0.8549	0.9632	0.9847	(89)
MIT 2	17.7624	18.1307	18.6530	19.1885	19.4749	19.5725	19.5858	19.5859	19.5284	19.1064	18.3324	17.6951	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	18.6025	18.9319	19.4047	19.9028	20.1906	20.2972	20.3171	20.3143	20.2398	19.8125	19.1068	18.5401	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6025	18.9319	19.4047	19.9028	20.1906	20.2972	20.3171	20.3143	20.2398	19.8125	19.1068	18.5401	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9762	0.9533	0.9025	0.7931	0.6273	0.4449	0.3098	0.3588	0.6052	0.8633	0.9587	0.9807	(94)
Useful gains	523.6583	622.7765	705.5252	731.5390	642.6772	454.8063	301.9821	316.1149	467.7799	549.3045	513.0515	493.6572	(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	1195.1709	1170.3559	1074.3563	908.0747	699.5930	465.8458	303.9371	319.6042	503.5221	759.0747	992.5973	1189.5847	(97)
Space heating kWh	499.6053	367.9734	274.4103	127.1057	42.3453	0.0000	0.0000	0.0000	0.0000	156.0690	345.2730	517.7701	(98a)
Space heating requirement - total per year (kWh/year)												2330.5522	
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	499.6053	367.9734	274.4103	127.1057	42.3453	0.0000	0.0000	0.0000	0.0000	156.0690	345.2730	517.7701	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2330.5522	
Space heating per m2											(98c) / (4) =	46.6110	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	499.6053	367.9734	274.4103	127.1057	42.3453	0.0000	0.0000	0.0000	0.0000	156.0690	345.2730	517.7701	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	499.6053	367.9734	274.4103	127.1057	42.3453	0.0000	0.0000	0.0000	0.0000	156.0690	345.2730	517.7701	(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	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1938	-21.2513	-37.5896	-48.3697	-54.0849	-49.0819	-48.1015	-42.8977	-34.0322	-25.9873	-14.4258	-9.9935	(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	-1.7339	-4.8760	-13.8356	-29.3903	-48.7657	-54.5981	-53.1420	-41.2040	-25.5838	-9.3676	-2.6814	-1.2558	(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	2330.5522	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	665.2763	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	127.4161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-684.4435	(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	2438.8011	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2330.5522	16.4900	384.3081	(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)	665.2763	16.4900	109.7041	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	127.4161	16.4900	21.0109	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-398.0092	16.4900	-65.6317	
PV Unit electricity exported	-286.4343	5.5900	-16.0117	
Total			-81.6434	(252)
Total energy cost			433.3796	(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] =	1.6423	(257)
SAP value		73.3786	
SAP rating (Section 12)		73	(258)
SAP band		C	

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	2330.5522	0.1561	363.8200	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			457.6506	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-398.0092	0.1325	-52.7222	
PV Unit electricity exported	-286.4343	0.1180	-33.7910	
Total			-86.5131	(269)
Total CO2, kg/year			389.5276	(272)
CO2 emissions per m2			7.7900	(273)
EI value			94.5056	
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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000 (1b)	x	2.4000 (2b)	=	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate	0.3807	0.3630	0.3630	0.3276	0.3187	0.3010	0.3010	0.2833	0.2833	0.3010	0.3010	0.3276	(22b)
Effective ac	0.5725	0.5659	0.5659	0.5537	0.5508	0.5453	0.5453	0.5401	0.5401	0.5453	0.5453	0.5537	(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	
Front Door (Uw = 1.30)			3.6000	1.2357	4.4487			(27)
Windows (Uw = 1.30)			9.0000	1.2357	11.1217			(27)
Rooflights			3.0000	1.2357	3.7072			(27a)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	71.0000	12.6000	58.4000	0.1900	11.0960	60.0000	3504.0000	(29a)
Roof	50.0000	3.0000	47.0000	0.1400	6.5800	9.0000	423.0000	(30)
Total net area of external elements Aum(A, m2)			171.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.9536			(33)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13302.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		266.0400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7000	0.0600	0.4620
E3 Sill	1.9000	0.0180	0.0342
E4 Jamb	18.0000	0.0140	0.2520
E5 Ground floor (normal)	29.5000	0.1110	3.2745
E16 Corner (normal)	12.0000	0.0490	0.5880
E15 Flat roof with parapet	29.5000	0.3000	8.8500
R1 Head of roof window	3.0000	0.2400	0.7200
R2 Sill of roof window	3.0000	0.2400	0.7200
R3 Jamb of roof window	7.8000	0.2400	1.8720

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.7727	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	59.7263	(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	22.6701	22.4093	22.4093	21.9250	21.8117	21.5944	21.5944	21.3895	21.3895	21.5944	21.5944	21.9250	(38)
Heat transfer coeff	82.3964	82.1356	82.1356	81.6513	81.5380	81.3207	81.3207	81.1158	81.1158	81.3207	81.3207	81.6513	(39)
Average = Sum(39)m / 12 =												81.5852	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6479	1.6427	1.6427	1.6330	1.6308	1.6264	1.6264	1.6223	1.6223	1.6264	1.6264	1.6330	(40)
HLP (average)												1.6317	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6901	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day)	98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:		
Store volume	173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.9200	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	1.0368	(55)

Total storage loss

	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408 (56)

If cylinder contains dedicated solar storage

	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408 (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

	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853 (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

	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853 (64)

Total per year (kWh/year) = Sum(64)m = 2015.4877 (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

	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753 (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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)

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

	18.0371	16.0204	13.0286	9.8635	7.3731	6.2247	6.7260	8.7427	11.7344	14.8995	17.3900	18.5384	(67)

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

	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)

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

	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)

	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)

Water heating gains (Table 5)

	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)

Total internal gains

	394.3114	392.6175	380.1079	356.4425	333.4462	312.4913	300.0454	302.4674	314.3542	335.6255	361.4831	384.0596	(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	
Northeast	3.6000	13.3408	0.6300	1.0000	0.7700	20.9681	(75)
Northeast	1.0000	13.3408	0.6300	0.7000	0.7700	4.0771	(75)
Southeast	7.0000	41.5040	0.6300	0.7000	0.7700	88.7892	(77)
Southwest	1.0000	41.5040	0.6300	0.7000	0.7700	12.6842	(79)
East	3.0000	31.0000	0.6300	0.7000	1.0000	36.9117	(82)

Solar gains	163.4303	257.1808	404.5811	587.8535	696.4302	769.5046	723.4411	626.7819	496.6317	331.8944	198.2251	131.3847	(83)
Total gains	557.7417	649.7983	784.6890	944.2960	1029.8764	1081.9959	1023.4866	929.2493	810.9858	667.5200	559.7082	515.4443	(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	44.8442	44.9866	44.9866	45.2534	45.3163	45.4374	45.4374	45.5522	45.5522	45.4374	45.4374	45.2534	
alpha	3.9896	3.9991	3.9991	4.0169	4.0211	4.0292	4.0292	4.0368	4.0368	4.0292	4.0292	4.0169	
util living area													
	0.9826	0.9682	0.9237	0.8119	0.6484	0.4475	0.3234	0.3626	0.6266	0.8776	0.9679	0.9869	(86)
MIT	19.4912	19.7277	20.1546	20.6141	20.8756	20.9777	20.9954	20.9929	20.9180	20.5407	19.9213	19.4212	(87)
Th 2	19.5784	19.5822	19.5822	19.5892	19.5909	19.5940	19.5940	19.5970	19.5970	19.5940	19.5940	19.5892	(88)
util rest of house													
	0.9765	0.9575	0.8992	0.7598	0.5674	0.3493	0.2137	0.2435	0.5182	0.8278	0.9551	0.9822	(89)
MIT 2	17.9165	18.2137	18.7319	19.2534	19.5073	19.5850	19.5932	19.5956	19.5546	19.2008	18.4689	17.8357	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	18.7353	19.0009	19.4717	19.9610	20.2188	20.3092	20.3223	20.3222	20.2636	19.8975	19.2241	18.6602	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7353	19.0009	19.4717	19.9610	20.2188	20.3092	20.3223	20.3222	20.2636	19.8975	19.2241	18.6602	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9717	0.9519	0.8969	0.7748	0.6050	0.4001	0.2709	0.3056	0.5720	0.8401	0.9507	0.9780	(94)
Useful gains	541.9387	618.5435	703.8250	731.6142	623.1238	432.8572	277.2372	284.0072	463.8921	560.7725	532.1184	504.1170	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W													
	1164.6993	1141.7624	1049.0089	886.8148	670.1483	439.8795	278.3053	285.7046	491.8540	739.8188	969.6782	1156.1951	(97)
Space heating kWh													
	463.3339	351.6031	256.8168	111.7445	34.9862	0.0000	0.0000	0.0000	0.0000	133.2104	315.0431	485.1461	(98a)

Space heating requirement - total per year (kWh/year) 2151.8841

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

	463.3339	351.6031	256.8168	111.7445	34.9862	0.0000	0.0000	0.0000	0.0000	133.2104	315.0431	485.1461	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 2151.8841

Space heating per m2 (98c) / (4) = 43.0377 (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 %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	463.3339	351.6031	256.8168	111.7445	34.9862	0.0000	0.0000	0.0000	0.0000	133.2104	315.0431	485.1461	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	463.3339	351.6031	256.8168	111.7445	34.9862	0.0000	0.0000	0.0000	0.0000	133.2104	315.0431	485.1461	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month													
	66.6602	58.9034	62.4289	54.5062	52.5832	47.1039	46.2728	48.2563	48.9502	54.9195	58.8122	65.8795	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3054	-21.5391	-38.3571	-49.7405	-54.1238	-51.7280	-50.4039	-45.5101	-36.5030	-28.6139	-16.7046	-11.2941	(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	-2.3007	-5.0721	-14.6753	-32.1667	-50.3338	-61.2832	-58.8748	-46.6269	-29.3338	-11.5621	-3.5130	-1.5622	(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												2151.8841	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												302.9550	
Water heating fuel used												665.2763	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												127.4161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-736.1280	(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												2208.4485	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2151.8841	25.1600	541.4140	(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)	665.2763	25.1600	167.3835	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	127.4161	25.1600	32.0579	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-418.8234	25.1600	-105.3760	
PV Unit electricity exported	-317.3046	5.8100	-18.4354	
Total			-123.8114	(252)
Total energy cost			617.0441	(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	2151.8841	0.1563	336.4375	(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)	665.2763	0.1410	93.8306	(264)
Space and water heating			430.2680	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)

Energy saving/generation technologies				
PV Unit electricity used in dwelling	-418.8234		0.1325	-55.5114
PV Unit electricity exported	-317.3046		0.1178	-37.3699
Total				-92.8813 (269)
Total CO2, kg/year				355.7768 (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	2151.8841	1.5788	3397.4069	(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)	665.2763	1.5215	1012.2323	(278)
Space and water heating			4409.6392	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	127.4161	1.5338	195.4351	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-418.8234	1.4898	-623.9428	
PV Unit electricity exported	-317.3046	0.4318	-137.0002	
Total			-760.9430	(283)
Total Primary energy kWh/year			3844.1314	(286)

SAP 10 EPC IMPROVEMENTS

ZA0905

Current energy efficiency rating: C 73
Current environmental impact rating: A 95

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 30	-15 kg (4.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£30	0.30 kg/m²	C 74	A 95
Total Savings	£30	0.30 kg/m²		

Potential energy efficiency rating: C 74
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£741	£709	£32
Space heating	£541	£562	-£20
Water heating	£167	£115	£52
Lighting	£32	£32	£0
Generated (PV)	-£124	-£122	-£2
Total cost of fuels	£617	£587	£30
Total cost of uses	£616	£587	£30
Delivered energy	44 kWh/m²	42 kWh/m²	3 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	77 kWh/m²	73 kWh/m²	3 kWh/m²

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000 (1b)	x	2.4000 (2b)	=	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	120.0000	(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) =	0.1667	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4167	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542	(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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161	(22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866	(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	
Front Door (Uw = 1.30)			3.6000	1.2357	4.4487			(27)
Windows (Uw = 1.30)			9.0000	1.2357	11.1217			(27)
Rooflights			3.0000	1.2357	3.7072			(27a)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	71.0000	12.6000	58.4000	0.1900	11.0960	60.0000	3504.0000	(29a)
Roof	50.0000	3.0000	47.0000	0.1400	6.5800	9.0000	423.0000	(30)
Total net area of external elements Aum(A, m2)			171.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.9536			(33)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13302.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		266.0400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.7000	0.0600	0.4620
E3 Sill	1.9000	0.0180	0.0342
E4 Jamb	18.0000	0.0140	0.2520
E5 Ground floor (normal)	29.5000	0.1110	3.2745
E16 Corner (normal)	12.0000	0.0490	0.5880
E15 Flat roof with parapet	29.5000	0.3000	8.8500
R1 Head of roof window	3.0000	0.2400	0.7200
R2 Sill of roof window	3.0000	0.2400	0.7200
R3 Jamb of roof window	7.8000	0.2400	1.8720

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.7727 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.7263 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	83.5637	83.4069	83.2532	82.5314	82.3964	81.7677	81.7677	81.6513	82.0099	82.3964	82.6696	82.9552	(39)
Average = Sum(39)m / 12 =												82.5308	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6713	1.6681	1.6651	1.6506	1.6479	1.6354	1.6354	1.6330	1.6402	1.6479	1.6534	1.6591	(40)
HLP (average)												1.6506	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6901 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day)	98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)											Total = Sum(45)m =	1637.0557	

Distribution loss (46)m = 0.15 x (45)m		
	25.4715 22.4130 23.5486 20.1038 19.0744 16.7399 16.2067 17.1081 17.5790 20.1361 22.0606 25.1167	(46)
Water storage loss:		
Store volume		173.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.9200 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		1.0368 (55)
Total storage loss		
	32.1408 29.0304 32.1408 31.1040 32.1408 31.1040 32.1408 32.1408 31.1040 32.1408 31.1040 32.1408	(56)
If cylinder contains dedicated solar storage		
	32.1408 29.0304 32.1408 31.1040 32.1408 31.1040 32.1408 32.1408 31.1040 32.1408 31.1040 32.1408	(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		
	201.9505 178.4507 189.1314 165.1291 159.3034 142.7036 140.1856 146.1949 148.2972 166.3814 178.1746 199.5853	(62)
WWHRS	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(63a)
PV diverter	-0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000	(63b)
Aperture area of solar collector		3.0000 (H1)

Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												582.6900	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												582.6900	
Solar input	-0.0000	-16.2956	-55.9833	-75.3762	-96.8757	-88.9012	-88.0078	-78.0500	-54.8534	-28.3468	-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													
	201.9505	162.1551	133.1480	89.7529	62.4277	53.8024	52.1778	68.1449	93.4437	138.0346	178.1746	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		1432.7977	(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													
	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.0371	16.0204	13.0286	9.8635	7.3731	6.2247	6.7260	8.7427	11.7344	14.8995	17.3900	18.5384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains													
	394.3114	392.6175	380.1079	356.4425	333.4462	312.4913	300.0454	302.4674	314.3542	335.6255	361.4831	384.0596	(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	
Northeast	3.6000	11.2829	0.6300	1.0000	0.7700	17.7337	(75)
Northeast	1.0000	11.2829	0.6300	0.7000	0.7700	3.4482	(75)
Southeast	7.0000	36.7938	0.6300	0.7000	0.7700	78.7127	(77)
Southwest	1.0000	36.7938	0.6300	0.7000	0.7700	11.2447	(79)
East	3.0000	26.0000	0.6300	0.7000	1.0000	30.9582	(82)

Solar gains	142.0975	260.6449	401.6461	565.9562	691.0714	709.8292	674.5673	578.5098	458.6013	300.6304	173.6936	119.2877	(83)
Total gains	536.4089	653.2624	781.7540	922.3987	1024.5176	1022.3205	974.6127	880.9772	772.9555	636.2559	535.1767	503.3473	(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	44.2178	44.3009	44.3827	44.7708	44.8442	45.1890	45.1890	45.2534	45.0556	44.8442	44.6960	44.5421	
alpha	3.9479	3.9534	3.9588	3.9847	3.9896	4.0126	4.0126	4.0169	4.0037	3.9896	3.9797	3.9695	
util living area													
	0.9857	0.9694	0.9286	0.8298	0.6706	0.4943	0.3648	0.4183	0.6608	0.8985	0.9739	0.9887	(86)
MIT	19.3780	19.6715	20.0986	20.5621	20.8512	20.9661	20.9921	20.9866	20.8964	20.4642	19.8216	19.3201	(87)
Th 2	19.5615	19.5638	19.5660	19.5764	19.5784	19.5875	19.5875	19.5892	19.5840	19.5784	19.5744	19.5703	(88)
util rest of house													
	0.9808	0.9591	0.9056	0.7807	0.5917	0.3929	0.2499	0.2940	0.5520	0.8549	0.9632	0.9847	(89)
MIT 2	17.7624	18.1307	18.6530	19.1885	19.4749	19.5725	19.5858	19.5859	19.5284	19.1064	18.3324	17.6951	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	18.6025	18.9319	19.4047	19.9028	20.1906	20.2972	20.3171	20.3143	20.2398	19.8125	19.1068	18.5401	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6025	18.9319	19.4047	19.9028	20.1906	20.2972	20.3171	20.3143	20.2398	19.8125	19.1068	18.5401	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9762	0.9533	0.9025	0.7931	0.6273	0.4449	0.3098	0.3588	0.6052	0.8633	0.9587	0.9807	(94)
Useful gains	523.6583	622.7765	705.5252	731.5390	642.6772	454.8063	301.9821	316.1149	467.7799	549.3045	513.0515	493.6572	(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													
	1195.1709	1170.3559	1074.3563	908.0747	699.5930	465.8458	303.9371	319.6042	503.5221	759.0747	992.5973	1189.5847	(97)
Space heating kWh													
	499.6053	367.9734	274.4103	127.1057	42.3453	0.0000	0.0000	0.0000	0.0000	156.0690	345.2730	517.7701	(98a)
Space heating requirement - total per year (kWh/year)												2330.5522	
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													
	499.6053	367.9734	274.4103	127.1057	42.3453	0.0000	0.0000	0.0000	0.0000	156.0690	345.2730	517.7701	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2330.5522	

Space heating per m2 (98c) / (4) = 46.6110 (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 %) 100.0000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	499.6053	367.9734	274.4103	127.1057	42.3453	0.0000	0.0000	0.0000	0.0000	156.0690	345.2730	517.7701	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	499.6053	367.9734	274.4103	127.1057	42.3453	0.0000	0.0000	0.0000	0.0000	156.0690	345.2730	517.7701	(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													
	201.9505	162.1551	133.1480	89.7529	62.4277	53.8024	52.1778	68.1449	93.4437	138.0346	178.1746	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month													
	66.6602	53.5245	43.9498	29.6258	20.6063	17.7592	17.2230	22.4934	30.8441	45.5628	58.8122	65.8795	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.2011	-21.2541	-37.4536	-47.7388	-52.2396	-46.7089	-45.8079	-41.3520	-33.4338	-25.9591	-14.4401	-9.9988	(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	-1.7266	-4.8732	-13.9717	-30.0212	-50.6109	-56.9711	-55.4356	-42.7497	-26.1822	-9.3957	-2.6671	-1.2505	(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 2330.5522 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 302.9550
Water heating fuel used 472.9408 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
pump for solar water heating 80.0000 (230g)
Total electricity for the above, kWh/year 80.0000 (231)
Electricity for lighting (calculated in Appendix L) 127.4161 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -684.4435 (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 2326.4656 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2330.5522	16.4900	384.3081	(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)	472.9408	16.4900	77.9879	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	127.4161	16.4900	21.0109	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-388.5879	16.4900	-64.0781	
PV Unit electricity exported	-295.8556	5.5900	-16.5383	
Total			-80.6165	(252)
Total energy cost			415.8824	(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] = 1.5760 (257)

SAP value	74.4534	
SAP rating (Section 12)	74	(258)
SAP band	C	

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	2330.5522	0.1561	363.8200	(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)	472.9408	0.1464	69.2510	(264)
Space and water heating			433.0710	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-388.5879	0.1327	-51.5829	
PV Unit electricity exported	-295.8556	0.1177	-34.8199	
Total			-86.4028	(269)
Total CO2, kg/year			376.1553	(272)
CO2 emissions per m2			7.5200	(273)
EI value			94.6942	
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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.4000	(2b) =	120.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		120.0000	(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) =	0.1667 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4167 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.1000	4.1000	3.7000	3.6000	3.4000	3.4000	3.2000	3.2000	3.4000	3.4000	3.7000	(22)
Wind factor	1.0750	1.0250	1.0250	0.9250	0.9000	0.8500	0.8500	0.8000	0.8000	0.8500	0.8500	0.9250	(22a)
Adj infilt rate	0.3807	0.3630	0.3630	0.3276	0.3187	0.3010	0.3010	0.2833	0.2833	0.3010	0.3010	0.3276	(22b)
Effective ac	0.5725	0.5659	0.5659	0.5537	0.5508	0.5453	0.5453	0.5401	0.5401	0.5453	0.5453	0.5537	(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	
Front Door (Uw = 1.30)			3.6000	1.2357	4.4487			(27)
Windows (Uw = 1.30)			9.0000	1.2357	11.1217			(27)
Rooflights			3.0000	1.2357	3.7072			(27a)
Ground Floor			50.0000	0.1200	6.0000	75.0000	3750.0000	(28a)
Wall (external)	71.0000	12.6000	58.4000	0.1900	11.0960	60.0000	3504.0000	(29a)
Roof	50.0000	3.0000	47.0000	0.1400	6.5800	9.0000	423.0000	(30)
Total net area of external elements Aum(A, m2)			171.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.9536			(33)
Internal Wall			75.0000			75.0000	5625.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13302.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		266.0400 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	7.7000	0.0600	0.4620

E3 Sill	1.9000	0.0180	0.0342	
E4 Jamb	18.0000	0.0140	0.2520	
E5 Ground floor (normal)	29.5000	0.1110	3.2745	
E16 Corner (normal)	12.0000	0.0490	0.5880	
E15 Flat roof with parapet	29.5000	0.3000	8.8500	
R1 Head of roof window	3.0000	0.2400	0.7200	
R2 Sill of roof window	3.0000	0.2400	0.7200	
R3 Jamb of roof window	7.8000	0.2400	1.8720	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.7727 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.7263 (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	22.6701	22.4093	22.4093	21.9250	21.8117	21.5944	21.5944	21.3895	21.3895	21.5944	21.5944	21.9250	(38)
Heat transfer coeff	82.3964	82.1356	82.1356	81.6513	81.5380	81.3207	81.3207	81.1158	81.1158	81.3207	81.3207	81.6513	(39)

Average = Sum(39)m / 12 = 81.5852

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6479	1.6427	1.6427	1.6330	1.6308	1.6264	1.6264	1.6223	1.6223	1.6264	1.6264	1.6330	(40)
HLP (average)												1.6317	
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 1.6901 (42)

Hot water usage for mixer showers												
	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556 (42a)
Hot water usage for baths												
	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)
Hot water usage for other uses												
	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss													
	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage													
	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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													
	201.9505	178.4507	189.1314	165.1291	159.3034	142.7036	140.1856	146.1949	148.2972	166.3814	178.1746	199.5853	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												625.4369	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												625.4369	
Solar input	-0.0000	-15.8592	-56.6720	-78.7790	-97.4210	-96.1979	-94.2161	-85.3855	-61.3068	-35.5324	-4.0671	-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													
	201.9505	162.5915	132.4594	86.3501	61.8824	46.5057	45.9695	60.8093	86.9904	130.8490	174.1075	199.5853	(64)
										Total per year (kWh/year) = Sum(64)m =		1390.0508	(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													
	56.4617	49.6822	52.1994	44.5634	42.2816	37.1069	35.9249	37.9230	38.9667	44.6350	48.9010	55.6753	(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	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.0371	16.0204	13.0286	9.8635	7.3731	6.2247	6.7260	8.7427	11.7344	14.8995	17.3900	18.5384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	75.8894	73.9319	70.1604	61.8935	56.8301	51.5373	48.2862	50.9717	54.1205	59.9933	67.9180	74.8324	(72)
Total internal gains													
	394.3114	392.6175	380.1079	356.4425	333.4462	312.4913	300.0454	302.4674	314.3542	335.6255	361.4831	384.0596	(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	
Northeast	3.6000	13.3408	0.6300	1.0000	0.7700	20.9681	(75)
Northeast	1.0000	13.3408	0.6300	0.7000	0.7700	4.0771	(75)
Southeast	7.0000	41.5040	0.6300	0.7000	0.7700	88.7892	(77)
Southwest	1.0000	41.5040	0.6300	0.7000	0.7700	12.6842	(79)
East	3.0000	31.0000	0.6300	0.7000	1.0000	36.9117	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	163.4303	257.1808	404.5811	587.8535	696.4302	769.5046	723.4411	626.7819	496.6317	331.8944	198.2251	131.3847	(83)
Total gains	557.7417	649.7983	784.6890	944.2960	1029.8764	1081.9959	1023.4866	929.2493	810.9858	667.5200	559.7082	515.4443	(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	44.8442	44.9866	44.9866	45.2534	45.3163	45.4374	45.4374	45.5522	45.5522	45.4374	45.4374	45.2534	
alpha	3.9896	3.9991	3.9991	4.0169	4.0211	4.0292	4.0292	4.0368	4.0368	4.0292	4.0292	4.0169	
util living area	0.9826	0.9682	0.9237	0.8119	0.6484	0.4475	0.3234	0.3626	0.6266	0.8776	0.9679	0.9869	(86)
MIT	19.4912	19.7277	20.1546	20.6141	20.8756	20.9777	20.9954	20.9929	20.9180	20.5407	19.9213	19.4212	(87)
Th 2	19.5784	19.5822	19.5822	19.5892	19.5909	19.5940	19.5940	19.5970	19.5970	19.5940	19.5940	19.5892	(88)
util rest of house	0.9765	0.9575	0.8992	0.7598	0.5674	0.3493	0.2137	0.2435	0.5182	0.8278	0.9551	0.9822	(89)
MIT 2	17.9165	18.2137	18.7319	19.2534	19.5073	19.5850	19.5932	19.5956	19.5546	19.2008	18.4689	17.8357	(90)
Living area fraction									fLA = Living area / (4) =			0.5200	(91)
MIT	18.7353	19.0009	19.4717	19.9610	20.2188	20.3092	20.3223	20.3222	20.2636	19.8975	19.2241	18.6602	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7353	19.0009	19.4717	19.9610	20.2188	20.3092	20.3223	20.3222	20.2636	19.8975	19.2241	18.6602	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9717	0.9519	0.8969	0.7748	0.6050	0.4001	0.2709	0.3056	0.5720	0.8401	0.9507	0.9780	(94)
Useful gains	541.9387	618.5435	703.8250	731.6142	623.1238	432.8572	277.2372	284.0072	463.8921	560.7725	532.1184	504.1170	(95)
Ext temp.	4.6000	5.1000	6.7000	9.1000	12.0000	14.9000	16.9000	16.8000	14.2000	10.8000	7.3000	4.5000	(96)
Heat loss rate W	1164.6993	1141.7624	1049.0089	886.8148	670.1483	439.8795	278.3053	285.7046	491.8540	739.8188	969.6782	1156.1951	(97)
Space heating kWh	463.3339	351.6031	256.8168	111.7445	34.9862	0.0000	0.0000	0.0000	0.0000	133.2104	315.0431	485.1461	(98a)
Space heating requirement - total per year (kWh/year)												2151.8841	
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	463.3339	351.6031	256.8168	111.7445	34.9862	0.0000	0.0000	0.0000	0.0000	133.2104	315.0431	485.1461	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2151.8841	
Space heating per m2											(98c) / (4) =	43.0377	(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 %)	100.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	463.3339	351.6031	256.8168	111.7445	34.9862	0.0000	0.0000	0.0000	0.0000	133.2104	315.0431	485.1461	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	463.3339	351.6031	256.8168	111.7445	34.9862	0.0000	0.0000	0.0000	0.0000	133.2104	315.0431	485.1461	(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	201.9505	162.5915	132.4594	86.3501	61.8824	46.5057	45.9695	60.8093	86.9904	130.8490	174.1075	199.5853	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	66.6602	53.6685	43.7225	28.5026	20.4263	15.3507	15.1737	20.0721	28.7140	43.1909	57.4697	65.8795	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	15.7877	12.6655	11.4039	8.3550	6.4536	5.2727	5.8872	7.6524	9.9397	13.0415	14.7303	16.2265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3156	-21.5426	-38.2056	-48.9815	-52.1616	-48.8191	-47.6593	-43.5590	-35.6979	-28.5434	-16.7201	-11.3009	(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	-2.2905	-5.0686	-14.8268	-32.9257	-52.2960	-64.1921	-61.6195	-48.5779	-30.1389	-11.6326	-3.4975	-1.5554 (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	2151.8841	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	458.8308	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	80.0000	(231)
Electricity for lighting (calculated in Appendix L)	127.4161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-736.1280	(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	2082.0030	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2151.8841	25.1600	541.4140	(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)	458.8308	25.1600	115.4418	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	25.1600	20.1280	(249)
Energy for lighting	127.4161	25.1600	32.0579	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-407.5066	25.1600	-102.5287	
PV Unit electricity exported	-328.6214	5.8100	-19.0929	
Total			-121.6216	(252)
Total energy cost			587.4202	(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	2151.8841	0.1563	336.4375	(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)	458.8308	0.1471	67.4821	(264)
Space and water heating			403.9195	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	127.4161	0.1443	18.3901	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-407.5066	0.1329	-54.1463	
PV Unit electricity exported	-328.6214	0.1175	-38.5996	
Total			-92.7459	(269)
Total CO2, kg/year			340.6607	(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	2151.8841	1.5788	3397.4069	(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)	458.8308	1.5441	708.4748	(278)
Space and water heating			4105.8817	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	127.4161	1.5338	195.4351	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-407.5066	1.4910	-607.5923	
PV Unit electricity exported	-328.6214	0.4306	-141.4969	
Total			-749.0892	(283)
Total Primary energy kWh/year			3673.2516	(286)

Part G Compliance Report

PROJECT DETAILS

Project Reference:	ZA0901G
Client:	Wynngate
Property:	Units 1-5 255 Guildford Road Effingham KT24 5NP

Local Authority:	Guildford Borough Council
Agent:	Vieo Projects

Assessor:	Joe Solti
Address:	Therm Energy Ltd
Contact:	01903 884357
Software:	G-Calc 2015 version 3.0.2
Prepared on:	09-Feb-24

RESULT SUMMARY

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 1 bed dwelling, as designed, achieves a water consumption of 110 litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Water Calculator for New Dwellings					
Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)		4.42	0.00	0
WC(dual flush)	Full flush vol.	6	1.46	0.00	8.76
	Part flush vol.	3	2.96	0.00	8.88
WC(multiple fittings)	Average effective Flush vol. (litres)		4.42	0.00	0
Taps(excl. Kitchen)	Flow rate (litres/min)	6	1.58	1.58	11.06
Bath (shower also present)	Capacity to overflow (litres)	180	0.11	0.00	19.8
Shower (bath also present)	Flow rate (litres/min)	8	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)	0	0.50	0.00	0
Shower only	Flow rate (litres/minute)	0	5.6	0.00	0
Kitchen sink taps	Flow rate (litres/minute)	6	0.44	10.36	13
Washing Machine	litres/kg dry load	7.1	2.1	0.0	14.91
Dishwasher	litres/place setting	1.1	3.6	0.0	3.96
Waste disposal	litres/use	0	3.08	0.0	0
Water softener	litres/person/day	0	1.0	0.0	0

Total calculated use (litres/person/day)	115.33
Contribution from greywater (litres/person/day)	-
Contribution from rainwater (litres/person/day)	-
Normalisation factor	0.91
Total Water Consumption. Code for Sustainable Homes (litres/person/day)	**105**
External water use	5.0
Total Water Consumption. (36(1)) (litres/person/day)	**110**

Summary of fitting types "As Designed"			
Type	Description	Flow rates, volumes etc.	Qty
Taps	Taps	6 litres/min	1
Baths	Baths	180 litres to overflow	1
Dishwashers	Dishwasher	1.1 litres/place	1
Washing Machines	Washing Machine	7.1 litres/kg	1
Showers	Showers	8 litres/min	1
WC's	Toilets	6 / 3 litres flush vols.	1
Kitchen/Utility taps	Taps	6 litres/min	1

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer (Vieo Projects).
The completed table should be returned to the assessor: Joe Solti (Contact: 01903 884357).

Declaration of fitting types "As Built"			
Type	Make and Model	Flow rates, volumes etc.	Qty
Taps			
Baths			
Dishwashers			
Washing Machines			
Showers			
WC's			
Kitchen/Utility taps			

Project ref: ZA0901G - Units 1-5

The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

Name: ..... Signature: ..... Date: .....

------End of Report------