

Energy Assessment Report

Proposed Development at

32 Norwich Road, Northwood, HA6 1NB

to provide 3 no. residential flats (1 x 3 bed plus 2 x 2 bed)



September 2023

Client: Mr A Ismat

Architects: Amasia Architects Ltd

Prepared by



accredited SAP assessors

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1.0 EXECUTIVE SUMMARY

1.1 Brief

Monitor Energy Consultancy has been instructed by Mr A Ismat to undertake an Energy Report to establish the carbon footprint of the proposed development of 3 residential flats (1 x 3 bed plus 2 x 2 bed) at 32 Norwich Road, Northwood HA6 1NB and to demonstrate compliance with Policy SI 2 “Minimising Greenhouse Gas Emissions” of the London Plan 2021, delivering energy efficiency measures which would achieve and surpass a 35% reduction in regulated CO₂ emissions, compared to compliance with the Building Regulations Part L 2021 requirements and also Policy DME1 2 of the Hillingdon Local Plan Part 2 – Development Management Policies (2020) requiring all developments to make the fullest contribution to minimising CO₂ emissions in accordance with London Plan targets.

The new development aims to achieve exemplary sustainability, to maximise energy efficiency and reduce carbon emissions to as near as is economically viable to achieve a net zero carbon target. Connection to existing heat networks and provision of new networks have been investigated alongside renewable and low carbon technologies and reviewed in terms of their technical feasibility and financial viability

The design approach to achieve this target follows the GLA Guidance for Energy Assessments using the Mayor of London’s Energy Hierarchy (summarised as ‘*be Lean, be Clean, be Green*’). This report demonstrates how this scheme meets the relevant on-site CO₂ emissions reduction target by following the energy hierarchy below:

- Maximise energy efficiency using fabric first approach to ensure all the thermal elements are insulated to a high standard in the first instance. (*Be Lean*).
- Supply energy efficiently using low carbon heating and cooling systems (*Be Clean*).
- Incorporate renewable energy by the addition of photovoltaic panels (*Be Green*).

The proposed energy reduction measures are summarised in the table below.

Be Lean Use less energy, minimise energy demand through efficient design and the incorporation of passive measures	Building Fabric - Enhanced standards of insulation for floor, walls and roof - High performance double glazed windows and doors - High levels of air tightness - Reduction of thermal bridging through the use of BRE approved details Energy Efficiency - Energy efficient lighting and controls - Energy efficient heating controls - Appropriate energy metering and monitoring - Energy efficient appliances - Mechanical Ventilation with heat recovery - Waste water heat recovery
Be Clean Supply energy efficiently. Reduce energy consumption through use of low carbon technology	Energy Efficient Energy Supply - The site is not within viable connection distance to potential decentralised heat networks - An on-site heat network/CHP is not considered appropriate for this site - Air source heat pumps proposed
Be Green Use renewable energy systems	Renewable Technologies Photovoltaic array to supply renewable electricity to the development to reduce regulated CO₂ emissions to zero.

Summary of the Be Lean, Be Clean and Be Green proposals

This appraisal demonstrates that by adopting the above approach this will be a **CARBON NEUTRAL** development.

2.0 ENERGY EFFICIENCY

2.1 APPROACH

The basic approach for the energy strategy is as follows:

1. To establish the baseline energy demand to ensure that the Standard Case dwelling carbon emission rates meet compliance with the statutory requirements of the Building Regulations 2021 Part L. The dwellings have all been modelled using SAP 10.2, with the TER (Target Emission Rate) calculated. The results are tabulated in **Section 2.2**
2. Following the “**Be Lean**” principle, passive design and efficiency measures were considered first to optimise the reduction of energy use within the development. These are described and the results are tabulated in **Section 2.3**
3. Localised and decentralised energy networks such as combined heat and power (CHP) or community/district heating schemes were considered to meet the “**Be Clean**” requirement. The proposed heating strategy is described and the results are tabulated in **Section 2.4**.
4. The potential viability of six low and zero carbon technologies were considered for integration within the proposed development as part of the “**Be Green**” stage and the feasibility assessments are described in **Section 2.5**
5. The actual energy demand for the dwellings as proposed has been calculated, to include the enhanced thermal and mechanical services specification and incorporating renewable technology deemed most suitable as a result of the above considerations. The actual DERs (Dwelling Emission Rates) for the regulated loads for each dwelling have been calculated and the results are tabulated in **Section 2.6**

2.2 ESTABLISHING BASELINE TARGET CO₂ EMISSIONS (TERs)

This section of the energy statement identifies the carbon footprint of the development if constructed to the standard required to achieve compliance with England and Wales Building Regulations 2021. The Standard Case TER carbon emissions for all three flats

have been calculated using SAP 10.2. The Flat 3 floor area includes the areas within the roof where the headroom is less than 1.5m.

Table 1 illustrates the regulated loads associated with each dwelling and totalled across the site. These figures have been used to assess the total energy usage and CO₂ emissions and to set the 35% carbon off-set required for regulated emissions only to satisfy the London Borough of Hillingdon planning requirement. The full figures calculated are tabulated in summary below and the completed GLA reporting spreadsheet, and the full TER/ DER worksheets for each individual flat are included in Appendix A. This demonstrates that the total regulated CO₂ emissions due to heating, hot water, pumps and fans and lighting for the development if built to Building Regulations Part L1 standard would be **3 191.73 kg/yr or 3.19 tonnes**.

	Total Area GI m2	Standard Case TER CO₂ kg/m2/yr	Total CO₂ kg/yr
Flat 1	101.23	12.31	1 246.14
Flat 2	98.22	11.12	1 092.21
Flat 3	61.87	13.81	854.42
Total	261.32		3 192.77

Table 1 Standard Case TER results for all dwellings (Baseline Case)

To comply with Building Regulations 2021, the total site wide carbon dioxide emissions for the dwellings would be **3 192.77 kgCO₂/yr**. To satisfy the minimum Planning requirement, 35% of carbon dioxide emissions to be off-set for this development would be **3 192.77 x 35% = 1 117.47 kg CO₂/yr**. The total CO₂ emissions for all 3 dwellings would need to be **3 192.77 - 1 117.47 = 2 075.30 kg CO₂/yr** or lower as indicated in Table 2 below.

Standard Case total regulated CO ₂ Emissions	3 192.77
Minimum 35% reduction of regulated emissions required	1 117.47
Target total Regulated Emissions to be achieved	2 075.30

Table 2. Site wide regulated CO₂ emissions used to derive the required 35% carbon off-set of regulated emissions.

2.3 BE LEAN ASSESSMENT

PROPOSED PASSIVE AND LOW ENERGY EFFICIENCY MEASURES

To satisfy the Planning requirement, a reduction of 10% of the total CO₂ emissions would need to be achieved for the “**Be Lean**” case as indicated in Table 3 below.

Standard Case total regulated CO ₂ Emissions	3 192.77
Minimum 10% reduction of regulated emissions required	319.28
Target total Regulated Emissions to be achieved	2 873.49

Table 3. Site wide regulated CO₂ emissions used to derive the required 10% carbon off-set of regulated emissions.

10% of carbon dioxide emissions required to be off-set for this development would be $3\,192.77 \times 0.1 = 319.28$ kg CO₂/yr. The maximum emissions to be achieved at this stage of the process = $3\,192.77 - 319.28 = 2\,873.49$ kg CO₂/yr or lower.

In order to achieve this, all the thermal elements are to be built to higher standards than required under the Building Regulations Part L 2021 incorporating improved U-values of:

- Floor: 0.10 W/m² (compared to Building Regulations standard of 0.18 W/m²K)
- Walls: 0.14W/m²K (compared to Building Regulations standard of 0.26 W/m²K)
- Roofs with flat ceilings 0.09 and roofs with sloping ceilings 0.14 W/m²K (compared to Building Regulations standard of 0.16 W/m²K)
- Windows 0.8 W/m²K (compared to Building Regulations standard of 1.4 W/m²K)

- Party walls fully insulated with sealed edges: U value 0.0 W/m²K (compared to Building Regulations standard of 0.2 W/m²K.)
- Low design air permeability rate: 3m³/hm²@50Pa compared to Building Regulations standard of 8 m³/hm²@50Pa for tested dwellings.
- BRE approved thermal bridging details at junctions to minimise cold bridging.

Additional energy efficient appliance and fittings are to be installed:

- Air source heat pumps are proposed for the heating system to minimise carbon emissions.
- Highly efficient mechanical ventilation with heat recovery system (MVHR) with a minimum efficiency of 95% and specific fan power of 0.53W/l/s eg Zehnder Comfoair.
- Lighting: 100% of all fittings to be low energy with a minimum efficacy of 90 l/W.
- 'A' rated or above appliances to be installed throughout.
- Flow restrictors to showers to limit demand for hot water to 8l/minute.
- Thermodynamic modelling will be undertaken to ensure that the risk of summer overheating is in line with Building Regulations requirements Part O to ensure no additional mechanical cooling is required.

The above measures, together with a default air source heat pump have all been incorporated into the “**Be Lean**” assessment and a summary of the results tabulated below. The full figures can be found in **Appendix A**

	Total Area GI m ²	Be Lean Case DER CO ₂ kg/m ² /yr	Total CO ₂ kg/yr
Flat 1	101.23	3.10	313.81
Flat 2	98.22	3.14	308.41
Flat 3	61.87	3.76	232.63
Total	261.32		854.85

Table 4 Be Lean Case DER results for all dwellings

The above Table demonstrates that the requirement to offset a minimum of 10% CO₂ emissions has been met.

A maximum of **2 873.49 kg CO₂/yr** for the total emissions for this development was calculated as necessary to satisfy the Planning requirement.

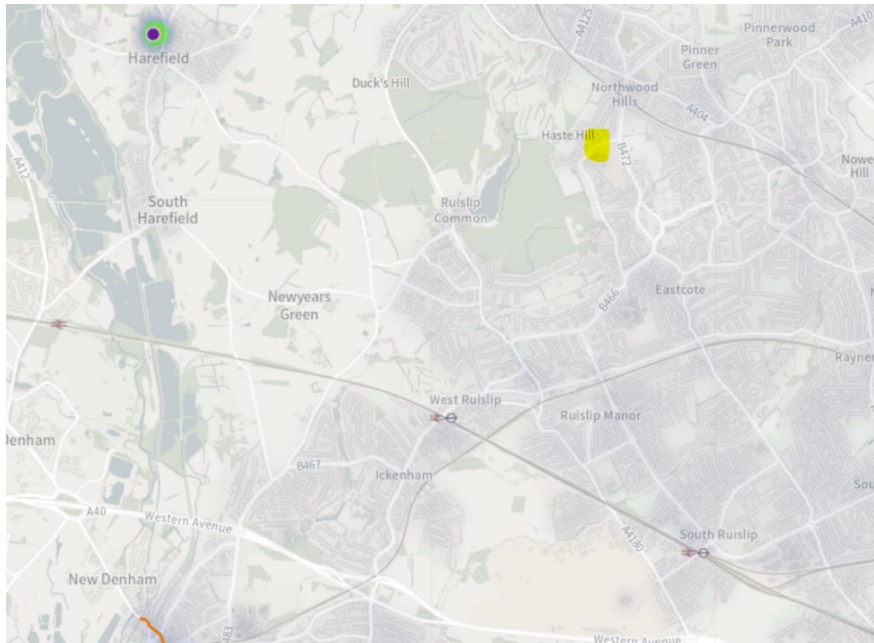
The actual emissions to be achieved by the scheme as proposed will be **854.85 CO₂/yr**, representing a **2337.92 kg CO₂/yr** or **73.23 %** reduction beyond the 2021 Building Regulations target emissions of **3192.77 kg CO₂/yr**, therefore it meets this requirement of the Planning policy.

2.4 BE CLEAN ASSESSMENT

The London Plan policy SI 3, states that the feasibility to exploit local energy resources such as secondary heat should be evaluated in accordance with the following hierarchy.

a) Connection to an existing heating or cooling network

Localised and decentralised energy networks and solutions were considered to meet the “Be Clean” requirement. From a study of The London Heat Map, which outlines both potential and existing heat networks, it is concluded that there is not currently an existing or planned energy network within an economically viable distance of the development, (location shown highlighted), and due to the size of this development, it is unlikely to be cost effective for a future connection.



Extract from London Heat Map

b) Zero emission or local secondary heat sources

Similarly, there are no such available heat sources known to be within an economically viable distance.

c) Site wide heat network and Combined Heat and Power (CHP).

For maximum efficiency, a CHP system needs to operate for at least 5000 hours/year and requires a heat sink, a consistent base heating load requirement throughout the year where the waste heat from the electrical generation may be used constantly and efficiently while simultaneously providing electricity for the site. It is therefore more appropriate for hospitals, hotels etc where demand is consistent. Domestic dwellings have variable occupation patterns resulting in inconsistent heating and electrical demand. For a development of this size and scale, it would not be appropriate to provide a new CHP plant.

d) Communal heating

Communal boilers have been considered as an option but these would not to be as efficient as individual systems where distribution heat losses are kept to a minimum and more efficient controls can be provided.

Proposed Heating

The heating system proposed for this site are Ecodan or similar air heat pumps with zone controls and highly insulated hot water cylinders to all flats. These has been incorporated into the “Be Clean” Assessment. The resulting revised emission rates are summarised in Table 5 below. The full figures calculated can be found in **Appendix B**

	Total Area GI m2	Be Clean Case DER CO ₂ kg/m2/yr	Total CO ₂ kg/yr
Flat 1	101.23	2.80	283.44
Flat 2	98.22	2.87	281.89
Flat 3	61.87	3.53	218.40
Total	261.32		783.73

Table 5 Be Clean Case DER results for all dwellings

This demonstrates that a total reduction in CO₂ emissions of **3 192.77 – 783.73 = 2 409.34 kg CO₂/yr** has been achieved through the incorporation of air source heat pumps, making the total reduction **75.47 %** for this stage of the process.

2.5 RENEWABLE ENERGY TECHNOLOGIES ASSESSMENT

In this section, the potential on-site low and zero carbon technologies that could further reduce the developments CO₂ emissions have been considered, taking into account the scale of this particular development and constraints such as location, visual impact, space limitations, local pollution concerns, cost and payback for both initial payment and ongoing maintenance and suitability. In conclusion, both PV panels and air source heat pumps have been considered as suitable for adoption for this development.

2.5.1 Photovoltaic Cells

There is an opportunity to install photovoltaic cells on the flat roof over the second floor and on the south west facing sloping roof. A total of 8.0 kWp of PV panels are proposed.

2.5.2 Solar Water Heating

The development has the potential to use solar water heating panels however these would be competing for the same space as the PV panels and the carbon reduction achieved would not be as good as using the PV panels.

2.5.3 Ground Source Heat Pump

Approximately 10m of trench for slinky pipes would be required to obtain 1kW output of heating. For a small to average heat pump of 6kW this would require 60m for each unit, therefore there would not be adequate space on the site for this option. The alternative method involving drilling a borehole would be extremely expensive and not generally considered a feasible option for small scale domestic applications.

2.5.4 Air Source Heat Pump

With the current ideology of moving away from fossil fuels, high efficiency air heat pumps with time and temperature zone controls have been selected to provide the heating and hot water for each dwelling on the site.

2.5.5 Wind Power

A wind turbine would not be able to generate sufficient energy to be viable in this location, would be both visually and audibly intrusive and not suitable for this small site where there is insufficient space to accommodate it. This option has therefore been discarded.

2.5.6 Biomass

Biomass boilers are less efficient than the heat pumps proposed, they would require increased management, maintenance and space for both a central plant room and biomass store. In addition, there would be a requirement for biomass deliveries via heavy vehicles, therefore it is considered that for this site and its location this would not be appropriate.

2.6 ESTABLISHING ACTUAL PROPOSED CO₂ EMISSIONS

For the “Be Green” stage of the assessment, the low and zero carbon technology proposed for this project is an array of PV panels providing 8.0 kWp of electricity to further reduce CO₂ emissions. These have been apportioned on a pro rata basis with the floor area of each flat.

The Actual Case DER carbon emissions for all three flats incorporating the improvements detailed above, specifically the fabric efficiency measures, heating system as described together with 8.0 kWp of photovoltaic panels have been calculated using SAP 10.2. The results are summarised in Table 6 below and the full figures can be found in **Appendix C**

	Total Area GI m2	Be Green Case DER CO ₂ kg/m2/yr	Total CO ₂ kg/yr
Flat 1	101.23	-0.47	-47.48
Flat 2	98.22	-0.41	-40.27
Flat 3	61.87	0.26	16.08
Total	261.32		-71.67

Table 6 Be Green Case DER results for all dwellings

This demonstrates that a total reduction in CO₂ emissions of **3 192.77 – (-71.67) = 3264.44 kg CO₂/yr** has been achieved through the incorporation of air source heat pumps making the total reduction of **102.2 %** for this stage of the process.

The proposed roof plan with indicative layout of example PV panels is appended in Appendix D

The total carbon emissions for the proposed development after each stage of the domestic Energy Hierarchy are tabulated in the GLA reporting spreadsheet.

2.7 CONCLUSIONS

This report identifies how 102.2 % of regulated carbon emissions for which this development is responsible, are proposed to be off-set by the various energy efficiency measures described, compared to a Building Regulations Part L1 2021 compliant scheme.

The completed GLA reporting spreadsheet summarises all the results at each stage of the hierarchy.

A summary of the standard baseline TER case and the DER results for the “Be Lean” case are included in **APPENDIX A**

A summary of the DER results for the proposed scheme, the “Be Lean” Case, are included in **APPENDIX B**

A summary of the DER results for the proposed scheme, the “Be Green” Case, are included in **APPENDIX C**

The proposed roof plan with indicative layout of PV panels is appended in **APPENDIX D**

3. FABRIC ENERGY EFFICIENCY STANDARD ASSESSMENT

The target fabric energy efficiency (TFEE) and actual as designed fabric energy (DFEE) efficiency have been modelled for each flat using SAP 10.2 and a summary of the results can be found below and on the GLA reporting spreadsheet.

	Target Fabric Energy Efficiency (TFEE)	Dwelling Fabric Fabric Energy Efficiency (TFEE)
Flat 1	40.74	27.79
Flat 2	34.11	25.89
Flat 3	37.30	28.76

Table 7 Dwelling Fabric Energy Efficiency

The TFEE and DFEE results are also included in **APPENDIX A**

4. MONITORING

Following the completion of the work, the actual CO₂ emissions will be re-calculated to account for any changes to the specification and the report will be updated to demonstrate that the resulting building still complies with the Requirements.

In addition, monitoring equipment will be installed in the form of smart meters to enable occupants to monitor and reduce their energy use as appropriate.

APPENDIX A

SAP 10 CALCULATIONS FOR THE STANDARD CASE (TERs)
AND THE BE LEAN CASE (DERs)

THE TFEE, DFEE, DPER AND DPER RESULTS

Block Compliance



Block Reference	32 Norwich Road	Issued on Date	18/09/2023
Block Name			
Calculation Type	New Build (As Designed)		
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

Block Compliance Report - DER				
Block Reference: 32 Norwich Road		Block Name:		
Property-Assessment Reference	Floor area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
001 - 01 Be Lean	101.23	3.10	12.31	74.82 %
002 - 02 Be Lean	98.22	3.14	11.12	71.76 %
003 - 03 Be Lean	61.87	3.76	13.81	72.77 %
Totals:	261.32	10.00	37.24	
Average DER = 3.27 kgCO ₂ /m ²	% DER/TER	PASS		
Average TER = 12.22 kgCO ₂ /m ²	73.23 %			

Block Compliance Report - DFEE				
Block Reference: 32 Norwich Road		Block Name:		
Property-Assessment Reference	Floor area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
001 - 01 Be Lean	101.23	27.79	40.74	31.78 %
002 - 02 Be Lean	98.22	25.89	34.11	24.09 %
003 - 03 Be Lean	61.87	28.76	37.30	22.89 %
Totals:	261.32	82.45	112.15	
Average DFEE = 27.31 kgCO ₂ /m ²	% DFEE/TFEE	PASS		
Average TFEE = 37.43 kgCO ₂ /m ²	27.05 %			

Block Compliance Report - DPER				
Block Reference: 32 Norwich Road		Block Name:		
Property-Assessment Reference	Floor area (m ²)	DPER (kWh/m ² /yr)	TPER (kWh/m ² /yr)	% DPER/TPER
001 - 01 Be Lean	101.23	32.84	64.63	49.19 %
002 - 02 Be Lean	98.22	33.38	58.39	42.83 %
003 - 03 Be Lean	61.87	40.08	72.83	44.97 %
Totals:	261.32	106.30	195.85	

Block Compliance



Average DPER = 34.76 kgCO ₂ /m ²	% DPER/TPER	PASS
Average TPER = 64.23 kgCO ₂ /m ²	45.88 %	

Full SAP Calculation Printout



Property Reference	001	Issued on Date	12/09/2023
Assessment Reference	01 Be Lean	Prop Type Ref	
Property	Flat 1, 32, Norwich Road, Northwood, HA6 1NB		
SAP Rating	86 B	DER	3.10
Environmental	97 A	TER	12.31
CO ₂ Emissions (t/year)	0.28	% DER < TER	74.82
Compliance Check	See BREL	DFEE	27.79
% DPER < TPER	49.18	TFEE	40.74
		% DFEE < TFEE	31.78
		TPER	64.63
Assessor Details	Mrs. Nicola Battista		Assessor ID
Client			L706-0001

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	101.2300 (1b)	x 2.6000 (2b)	= 263.1980 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.1980 (5)

2. Ventilation rate

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

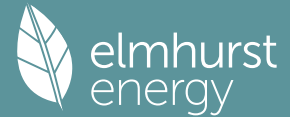
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												85.5000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2207	0.2178	0.2149	0.2004	0.1975	0.1829	0.1829	0.1800	0.1888	0.1975	0.2033	0.2091 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.80)			17.0700	0.7752	13.2326		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Heatloss Floor 1			101.2300	0.1000	10.1230	110.0000	11135.3000 (28a)

Full SAP Calculation Printout



External Wall 1	96.8200	17.0700	79.7500	0.1400	11.1650	60.0000	4785.0000 (29a)
External Wall 2	26.4700	1.8900	24.5800	0.1300	3.1954	190.0000	4670.2000 (29a)
Total net area of external elements Aum(A, m2)			224.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	40.3620			(33)
Party Ceiling 1			101.2300			20.0000	2024.6000 (32b)
Internal Wall 1			172.9000			9.0000	1556.1000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24171.2000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 238.7751 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	18.2000	0.0340	0.6188
E17 Corner (inverted - internal area greater than external area)	7.8000	-0.0630	-0.4914
E2 Other lintels (including other steel lintels)	12.1200	0.0500	0.6060
E3 Sill	11.2200	0.0060	0.0673
E4 Jamb	22.1000	0.0100	0.2210
E5 Ground floor (normal)	46.6900	0.0600	2.8014
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.8231 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 44.1851 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	19.1706	18.9182	18.6658	17.4036	17.1512	15.8891	15.8891	15.6367	16.3939	17.1512	17.6561	18.1609 (38)
Average = Sum(39)m / 12 =	63.3557	63.1033	62.8508	61.5887	61.3363	60.0742	60.0742	59.8218	60.5790	61.3363	61.8411	62.3460 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6259	0.6234	0.6209	0.6084	0.6059	0.5934	0.5934	0.5909	0.5984	0.6059	0.6109	0.6159 (40)
HLP (average)												0.6078
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7506 (42)
Hot water usage for mixer showers	70.3387	69.2817	67.7413	64.7942	62.6192	60.1938	58.8152	60.3438	62.0196	64.6238	67.6342	70.0692 (42a)
Hot water usage for baths	30.3712	29.9201	29.2849	28.1138	27.2368	26.2644	25.7392	26.3699	27.0567	28.0972	29.2925	30.2685 (42b)
Hot water usage for other uses	42.7991	41.2428	39.6865	38.1301	36.5738	35.0175	35.0175	36.5738	38.1301	39.6865	41.2428	42.7991 (42c)
Average daily hot water use (litres/day)												131.9171 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	143.5090	140.4446	136.7127	131.0381	126.4299	121.4757	119.5718	123.2876	127.2064	132.4074	138.1695	143.1369 (44)
Energy conte	227.2832	199.9912	210.1224	179.3846	170.1989	149.3686	144.6118	152.6558	156.8582	179.6756	196.8478	224.1177 (45)
Energy content (annual)												Total = Sum(45)m = 2191.1158

Distribution loss (46)m = 0.15 x (45)m	34.0925	29.9987	31.5184	26.9077	25.5298	22.4053	21.6918	22.8984	23.5287	26.9513	29.5272	33.6177 (46)
Water storage loss:												180.0000 (47)
Store volume												1.2000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.6480 (55)
Enter (49) or (54) in (55)												

Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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	270.6336	239.1464	253.4728	221.3366	213.5493	191.3206	187.9622	196.0062	198.8102	223.0260	238.7998	267.4681 (62)
WWHRS	-61.9458	-54.7853	-57.3681	-47.5030	-44.2711	-37.8831	-35.5094	-37.7607	-39.1953	-46.2070	-52.3469	-60.7986 (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)

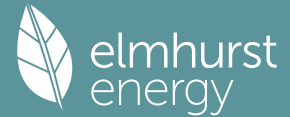
Output from w/h	208.6879	184.3611	196.1047	173.8336	169.2782	153.4375	152.4528	158.2455	159.6149	176.8191	186.4529	206.6695 (64)
Total per year (kWh/year) = Sum(64)m =												2125.9576 (64)
12Total per year (kWh/year)												2126 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	110.2520	97.8212	104.5460	93.2070	91.2715	83.2266	82.7637	85.4384	85.7169	94.4225	99.0135	109.1995 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	138.2012	153.0085	138.2012	142.8079	138.2012	142.8079	138.2012	138.2012	142.8079	138.2012	142.8079	138.2012 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.3010	260.9814	254.2270	239.8476	221.6963	204.6366	193.2397	190.5593	197.3137	211.6931	229.8444	246.9041 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												

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Pumps, fans	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	(71)
Total internal gains	148.1882	145.5673	140.5188	129.4541	122.6767	115.5926	111.2416	114.8365	119.0513	126.9119	137.5187	146.7735	(72)
	611.9498	626.8165	600.2064	579.3690	549.8336	527.2964	506.9418	507.8564	523.4323	544.0655	577.4304	599.1381	(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			0.8800	11.2829	0.6800	0.7000	0.7700	3.2753 (75)				
Southeast			6.0800	36.7938	0.6800	0.7000	0.7700	73.7936 (77)				
Northwest			10.1100	11.2829	0.6800	0.7000	0.7700	37.6282 (81)				
Solar gains	114.6971	208.9580	321.9937	459.4550	569.8396	590.0046	558.7208	472.6560	369.0113	240.6735	139.8549	96.5558 (83)
Total gains	726.6468	835.7746	922.2000	1038.8240	1119.6732	1117.3011	1065.6626	980.5124	892.4436	784.7390	717.2853	695.6939 (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	105.9766	106.4006	106.8279	109.0171	109.4657	111.7655	111.7655	112.2371	110.8341	109.4657	108.5721	107.6929
alpha	8.0651	8.0934	8.1219	8.2678	8.2977	8.4510	8.4510	8.4825	8.3889	8.2977	8.2381	8.1795
util living area	0.9844	0.9560	0.8850	0.7037	0.5085	0.3441	0.2480	0.2806	0.4679	0.7810	0.9541	0.9879 (86)
MIT	20.6482	20.7632	20.8746	20.9493	20.9615	20.9631	20.9631	20.9633	20.9625	20.9395	20.8016	20.6321 (87)
Th 2	20.4068	20.4090	20.4113	20.4224	20.4247	20.4359	20.4359	20.4382	20.4314	20.4247	20.4202	20.4157 (88)
util rest of house	0.9805	0.9466	0.8652	0.6736	0.4774	0.3138	0.2162	0.2464	0.4296	0.7461	0.9427	0.9848 (89)
MIT 2	19.9961	20.1396	20.2723	20.3624	20.3758	20.3886	20.3886	20.3910	20.3836	20.3564	20.1981	19.9840 (90)
Living area fraction									fLA = Living area / (4) =			0.3746 (91)
MIT	20.2403	20.3732	20.4979	20.5823	20.5952	20.6038	20.6038	20.6054	20.6004	20.5748	20.4242	20.2268 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2403	20.3732	20.4979	20.5823	20.5952	20.6038	20.6038	20.6054	20.6004	20.5748	20.4242	20.2268 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9792	0.9460	0.8683	0.6820	0.4866	0.3228	0.2257	0.2566	0.4410	0.7555	0.9428	0.9837	(94)
Useful gains	711.5533	790.6024	800.7226	708.5177	544.8805	360.6568	240.5263	251.5723	393.5601	592.8542	676.2575	684.3502	(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													
Space heating kwh	1009.9108	976.4088	879.7815	719.4972	545.5993	360.6741	240.5269	251.5742	393.7902	611.8183	823.9822	999.2045	(97)
Space heating requirement - total per year (kWh/year)	221.9780	124.8619	58.8198	7.9052	0.5348	0.0000	0.0000	0.0000	0.0000	14.1093	106.3617	234.2516	(98a)
Solar heating kwh													
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kwh													
Space heating requirement after solar contribution - total per year (kWh/year)	221.9780	124.8619	58.8198	7.9052	0.5348	0.0000	0.0000	0.0000	0.0000	14.1093	106.3617	234.2516	(98c)
Space heating per m2	(98c) / (4) =												

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 %)												170.0000 (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	221.9780	124.8619	58.8198	7.9052	0.5348	0.0000	0.0000	0.0000	0.0000	14.1093	106.3617	234.2516	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	130.5753	73.4482	34.5999	4.6501	0.3146	0.0000	0.0000	0.0000	0.0000	8.2996	62.5657	137.7951	(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)

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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	0.0000 (215)
Water heating													
Water heating requirement	208.6879	184.3611	196.1047	173.8336	169.2782	153.4375	152.4528	158.2455	159.6149	176.8191	186.4529	206.6695	(64)
Efficiency of water heater													
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
Fuel for water heating, kWh/month													
(217)m	122.7576	108.4477	115.3557	102.2551	99.5754	90.2573	89.6781	93.0856	93.8911	104.0112	109.6782	121.5703	(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	15.8994	14.3607	15.8994	15.3865	15.8994	15.3865	15.8994	15.8994	15.3865	15.8994	15.3865	15.8994	(231)
Lighting	34.0408	27.3088	24.5885	18.0146	13.9150	11.3687	12.6937	16.4998	21.4316	28.1194	31.7608	34.9869	(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													452.2485 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													170.0000
Water heating fuel used													1250.5633 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5830)													
mechanical ventilation fans (SFP = 0.5830)													187.2022 (230a)
Total electricity for the above, kWh/year													187.2022 (231)
Electricity for lighting (calculated in Appendix L)													274.7287 (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													2164.7427 (238)

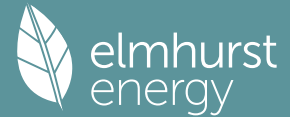
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	452.2485	0.1594	72.0725 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1250.5633	0.1407	175.9653 (264)
Space and water heating			248.0378 (265)
Pumps, fans and electric keep-hot	187.2022	0.1387	25.9673 (267)
Energy for lighting	274.7287	0.1443	39.6518 (268)
Total CO2, kg/year			313.6569 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.1000 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	452.2485	1.5898	719.0030 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1250.5633	1.5203	1901.2068 (278)
Space and water heating			2620.2098 (279)
Pumps, fans and electric keep-hot	187.2022	1.5128	283.1995 (281)
Energy for lighting	274.7287	1.5338	421.3881 (282)
Total Primary energy kWh/year			3324.7974 (286)
Dwelling Primary energy Rate (DPER)			32.8400 (287)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	101.2300 (1b)	x 2.6000 (2b)	= 263.1980 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	263.1980 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1520 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4020 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3115 (21)

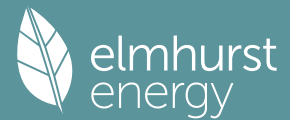
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3972	0.3894	0.3816	0.3427	0.3349	0.2960	0.2960	0.2882	0.3115	0.3349	0.3505	0.3661 (22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			17.0700	1.1450	19.5458		(27)
Heatloss Floor 1			101.2300	0.1300	13.1599		(28a)
External Wall 1	96.8200	17.0700	79.7500	0.1800	14.3550		(29a)
External Wall 2	26.4700	1.8900	24.5800	0.1800	4.4244		(29a)
Total net area of external elements Aum(A, m ²)			224.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.3751		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							248.7751 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				18.2000	0.0900	1.6380	
E17 Corner (inverted - internal area greater than external area)				7.8000	-0.0900	-0.7020	
E2 Other lintels (including other steel lintels)				12.1200	0.0500	0.6060	
E3 Sill				11.2200	0.0500	0.5610	
E4 Jamb				22.1000	0.0500	1.1050	
E5 Ground floor (normal)				46.6900	0.1600	7.4704	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6784 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	64.0535 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.2793	50.0132	49.7524	48.5275	48.2983	47.2315	47.2315	47.0339	47.6424	48.2983	48.7620	49.2467 (38)
Average = Sum(39)m / 12 =	114.3328	114.0667	113.8059	112.5810	112.3518	111.2850	111.2850	111.0874	111.6959	112.3518	112.8155	113.3002 (39)
												112.5799
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1294	1.1268	1.1242	1.1121	1.1099	1.0993	1.0993	1.0974	1.1034	1.1099	1.1144	1.1192 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7506 (42)
Hot water usage for mixer showers												70.0692 (42a)
Hot water usage for baths												30.2685 (42b)
Hot water usage for other uses												42.7991 (42c)
Average daily hot water use (litres/day)												131.9171 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	143.5090	140.4446	136.7127	131.0381	126.4299	121.4757	119.5718	123.2876	127.2064	132.4074	138.1695	143.1369 (44)
Energy content (annual)	227.2832	199.9912	210.1224	179.3846	170.1989	149.3686	144.6118	152.6558	156.8582	179.6756	196.8478	224.1177 (45)
Distribution loss (46)m = 0.15 x (45)m												2191.1158
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
If cylinder contains dedicated solar storage												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	-32.1559	-28.4390	-29.7796	-24.6587	-22.9810	-19.6650	-18.4328	-19.6015	-20.3462	-23.9859	-27.1732	-31.5604 (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	244.3700	216.0295	229.5854	202.3801	196.4606	177.3577	175.4216	182.2970	184.1662	204.9324	217.3288	241.8000 (64)
12Total per year (kWh/year)												2472.1291 (64)
Electric shower(s)												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	114.9658	102.0789	109.2598	97.7687	95.9853	87.7884	87.4776	90.1522	90.2787	99.1363	103.5752	113.9133 (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	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.5683	148.9863	134.5683	139.0539	134.5683	139.0539	134.5683	134.5683	139.0539	134.5683	139.0539	134.5683 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.3010	260.9814	254.2270	239.8476	221.6963	204.6366	193.2397	190.5593	197.3137	211.6931	229.8444	246.9041 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250 (71)
Water heating gains (Table 5)	154.5239	151.9031	146.8546	135.7899	129.0125	121.9283	117.5774	121.1723	125.3871	133.2477	143.8545	153.1092 (72)
Total internal gains	614.6526	629.1302	602.9093	581.9508	552.5364	529.8782	509.6447	510.5593	526.0141	546.7684	580.0122	601.8410 (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	

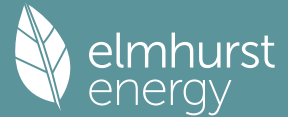
Northeast				0.8800		11.2829	0.6300		0.7000	0.7700		3.0344 (75)
Southeast				6.0800		36.7938	0.6300		0.7000	0.7700		68.3676 (77)
Northwest				10.1100		11.2829	0.6300		0.7000	0.7700		34.8614 (81)

Solar gains	106.2635	193.5935	298.3177	425.6715	527.9396	546.6219	517.6384	437.9019	341.8781	222.9769	129.5715	89.4561 (83)
Total gains	720.9161	822.7237	901.2269	1007.6223	1080.4761	1076.5001	1027.2831	948.4612	867.8922	769.7453	709.5836	691.2971 (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)												
tau	61.1847	61.3274	61.4679	62.1367	62.2635	62.8604	62.8604	62.9722	62.6291	62.2635	62.0076	61.7423

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alpha	5.0790	5.0885	5.0979	5.1424	5.1509	5.1907	5.1907	5.1981	5.1753	5.1509	5.1338	5.1162
util living area	0.9956	0.9907	0.9787	0.9345	0.8231	0.6332	0.4713	0.5286	0.7845	0.9569	0.9906	0.9964 (86)
MIT	19.7284	19.9095	20.1795	20.5498	20.8334	20.9672	20.9941	20.9896	20.9037	20.5375	20.0742	19.7015 (87)
Th 2	19.9769	19.9790	19.9811	19.9909	19.9928	20.0014	20.0014	20.0030	19.9981	19.9928	19.9891	19.9852 (88)
util rest of house	0.9941	0.9876	0.9715	0.9125	0.7697	0.5461	0.3672	0.4192	0.7054	0.9378	0.9870	0.9952 (89)
MIT 2	18.5040	18.7358	19.0783	19.5388	19.8553	19.9831	19.9995	19.9994	19.9339	19.5346	18.9541	18.4755 (90)
Living area fraction	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	0.3746 (91)
MIT	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	18.9348 (92)
Temperature adjustment	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	0.0000
adjusted MIT	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	18.9348 (93)

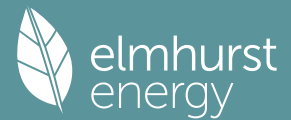
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9921	0.9844	0.9671	0.9106	0.7829	0.5777	0.4063	0.4603	0.7310	0.9359	0.9840	0.9935 (94)
Useful gains	715.2292	809.9069	871.5612	917.5497	845.9389	621.8889	417.3815	436.6039	634.4512	720.3731	698.2151	686.8256 (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	1676.4198	1628.3586	1478.4323	1240.3585	957.4294	640.0824	419.7754	441.0510	692.2030	1046.0264	1384.6627	1669.4507 (97)
Space heating kWh	715.1258	549.9995	451.5121	232.4223	82.9489	0.0000	0.0000	0.0000	0.0000	242.2861	494.2423	731.0731 (98a)
Space heating requirement - total per year (kWh/year)												3499.6102
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	715.1258	549.9995	451.5121	232.4223	82.9489	0.0000	0.0000	0.0000	0.0000	242.2861	494.2423	731.0731 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3499.6102
Space heating per m2										(98c) / (4) =		34.5709 (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	715.1258	549.9995	451.5121	232.4223	82.9489	0.0000	0.0000	0.0000	0.0000	242.2861	494.2423	731.0731 (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)	774.7841	595.8825	489.1789	251.8119	89.8689	0.0000	0.0000	0.0000	0.0000	262.4985	535.4737	792.0619 (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	244.3700	216.0295	229.5854	202.3801	196.4606	177.3577	175.4216	182.2970	184.1662	204.9324	217.3288	241.8000 (64)
Efficiency of water heater	86.3205	86.0627	85.5478	84.3710	82.2755	79.8000	79.8000	79.8000	79.8000	84.4363	85.8431	79.8000 (216)
Fuel for water heating, kWh/month	283.0960	251.0141	268.3711	239.8693	238.7837	222.2528	219.8266	228.4423	230.7847	242.7066	253.1699	279.9300 (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	27.9606	22.4311	20.1967	14.7970	11.4296	9.3381	10.4265	13.5527	17.6036	23.0969	26.0879	28.7377 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-33.6816	-48.6199	-71.5264	-82.3502	-90.4239	-84.9516	-83.8741	-78.3684	-68.9440	-56.4308	-37.4184	-28.9859 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-15.7253	-33.4116	-67.0369	-101.6194	-135.2969	-136.3146	-134.7452	-113.6912	-82.7858	-48.1288	-21.1046	-12.4131 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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												3791.5603 (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												2958.2471 (219)

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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)	225.6583 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1667.8488 (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	5393.6169 (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	3791.5603	0.2100	796.2277 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	2958.2471	0.2100	621.2319 (264)
Space and water heating			1417.4596 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	225.6583	0.1443	32.5695 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-765.5752	0.1341	-102.6670
PV Unit electricity exported	-902.2736	0.1256	-113.3424
Total			-216.0093 (269)
Total CO2, kg/year			1245.9489 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3100 (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	3791.5603	1.1300	4284.4632 (275)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	2958.2471	1.1300	3342.8192 (278)
Space and water heating			7627.2823 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	225.6583	1.5338	346.1223 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-765.5752	1.4956	-1144.9943
PV Unit electricity exported	-902.2736	0.4611	-416.0321
Total			-1561.0264 (283)
Total Primary energy kWh/year			6542.4790 (286)
Target Primary Energy Rate (TPER)			64.6300 (287)

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Property Reference	002	Issued on Date	12/09/2023
Assessment Reference	02 Be Lean	Prop Type Ref	
Property	Flat 2, 32, Norwich Road, Northwood, HA6 1NB		
SAP Rating	86 B	DER	3.14
Environmental	97 A	TER	11.12
CO ₂ Emissions (t/year)	0.28	% DER < TER	71.76
Compliance Check	See BREL	DFEE	25.89
% DPER < TPER	42.83	TFEE	34.11
		% DFEE < TFEE	24.09
		DPER	33.38
		TPER	58.39
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9600 (1b)	x 2.6000 (2b)	= 111.6960 (1b) -
First floor	55.2600 (1c)	x 2.7000 (2c)	= 149.2020 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	260.8980 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												85.5000 (23c)
Effective ac	0.2207	0.2178	0.2149	0.2004	0.1975	0.1829	0.1829	0.1800	0.1888	0.1975	0.2033	0.2091 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.80)			10.6400	0.7752	8.2481		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)

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External Wall 1	36.4000	6.9600	29.4400	0.1400	4.1216	60.0000	1766.4000 (29a)
External Wall 2	14.1400	1.8900	12.2500	0.1300	1.5925	190.0000	2327.5000 (29a)
External Wall 3	7.6800	3.6800	4.0000	0.1400	0.5600	9.0000	36.0000 (29a)
External Wall 4	63.3300		63.3300	0.1400	8.8662	9.0000	569.9700 (29a)
External Roof 1	34.8000		34.8000	0.0900	3.1320	9.0000	313.2000 (30)
External Roof 2	24.7600		24.7600	0.1400	3.4664	9.0000	222.8400 (30)
External Roof 3	21.0800		21.0800	0.0900	1.8972	9.0000	189.7200 (30)
External Roof 4	6.2000		6.2000	0.1400	0.8680	9.0000	55.8000 (30)
Total net area of external elements Aum(A, m2)			208.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	35.3980			(33)
Party Wall 1		19.7600	0.0000	0.0000	180.0000	3556.8000	(32)
Party Floor 1		42.9600			40.0000	1718.4000	(32d)
Party Floor 2		26.1100			40.0000	1044.4000	(32d)
Party Ceiling 1		101.2300			20.0000	2024.6000	(32b)
Internal Wall 1		179.2600			9.0000	1613.3400	(32c)
Internal Floor 1		28.0000			18.0000	504.0000	(32d)
Internal Ceiling 1		42.9600			9.0000	386.6400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16329.6100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 166.2554 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.2500	0.0500	0.4625
E3 Sill	8.3500	0.0140	0.1169
E4 Jamb	16.9000	0.0150	0.2535
E6 Intermediate floor within a dwelling	17.5200	0.0090	0.1577
E7 Party floor between dwellings (in blocks of flats)	35.2500	0.0310	1.0927
E11 Eaves (insulation at rafter level)	23.3200	0.0330	0.7696
E14 Flat roof	5.8000	0.0530	0.3074
E16 Corner (normal)	34.4000	0.0360	1.2384
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0610	-1.3176
E18 Party wall between dwellings	5.2000	0.0210	0.1092
P2 Party wall - Intermediate floor within a dwelling	17.5200	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	23.4100	0.0310	0.7257
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.7000	0.4800	1.2960

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2120 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 40.6100 (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	19.0031	18.7529	18.5026	17.2516	17.0013	15.7502	15.7502	15.5000	16.2507	17.0013	17.5018	18.0022 (38)
Heat transfer coeff	59.6130	59.3628	59.1126	57.8615	57.6113	56.3602	56.3602	56.1100	56.8606	57.6113	58.1117	58.6122 (39)
Average = Sum(39)m / 12 =												57.7990
HLP	0.6069	0.6044	0.6018	0.5891	0.5866	0.5738	0.5738	0.5713	0.5789	0.5866	0.5916	0.5967 (40)
HLP (average)												0.5885
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7224 (42)
Hot water usage for mixer showers	69.8659	68.8160	67.2860	64.3586	62.1983	59.7892	58.4198	59.9382	61.6027	64.1894	67.1796	69.5982 (42a)
Hot water usage for baths	30.1678	29.7198	29.0889	27.9256	27.0545	26.0886	25.5669	26.1934	26.8756	27.9091	29.0964	30.0659 (42b)
Hot water usage for other uses	42.5104	40.9645	39.4187	37.8729	36.3270	34.7812	34.7812	36.3270	37.8729	39.4187	40.9645	42.5104 (42c)
Average daily hot water use (litres/day)												131.0302 (43)
Daily hot water use	142.5441	139.5003	135.7936	130.1571	125.5799	120.6590	118.7679	122.4586	126.3511	131.5172	137.2405	142.1744 (44)
Energy conte	225.7550	198.6466	208.7097	178.1785	169.0546	148.3643	143.6395	151.6294	155.8035	178.4675	195.5242	222.6108 (45)
Energy content (annual)										Total = Sum(45)m =		2176.3837
Distribution loss (46)m = 0.15 x (45)m	33.8633	29.7970	31.3064	26.7268	25.3582	22.2546	21.5459	22.7444	23.3705	26.7701	29.3286	33.3916 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	269.1054	237.8018	252.0601	220.1305	212.4050	190.3163	186.9899	194.9798	197.7555	221.8179	237.4762	265.9612 (62)
WWHRS	-61.5294	-54.4171	-56.9824	-47.1837	-43.9735	-37.6285	-35.2707	-37.5068	-38.9319	-45.8964	-51.9950	-60.3899 (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	207.5761	183.3847	195.0776	172.9468	168.4315	152.6878	151.7192	157.4730	158.8237	175.9216	185.4812	205.5713 (64)
Total per year (kWh/year) = Sum(64)m =												2115.0944 (64)
12Total per year (kWh/year)												2115 (64)

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Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	109.7439	97.3741	104.0763	92.8060	90.8910	82.8927	82.4404	85.0971	85.3663	94.0208	98.5734	108.6984 (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	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.2480	165.2389	149.2480	154.2230	149.2480	154.2230	149.2480	149.2480	154.2230	149.2480	154.2230	149.2480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	253.4176	256.0473	249.4206	235.3131	217.5049	200.7677	189.5863	186.9566	193.5833	207.6908	225.4990	242.2362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	(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)	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	(71)
Water heating gains (Table 5)	147.5052	144.9020	139.8875	128.8972	122.1653	115.1288	110.8071	114.3778	118.5643	126.3720	136.9075	146.1000	(72)
Total internal gains	617.0072	633.0246	605.3924	585.2696	555.7546	533.9559	513.4778	514.4188	530.2069	550.1472	583.4658	604.4206	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			

Southeast				7.9200	36.7938	0.6800	0.7000	0.7700	96.1259 (77)			
Southwest				0.8800	36.7938	0.6800	0.7000	0.7700	10.6807 (79)			
Northwest				1.8400	11.2829	0.6800	0.7000	0.7700	6.8483 (81)			

Solar gains	113.6548	195.8709	274.0412	349.6777	400.9120	402.0789	385.9548	347.1101	300.1374	218.1082	136.5465	96.9968 (83)
Total gains	730.6620	828.8955	879.4336	934.9473	956.6666	936.0347	899.4326	861.5289	830.3444	768.2554	720.0123	701.4174 (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	76.0908	76.4115	76.7350	78.3941	78.7346	80.4824	80.4824	80.8413	79.7740	78.7346	78.0566	77.3901
alpha	6.0727	6.0941	6.1157	6.2263	6.2490	6.3655	6.3655	6.3894	6.3183	6.2490	6.2038	6.1593
util living area	0.9542	0.9124	0.8482	0.7134	0.5534	0.3848	0.2757	0.2995	0.4703	0.7364	0.9055	0.9610 (86)
MIT	20.5651	20.6922	20.8060	20.9073	20.9420	20.9505	20.9511	20.9513	20.9485	20.9071	20.7487	20.5488 (87)
Th 2	20.4238	20.4261	20.4283	20.4398	20.4421	20.4536	20.4536	20.4559	20.4490	20.4421	20.4375	20.4329 (88)
util rest of house	0.9470	0.9003	0.8296	0.6867	0.5219	0.3522	0.2415	0.2641	0.4335	0.7055	0.8908	0.9547 (89)
MIT 2	19.9137	20.0709	20.2082	20.3331	20.3711	20.3905	20.3910	20.3935	20.3842	20.3368	20.1516	19.9017 (90)
Living area fraction	20.0928	20.2417	20.3725	20.4910	20.5280	20.5445	20.5450	20.5468	20.5393	20.4936	20.3158	20.0796 (92)
Temperature adjustment	20.0928	20.2417	20.3725	20.4910	20.5280	20.5445	20.5450	20.5468	20.5393	20.4936	20.3158	20.0796 (93)
adjusted MIT	20.0928	20.2417	20.3725	20.4910	20.5280	20.5445	20.5450	20.5468	20.5393	20.4936	20.3158	20.0796 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9424	0.8961	0.8277	0.6892	0.5268	0.3576	0.2472	0.2700	0.4396	0.7084	0.8874	0.9503 (94)
Useful gains	688.5540	742.7697	727.9158	644.3228	503.9516	334.7211	222.3157	232.6382	364.9801	544.2492	638.9066	666.5532 (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												
	941.4546	910.7258	820.0415	670.6704	508.5945	335.0319	222.3386	232.6778	366.1425	569.9805	767.9908	930.7359 (97)
Space heating kWh	188.1580	112.8665	68.5415	18.9702	3.4543	0.0000	0.0000	0.0000	0.0000	19.1441	92.9407	196.5519 (98a)
Space heating requirement - total per year (kWh/year)												700.6272
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	188.1580	112.8665	68.5415	18.9702	3.4543	0.0000	0.0000	0.0000	0.0000	19.1441	92.9407	196.5519 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												700.6272
Space heating per m2												(98c) / (4) = 7.1332 (99)

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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 %)													170.0000 (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	188.1580	112.8665	68.5415	18.9702	3.4543	0.0000	0.0000	0.0000	0.0000	19.1441	92.9407	196.5519	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	110.6812	66.3921	40.3185	11.1589	2.0319	0.0000	0.0000	0.0000	0.0000	11.2612	54.6710	115.6188	(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	207.5761	183.3847	195.0776	172.9468	168.4315	152.6878	151.7192	157.4730	158.8237	175.9216	185.4812	205.5713	(64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
Fuel for water heating, kWh/month	122.1036	107.8733	114.7515	101.7334	99.0774	89.8164	89.2466	92.6312	93.4257	103.4833	109.1066	120.9243	(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	15.7604	14.2352	15.7604	15.2520	15.7604	15.2520	15.7604	15.7604	15.2520	15.7604	15.2520	15.7604	(231)
Lighting	36.5613	29.3308	26.4092	19.3485	14.9453	12.2105	13.6336	17.7215	23.0185	30.2015	34.1125	37.5774	(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													412.1337 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													170.0000
Water heating fuel used													1244.1732 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5830)													
mechanical ventilation fans (SFP = 0.5830)													185.5663 (230a)
Total electricity for the above, kWh/year													185.5663 (231)
Electricity for lighting (calculated in Appendix L)													295.0706 (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													2136.9437 (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	412.1337	0.1585	65.3291	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1244.1732	0.1407	175.0621	(264)
Space and water heating			240.3913	(265)
Pumps, fans and electric keep-hot	185.5663	0.1387	25.7403	(267)
Energy for lighting	295.0706	0.1443	42.5878	(268)
Total CO2, kg/year			308.7194	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.1400	(273)

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

Energy Primary energy factor Primary energy

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Space heating - main system 1	kWh/year	kg CO2/kWh	kWh/year
Total CO2 associated with community systems	412.1337	1.5868	653.9547 (275)
Water heating (other fuel)			0.0000 (473)
Space and water heating	1244.1732	1.5203	1891.4769 (278)
Pumps, fans and electric keep-hot			2545.4317 (279)
Energy for lighting	185.5663	1.5128	280.7247 (281)
Total Primary energy kWh/year	295.0706	1.5338	452.5891 (282)
Dwelling Primary energy Rate (DPER)			3278.7455 (286)
			33.3800 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9600 (1b)	x 2.6000 (2b)	= 111.6960 (1b) -
First floor	55.2600 (1c)	x 2.7000 (2c)	= 149.2020 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.8980 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) = 0.1150 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3650 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2829 (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	0.3607	0.3536	0.3465	0.3112	0.3041	0.2687	0.2687	0.2617	0.2829	0.3041	0.3182	0.3324 (22b)
Effective ac	0.5650	0.5625	0.5600	0.5484	0.5462	0.5361	0.5361	0.5342	0.5400	0.5462	0.5506	0.5552 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			10.6400	1.1450	12.1832		(27)
External Wall 1	36.4000	6.9600	29.4400	0.1800	5.2992		(29a)
External Wall 2	14.1400	1.8900	12.2500	0.1800	2.2050		(29a)
External Wall 3	7.6800	3.6800	4.0000	0.1800	0.7200		(29a)
External Wall 4	63.3300		63.3300	0.1800	11.3994		(29a)
External Roof 1	34.8000		34.8000	0.1100	3.8280		(30)
External Roof 2	24.7600		24.7600	0.1100	2.7236		(30)
External Roof 3	21.0800		21.0800	0.1100	2.3188		(30)
External Roof 4	6.2000		6.2000	0.1100	0.6820		(30)
Total net area of external elements Aum(A, m ²)			208.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.2492		(33)
Party Wall 1			19.7600	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							176.5619 (35)
List of Thermal Bridges							

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K1 Element						Length	Psi-value		Total				
E2 Other lintels (including other steel lintels)						9.2500	0.0500		0.4625				
E3 Sill						8.3500	0.0500		0.4175				
E4 Jamb						16.9000	0.0500		0.8450				
E6 Intermediate floor within a dwelling						17.5200	0.0000		0.0000				
E7 Party floor between dwellings (in blocks of flats)						35.2500	0.0700		2.4675				
E11 Eaves (insulation at rafter level)						23.3200	0.0400		0.9328				
E14 Flat roof						5.8000	0.0800		0.4640				
E16 Corner (normal)						34.4000	0.0900		3.0960				
E17 Corner (inverted - internal area greater than external area)						21.6000	-0.0900		-1.9440				
E18 Party wall between dwellings						5.2000	0.0600		0.3120				
P2 Party wall - Intermediate floor within a dwelling						17.5200	0.0000		0.0000				
E7 Party floor between dwellings (in blocks of flats)						23.4100	0.0700		1.6387				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)						23.4100	0.0000		0.0000				
P4 Party wall - Roof (insulation at ceiling level)						2.7000	0.1200		0.3240				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)										9.0160	(36)		
Point Thermal bridges										(36a) =	0.0000		
Total fabric heat loss									(33) + (36) + (36a) =	52.2652	(37)		
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	48.6475	48.4301	48.2169	47.2159	47.0286	46.1567	46.1567	45.9953	46.4926	47.0286	47.4075	47.8036	(38)
Average = Sum(39)m / 12 =	100.9127	100.6953	100.4821	99.4811	99.2938	98.4220	98.4220	98.2605	98.7578	99.2938	99.6727	100.0688	(39)
												99.4802	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0274	1.0252	1.0230	1.0128	1.0109	1.0021	1.0021	1.0004	1.0055	1.0109	1.0148	1.0188	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy												2.7224	(42)
Hot water usage for mixer showers	69.8659	68.8160	67.2860	64.3586	62.1983	59.7892	58.4198	59.9382	61.6027	64.1894	67.1796	69.5982	(42a)
Hot water usage for baths	30.1678	29.7198	29.0889	27.9256	27.0545	26.0886	25.5669	26.1934	26.8756	27.9091	29.0964	30.0659	(42b)
Hot water usage for other uses	42.5104	40.9645	39.4187	37.8729	36.3270	34.7812	34.7812	36.3270	37.8729	39.4187	40.9645	42.5104	(42c)
Average daily hot water use (litres/day)												131.0302	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	142.5441	139.5003	135.7936	130.1571	125.5799	120.6590	118.7679	122.4586	126.3511	131.5172	137.2405	142.1744	(44)
Energy content (annual)	225.7550	198.6466	208.7097	178.1785	169.0546	148.3643	143.6395	151.6294	155.8035	178.4675	195.5242	222.6108	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2176.3837	
Water storage loss:	33.8633	29.7970	31.3064	26.7268	25.3582	22.2546	21.5459	22.7444	23.3705	26.7701	29.3286	33.3916	(46)
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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	274.9977	243.1238	257.9523	225.8327	218.2973	196.0185	192.8822	200.8721	203.4577	227.7102	243.1784	271.8535	(62)
WWHRS	-31.9398	-28.2478	-29.5795	-24.4930	-22.8266	-19.5329	-18.3089	-19.4697	-20.2094	-23.8247	-26.9905	-31.3483	(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	243.0579	214.8760	228.3729	201.3398	195.4707	176.4856	174.5732	181.4023	183.2483	203.8855	216.1879	240.5052	(64)
								Total per year (kWh/year) = Sum(64)m =				2459.4054	(64)
12Total per year (kWh/year)												2459	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month	114.4577	101.6318	108.7901	97.3677	95.6048	87.4545	87.1543	89.8109	89.9280	98.7346	103.1352	113.4122	(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	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.0964	160.6424	145.0964	149.9329	145.0964	149.9329	145.0964	145.0964	149.9329	145.0964	149.9329	145.0964	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	253.4176	256.0473	249.4206	235.3131	217.5049	200.7677	189.5863	186.9566	193.5833	207.6908	225.4990	242.2362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	(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)

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

Water heating gains (Table 5)	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	(71)
Total internal gains	153.8410	151.2378	146.2232	135.2329	128.5011	121.4646	117.1428	120.7136	124.9000	132.7078	143.2433	152.4358	(72)
	619.1913	634.7638	607.5766	587.3153	557.9387	536.0016	515.6619	516.6029	532.2526	552.3313	585.5115	606.6047	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				7.9200	36.7938		0.6300		0.7000		0.7700		89.0578 (77)
Southwest				0.8800	36.7938		0.6300		0.7000		0.7700		9.8953 (79)
Northwest				1.8400	11.2829		0.6300		0.7000		0.7700		6.3447 (81)
Solar gains	105.2978	181.4686	253.8911	323.9661	371.4332	372.5142	357.5758	321.5873	278.0685	202.0708	126.5063		89.8647 (83)
Total gains	724.4892	816.2325	861.4676	911.2814	929.3719	908.5158	873.2376	838.1902	810.3212	754.4021	712.0179		696.4694 (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)														
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
alpha	47.7363	47.8394	47.9408	48.4232	48.5146	48.9443	48.9443	49.0248	48.7779	48.5146	48.3302	48.1389		
util living area	4.1824	4.1893	4.1961	4.2282	4.2343	4.2630	4.2630	4.2683	4.2519	4.2343	4.2220	4.2093		
	0.9831	0.9712	0.9518	0.9023	0.8064	0.6411	0.4830	0.5207	0.7337	0.9116	0.9698	0.9855	(86)	
MIT	19.5754	19.7864	20.0663	20.4395	20.7442	20.9301	20.9834	20.9771	20.8721	20.4929	19.9794	19.5405	(87)	
Th 2	20.0606	20.0624	20.0642	20.0726	20.0742	20.0816	20.0816	20.0830	20.0788	20.0742	20.0710	20.0677	(88)	
util rest of house	0.9793	0.9649	0.9409	0.8796	0.7615	0.5659	0.3880	0.4249	0.6651	0.8865	0.9621	0.9823	(89)	
MIT 2	18.4056	18.6729	19.0252	19.4883	19.8407	20.0336	20.0743	20.0721	19.9816	19.5612	18.9256	18.3663	(90)	
Living area fraction	18.7272	18.9790	19.3114	19.7498	20.0890	20.2801	20.3242	20.3209	fLA = Living area / (4) =	20.2264	19.8173	19.2153	0.2749	(91)
MIT	18.7272	18.9790	19.3114	19.7498	20.0890	20.2801	20.3242	20.3209	20.2264	19.8173	19.2153	18.6891	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7272	18.9790	19.3114	19.7498	20.0890	20.2801	20.3242	20.3209	20.2264	19.8173	19.2153	18.6891	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9721	0.9555	0.9300	0.8704	0.7623	0.5830	0.4137	0.4505	0.6770	0.8782	0.9529	0.9757	(94)	
Ext temp.	704.2955	779.8854	801.1650	793.1596	708.4182	529.6233	361.2317	377.5955	548.6032	662.4881	678.4833	679.5704	(95)	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
	1455.8842	1417.6843	1287.3193	1079.3498	832.9791	559.0418	366.5416	385.2661	605.0276	915.2225	1207.5638	1449.9022	(97)	
Space heating kWh	559.1820	428.6009	361.6988	206.0569	92.6733	0.0000	0.0000	0.0000	0.0000	188.0344	380.9379	573.1269	(98a)	
Space heating requirement - total per year (kWh/year)												2790.3110		
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	559.1820	428.6009	361.6988	206.0569	92.6733	0.0000	0.0000	0.0000	0.0000	188.0344	380.9379	573.1269	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2790.3110		
Space heating per m2										(98c) / (4) =		28.4088	(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)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	559.1820	428.6009	361.6988	206.0569	92.6733	0.0000	0.0000	0.0000	0.0000	188.0344	380.9379	573.1269	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	605.8310	464.3564	391.8730	223.2470	100.4044	0.0000	0.0000	0.0000	0.0000	203.7209	412.7171	620.9392	(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)	

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Water heating												
Water heating requirement												
	243.0579	214.8760	228.3729	201.3398	195.4707	176.4856	174.5732	181.4023	183.2483	203.8855	216.1879	240.5052 (64)
Efficiency of water heater												
(217)m	85.8660	85.5771	85.0860	84.1118	82.4889	79.8000	79.8000	79.8000	79.8000	83.8787	85.3163	79.8000 (216)
Fuel for water heating, kWh/month												
	283.0667	251.0907	268.4023	239.3717	236.9662	221.1600	218.7634	227.3212	229.6344	243.0719	253.3957	279.8683 (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												
	30.1482	24.1860	21.7768	15.9546	12.3238	10.0686	11.2422	14.6130	18.9809	24.9039	28.1289	30.9861 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-32.8104	-47.4200	-69.8318	-80.4717	-88.4149	-83.0844	-82.0531	-76.6689	-67.4200	-55.1078	-36.4803	-28.2312 (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	-15.1274	-32.1724	-64.6114	-98.0277	-130.5943	-131.6027	-130.0657	-109.6800	-79.7982	-46.3429	-20.3025	-11.9368 (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												3023.0888 (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												2952.1125 (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)												243.3129 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1618.2565 (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												4686.2577 (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			
Total CO2 associated with community systems	3023.0888	0.2100	634.8487 (261)
Water heating (other fuel)			
Space and water heating	2952.1125	0.2100	619.9436 (264)
Pumps, fans and electric keep-hot			
Energy for lighting	86.0000	0.1387	11.9293 (267)
	243.3129	0.1443	35.1176 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-747.9946	0.1341	-100.2929
PV Unit electricity exported	-870.2619	0.1256	-109.3016
Total			-209.5944 (269)
Total CO2, kg/year			1092.2447 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1200 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1			
Total CO2 associated with community systems	3023.0888	1.1300	3416.0904 (275)
Water heating (other fuel)			
Space and water heating	2952.1125	1.1300	3335.8871 (278)
Pumps, fans and electric keep-hot			
Energy for lighting	86.0000	1.5128	130.1008 (281)
	243.3129	1.5338	373.2014 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-747.9946	1.4955	-1118.6390
PV Unit electricity exported	-870.2619	0.4610	-401.1992
Total			-1519.8382 (283)
Total Primary energy kWh/year			5735.4415 (286)
Target Primary Energy Rate (TPER)			58.3900 (287)

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Property Reference	003	Issued on Date	18/09/2023
Assessment Reference	03 Be Lean	Prop Type Ref	01 - Be Lean
Property	Flat 3, 32, Norwich Road, Northwood, HA6 1NB		
SAP Rating	86 B	DER	3.76
Environmental	97 A	TER	13.81
CO ₂ Emissions (t/year)	0.22	% DER < TER	72.77
Compliance Check	See BREL	DFEE	28.76
% DPER < TPER	44.97	TFEE	37.30
		% DFEE < TFEE	22.89
		DPER	40.08
		TPER	72.83
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8700 (1b)	x 2.6000 (2b)	= 160.8620 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 160.8620 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												86.4000 (23c)
Effective ac	0.2162	0.2133	0.2104	0.1959	0.1930	0.1784	0.1784	0.1755	0.1842	0.1930	0.1988	0.2046 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.80)			20.0600	0.7752	15.5504		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
External Wall 1	57.8500	20.0600	37.7900	0.1400	5.2906	60.0000	2267.4000 (29a)

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External Wall 2	11.4400	1.8900	9.5500	0.1300	1.2415	190.0000	1814.5000 (29a)
External Roof 1	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m2)			106.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	28.0585			(33)
Party Wall 1			19.7600	0.0000	0.0000	180.0000	3556.8000 (32)
Party Floor 1			61.2500			40.0000	2450.0000 (32d)
Party Ceiling 1			24.7500			20.0000	495.0000 (32b)
Internal Wall 1			141.6000			9.0000	1274.4000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12191.1000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 197.0438 (35)

List of Thermal Bridges							
K1 Element	Length	Psi-value	Total				
E16 Corner (normal)	7.8000	0.0270	0.2106				
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0610	-0.1586				
E2 Other lintels (including other steel lintels)	14.3400	0.0500	0.7170				
E3 Sill	13.4400	0.0140	0.1882				
E4 Jamb	27.5000	0.0150	0.4125				
E7 Party floor between dwellings (in blocks of flats)	26.6500	0.0310	0.8261				
E18 Party wall between dwellings	5.2000	0.0210	0.1092				
E10 Eaves (insulation at ceiling level)	22.2500	0.0330	0.7343				
E12 Gable (insulation at ceiling level)	4.4000	0.0390	0.1716				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.5000	0.0000	0.0000				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.2109 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 31.2693 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	11.4779	11.3236	11.1693	10.3979	10.2436	9.4723	9.4723	9.3180	9.7808	10.2436	10.5522	10.8607 (38)
Average = Sum(39)m / 12 =	42.7472	42.5929	42.4386	41.6673	41.5130	40.7416	40.7416	40.5873	41.0502	41.5130	41.8215	42.1301 (39)
												41.6287
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6909	0.6884	0.6859	0.6735	0.6710	0.6585	0.6585	0.6560	0.6635	0.6710	0.6760	0.6809 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

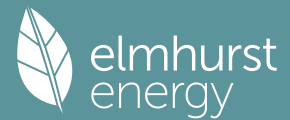
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0340 (42)
Hot water usage for mixer showers													
Hot water usage for baths	58.3228	57.4463	56.1691	53.7254	51.9220	49.9109	48.7678	50.0353	51.4248	53.5841	56.0803	58.0993 (42a)	
Hot water usage for other uses	25.2039	24.8296	24.3025	23.3306	22.6029	21.7959	21.3600	21.8835	22.4534	23.3168	24.3088	25.1187 (42b)	
Average daily hot water use (litres/day)	35.4600	34.1706	32.8811	31.5917	30.3022	29.0127	29.0127	30.3022	31.5917	32.8811	34.1706	35.4600 (42c)	
												109.3761 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	118.9867	116.4465	113.3527	108.6477	104.8271	100.7196	99.1406	102.2210	105.4698	109.7821	114.5596	118.6781 (44)	
Distribution loss (46)m = 0.15 x (45)m	188.4459	165.8183	174.2189	148.7332	141.1174	123.8465	119.9019	126.5709	130.0548	148.9732	163.2112	185.8212 (45)	
Water storage loss:													
Store volume	28.2669	24.8727	26.1328	22.3100	21.1676	18.5770	17.9853	18.9856	19.5082	22.3460	24.4817	27.8732 (46)	
a) If manufacturer declared loss factor is known (kWh/day):												180.0000 (47)	
Temperature factor from Table 2b												1.2000 (48)	
Enter (49) or (54) in (55)												0.5400 (49)	
Total storage loss												0.6480 (55)	
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)	
Primary loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)	
Combi 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)	
Total heat required for water heating calculated for each month	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)	
WWHRS	231.7963	204.9735	217.5693	190.6852	184.4678	165.7985	163.2523	169.9213	172.0068	192.3236	205.1632	229.1716 (62)	
PV diverter	-51.3636	-45.4264	-47.5679	-39.3881	-36.7083	-31.4116	-29.4433	-31.3100	-32.4996	-38.3134	-43.4045	-50.4124 (63a)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
Output from w/h	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)	
12Total per year (kWh/year)	180.4327	159.5471	170.0014	151.2971	147.7595	134.3869	133.8090	138.6113	139.5072	154.0102	161.7587	178.7592 (64)	
Electric shower(s)													
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												1849.8803 (64)	
Heat gains from water heating, kWh/month													
	97.3386	86.4587	92.6081	83.0154	81.6019	74.7405	74.5477	76.7652	76.8048	84.2139	87.8293	96.4659 (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

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(66)m	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.5976	99.1974	89.5976	92.5842	89.5976	92.5842	89.5976	89.5976	92.5842	89.5976	92.5842	89.5976 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.6373	179.4806	174.8355	164.9466	152.4637	140.7315	132.8937	131.0503	135.6954	145.5843	158.0673	169.7994 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699 (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)	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593 (71)
Water heating gains (Table 5)	130.8314	128.6588	124.4733	115.2992	109.6799	103.8063	100.1985	103.1790	106.6734	113.1907	121.9852	129.6584 (72)
Total internal gains	454.5761	463.8465	445.4161	429.3397	408.2510	390.6317	376.1995	377.3367	388.4627	404.8824	429.1463	445.5652 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	0.8800	11.2829	0.6800	0.7000	0.7700	3.2753 (75)
Southwest	0.8800	36.7938	0.6800	0.7000	0.7700	10.6807 (79)
Northwest	18.3000	11.2829	0.6800	0.7000	0.7700	68.1104 (81)

Solar gains	82.0663	163.5007	286.6907	460.7909	612.4810	650.4360	609.4513	489.8039	345.9585	197.6847	102.6146	67.4376 (83)
Total gains	536.6424	627.3472	732.1068	890.1306	1020.7319	1041.0677	985.6509	867.1406	734.4213	602.5671	531.7610	513.0028 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, n1,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	79.2196	79.5066	79.7956	81.2728	81.5749	83.1194	83.1194	83.4353	82.4946	81.5749	80.9730	80.3800
alpha	6.2813	6.3004	6.3197	6.4182	6.4383	6.5413	6.5413	6.5624	6.4996	6.4383	6.3982	6.3587
util living area	0.9527	0.8983	0.7784	0.5599	0.3778	0.2504	0.1819	0.2153	0.3852	0.6906	0.9001	0.9608 (86)
MIT	20.5990	20.7385	20.8718	20.9415	20.9509	20.9525	20.9525	20.9526	20.9516	20.9245	20.7727	20.5774 (87)
Th 2	20.3489	20.3511	20.3533	20.3643	20.3665	20.3776	20.3776	20.3799	20.3732	20.3665	20.3621	20.3577 (88)
util rest of house	0.9441	0.8828	0.7536	0.5320	0.3522	0.2261	0.1561	0.1863	0.3504	0.6547	0.8823	0.9534 (89)
MIT 2	19.8860	20.0555	20.2095	20.2930	20.3040	20.3167	20.3167	20.3191	20.3114	20.2802	20.1089	19.8673 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	20.1751	20.3325	20.4781	20.5560	20.5664	20.5745	20.5745	20.5760	20.5710	20.5415	20.3781	20.1553 (92)
Temperature adjustment	0.0000											
adjusted MIT	20.1751	20.3325	20.4781	20.5560	20.5664	20.5745	20.5745	20.5760	20.5710	20.5415	20.3781	20.1553 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9415	0.8823	0.7585	0.5405	0.3603	0.2338	0.1643	0.1955	0.3614	0.6648	0.8828	0.9508 (94)
Useful gains	505.2601	553.5122	555.3032	481.1035	367.7377	243.3965	161.9273	169.4901	265.4084	400.6052	469.4500	487.7618 (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	678.6177	657.3136	593.2103	485.6740	368.0687	243.4103	161.9283	169.4931	265.6370	412.7009	555.3092	672.1970 (97)
Space heating kWh	128.9781	69.7546	28.2029	3.2907	0.2463	0.0000	0.0000	0.0000	0.0000	8.9992	61.8186	137.2198 (98a)
Space heating requirement - total per year (kWh/year)												438.5102
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	128.9781	69.7546	28.2029	3.2907	0.2463	0.0000	0.0000	0.0000	0.0000	8.9992	61.8186	137.2198 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												438.5102
Space heating per m2												(98c) / (4) = 7.0876 (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 %)	170.0000 (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	128.9781	69.7546	28.2029	3.2907	0.2463	0.0000	0.0000	0.0000	0.0000	8.9992	61.8186	137.2198 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)

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	257.9471	0.1595	41.1339 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1088.1649	0.1406	153.0119 (264)
Space and water heating			194.1458 (265)
Pumps, fans and electric keep-hot	114.4147	0.1387	15.8707 (267)
Energy for lighting	157.9460	0.1443	22.7965 (268)
Total CO2, kg/year			232.8130 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7600 (273)

13a. Primary energy - Individual heating systems including micro-CHP			
	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year (275)
Space heating - main system 1	257.9471	1.5902	410.1846 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1088.1649	1.5199	1653.9317 (278)
Space and water heating			2064.1163 (279)
Pumps, fans and electric keep-hot	114.4147	1.5128	173.0866 (281)
Energy for lighting	157.9460	1.5338	242.2628 (282)
Total Primary energy kWh/year			2479.4657 (286)
Dwelling Primary energy Rate (DPER)			40.0800 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8700 (1b)	x 2.6000 (2b)	= 160.8620 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 160.8620 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1243 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3743	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2901 (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	0.3699	0.3626	0.3554	0.3191	0.3119	0.2756	0.2756	0.2683	0.2901	0.3119	0.3264	0.3409 (22b)
Effective ac	0.5684	0.5658	0.5631	0.5509	0.5486	0.5380	0.5380	0.5360	0.5421	0.5486	0.5533	0.5581 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			13.5900	1.1450	15.5611		(27)
External Wall 1	57.8500	13.5900	44.2600	0.1800	7.9668		(29a)
External Wall 2	11.4400	1.8900	9.5500	0.1800	1.7190		(29a)
External Roof 1	37.0000		37.0000	0.1100	4.0700		(30)
Total net area of external elements Aum(A, m ²)			106.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.2069		(33)
Party Wall 1			19.7600	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 201.0441 (35)

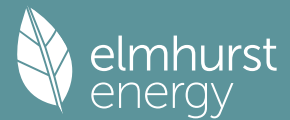
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340
E2 Other lintels (including other steel lintels)	14.3400	0.0500	0.7170
E3 Sill	13.4400	0.0500	0.6720
E4 Jamb	27.5000	0.0500	1.3750
E7 Party floor between dwellings (in blocks of flats)	26.6500	0.0700	1.8655
E18 Party wall between dwellings	5.2000	0.0600	0.3120
E10 Eaves (insulation at ceiling level)	22.2500	0.0600	1.3350
E12 Gable (insulation at ceiling level)	4.4000	0.0600	0.2640
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.5000	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.0085 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	38.2154 (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	30.1736	30.0326	29.8944	29.2452	29.1237	28.5583	28.5583	28.4536	28.7761	29.1237	29.3694	29.6263 (38)
Heat transfer coeff												

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Average = Sum(39)m / 12 =	68.3890	68.2480	68.1097	67.4605	67.3391	66.7736	66.7736	66.6689	66.9914	67.3391	67.5848	67.8417 (39)
												67.4600
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1054	1.1031	1.1009	1.0904	1.0884	1.0793	1.0793	1.0776	1.0828	1.0884	1.0924	1.0965 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.0903 (40)
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0340 (42)
Hot water usage for mixer showers												
Hot water usage for baths	58.3228	57.4463	56.1691	53.7254	51.9220	49.9109	48.7678	50.0353	51.4248	53.5841	56.0803	58.0993 (42a)
Hot water usage for other uses	25.2039	24.8296	24.3025	23.3306	22.6029	21.7959	21.3600	21.8835	22.4534	23.3168	24.3088	25.1187 (42b)
Average daily hot water use (litres/day)	35.4600	34.1706	32.8811	31.5917	30.3022	29.0127	29.0127	30.3022	31.5917	32.8811	34.1706	35.4600 (42c)
												109.3761 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	118.9867	116.4465	113.3527	108.6477	104.8271	100.7196	99.1406	102.2210	105.4698	109.7821	114.5596	118.6781 (44)
Energy content (annual)	188.4459	165.8183	174.2189	148.7332	141.1174	123.8465	119.9019	126.5709	130.0548	148.9732	163.2112	185.8212 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1816.7135
Water storage loss:	28.2669	24.8727	26.1328	22.3100	21.1676	18.5770	17.9853	18.9856	19.5082	22.3460	24.4817	27.8732 (46)
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	237.6886	210.2955	223.4616	196.3874	190.3601	171.5007	169.1446	175.8136	177.7090	198.2159	210.8654	235.0639 (62)
WWHRS	-26.6627	-23.5807	-24.6924	-20.4463	-19.0552	-16.3057	-15.2840	-16.2530	-16.8705	-19.8884	-22.5312	-26.1690 (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	211.0258	186.7148	198.7692	175.9412	171.3049	155.1950	153.8606	159.5606	160.8385	178.3275	188.3342	208.8949 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2148.7671 (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	102.0524	90.7164	97.3219	87.5772	86.3157	79.3023	79.2615	81.4790	81.3666	88.9277	92.3911	101.1797 (65)

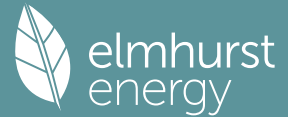
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.6331	99.2366	89.6331	92.6208	89.6331	92.6208	89.6331	89.6331	92.6208	89.6331	92.6208	89.6331 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.6373	179.4806	174.8355	164.9466	152.4637	140.7315	132.8937	131.0503	135.6954	145.5843	158.0673	169.7994 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593 (71)
Water heating gains (Table 5)	137.1672	134.9946	130.8090	121.6349	116.0157	110.1421	106.5343	109.5147	113.0091	119.5265	128.3209	135.9942 (72)
Total internal gains	460.9473	470.2215	451.7873	435.7121	414.6222	397.0041	382.5708	383.7079	394.8352	411.2536	435.5188	451.9364 (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				0.6000	11.2829		0.6300		0.7000		0.7700		2.0689 (75)
Southwest				0.6000	36.7938		0.6300		0.7000		0.7700		6.7468 (79)
Northwest				12.3900	11.2829		0.6300		0.7000		0.7700		42.7234 (81)
Solar gains	51.5391	102.6683	179.9944	289.2619	384.4584	408.2729	382.5511	307.4645	217.1918	124.1258	64.4414		42.3535 (83)

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Total gains 512.4864 572.8898 631.7818 724.9741 799.0806 805.2770 765.1219 691.1723 612.0270 535.3794 499.9602 494.2899 (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	50.5223	50.6267	50.7294	51.2176	51.3100	51.7445	51.7445	51.8257	51.5762	51.3100	51.1234	50.9298
alpha	4.3682	4.3751	4.3820	4.4145	4.4207	4.4496	4.4496	4.4550	4.4384	4.4207	4.4082	4.3953
util living area	0.9831	0.9714	0.9441	0.8602	0.7050	0.5153	0.3806	0.4370	0.6873	0.9063	0.9700	0.9854 (86)
MIT	19.6789	19.8770	20.1896	20.5999	20.8693	20.9743	20.9946	20.9904	20.9135	20.5531	20.0566	19.6465 (87)
Th 2	19.9965	19.9983	20.0001	20.0087	20.0103	20.0178	20.0178	20.0192	20.0149	20.0103	20.0071	20.0037 (88)
util rest of house	0.9789	0.9644	0.9303	0.8286	0.6495	0.4421	0.2973	0.3470	0.6108	0.8771	0.9614	0.9818 (89)
MIT 2	18.4778	18.7283	19.1182	19.6124	19.9020	20.0025	20.0158	20.0153	19.9552	19.5728	18.9639	18.4420 (90)
Living area fraction									fLA =	Living area / (4) =		
MIT	18.9649	19.1942	19.5527	20.0129	20.2943	20.3966	20.4128	20.4107	20.3438	19.9703	19.4070	18.9304 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9649	19.1942	19.5527	20.0129	20.2943	20.3966	20.4128	20.4107	20.3438	19.9703	19.4070	18.9304 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9732	0.9574	0.9230	0.8287	0.6662	0.4709	0.3311	0.3834	0.6377	0.8757	0.9548	0.9766 (94)
Useful gains	498.7680	548.4604	583.1181	600.7905	532.3220	379.1954	253.3198	264.9940	390.3017	468.8362	477.3704	482.7112 (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	1002.9153	975.5475	889.0143	749.6807	578.7321	387.0584	254.5927	267.3912	418.2805	630.9903	831.7669	999.3372 (97)
Space heating kWh	375.0856	287.0025	227.5868	107.2010	34.5291	0.0000	0.0000	0.0000	0.0000	120.6426	255.1656	384.3698 (98a)
Space heating requirement - total per year (kWh/year)												1791.5829
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	375.0856	287.0025	227.5868	107.2010	34.5291	0.0000	0.0000	0.0000	0.0000	120.6426	255.1656	384.3698 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1791.5829
Space heating per m2										(98c) / (4) =		28.9572 (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	375.0856	287.0025	227.5868	107.2010	34.5291	0.0000	0.0000	0.0000	0.0000	120.6426	255.1656	384.3698 (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)	406.3766	310.9453	246.5729	116.1441	37.4097	0.0000	0.0000	0.0000	0.0000	130.7071	276.4524	416.4353 (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	211.0258	186.7148	198.7692	175.9412	171.3049	155.1950	153.8606	159.5606	160.8385	178.3275	188.3342	208.8949 (64)	
Efficiency of water heater												79.8000 (216)	
(217)m	85.3349	85.0206	84.3642	82.9843	81.1802	79.8000	79.8000	79.8000	79.8000	83.2028	84.7414	85.4083 (217)	
Fuel for water heating, kWh/month	247.2915	219.6112	235.6085	212.0173	211.0180	194.4799	192.8078	199.9507	201.5521	214.3286	222.2457	244.5838 (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	18.6240	14.9408	13.4526	9.8559	7.6130	6.2199	6.9448	9.0272	11.7254	15.3844	17.3766	19.1416 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-21.1448	-30.8254	-45.8087	-53.3199	-59.0858	-55.7477	-55.0797	-51.2182	-44.6629	-36.0655	-23.6094	-18.1654 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-9.0518	-19.3108	-38.8787	-59.1191	-78.8708	-79.4864	-78.5366	-66.1653	-48.0716	-27.8396	-12.1588	-7.1369 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													

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(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												1941.0433	(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												2595.4951	(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)												150.3062	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1019.3599	(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												3753.4846	(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	1941.0433	0.2100	407.6191 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2595.4951	0.2100	545.0540 (264)
Space and water heating			952.6730 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	150.3062	0.1443	21.6938 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-494.7336	0.1339	-66.2313
PV Unit electricity exported	-524.6263	0.1255	-65.8614
Total			-132.0926 (269)
Total CO2, kg/year			854.2035 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8100 (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	1941.0433	1.1300	2193.3789 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2595.4951	1.1300	2932.9094 (278)
Space and water heating			5126.2883 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	150.3062	1.5338	230.5446 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-494.7336	1.4947	-739.4931
PV Unit electricity exported	-524.6263	0.4608	-241.7480
Total			-981.2411 (283)
Total Primary energy kWh/year			4505.6926 (286)
Target Primary Energy Rate (TPER)			72.8300 (287)

APPENDIX B

SAP 10 CALCULATIONS FOR THE BE CLEAN CASE

Block Compliance

Block Reference	32 Norwich Road	Issued on Date	18/09/2023
Block Name			
Calculation Type	New Build (As Designed)		
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

Block Compliance Report - DER				
Block Reference: 32 Norwich Road		Block Name:		
Property-Assessment Reference	Floor area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
001 - 01 Be Clean	101.23	2.80	12.31	77.25 %
002 - 02 Be Clean	98.22	2.87	11.14	74.24 %
003 - 03 Be Clean	61.87	3.53	13.81	74.44 %
Totals:	261.32	9.20	37.26	
Average DER = 3.00 kgCO ₂ /m ²	% DER/TER	PASS		
Average TER = 12.23 kgCO ₂ /m ²	75.47 %			

Block Compliance Report - DFEE				
Block Reference: 32 Norwich Road		Block Name:		
Property-Assessment Reference	Floor area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
001 - 01 Be Clean	101.23	27.79	40.74	31.78 %
002 - 02 Be Clean	98.22	25.92	34.19	24.20 %
003 - 03 Be Clean	61.87	28.76	37.30	22.89 %
Totals:	261.32	82.48	112.24	
Average DFEE = 27.32 kgCO ₂ /m ²	% DFEE/TFEE	PASS		
Average TFEE = 37.47 kgCO ₂ /m ²	27.08 %			

Block Compliance Report - DPER				
Block Reference: 32 Norwich Road		Block Name:		
Property-Assessment Reference	Floor area (m ²)	DPER (kWh/m ² /yr)	TPER (kWh/m ² /yr)	% DPER/TPER
001 - 01 Be Clean	101.23	29.78	64.63	53.92 %
002 - 02 Be Clean	98.22	30.62	58.49	47.65 %
003 - 03 Be Clean	61.87	37.73	72.83	48.19 %
Totals:	261.32	98.13	195.95	

Block Compliance



Average DPER = 31.98 kgCO ₂ /m ²	% DPER/TPER	PASS
Average TPER = 64.26 kgCO ₂ /m ²	50.24 %	

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Property Reference	001	Issued on Date	12/09/2023
Assessment Reference	01 Be Clean	Prop Type Ref	
Property	Flat 1, 32, Norwich Road, Northwood, HA6 1NB		
SAP Rating	87 B	DER	2.80
Environmental	97 A	TER	12.31
CO ₂ Emissions (t/year)	0.26	% DER < TER	77.25
Compliance Check	See BREL	DFEE	27.79
% DPER < TPER	53.92	TFEE	40.74
		% DFEE < TFEE	31.78
		DPER	29.78
		TPER	64.63
Assessor Details	Mrs. Nicola Battista		Assessor ID
Client			L706-0001

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	101.2300 (1b)	x 2.6000 (2b)	= 263.1980 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.1980 (5)

2. Ventilation rate

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

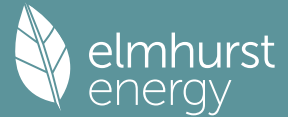
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												85.5000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2207	0.2178	0.2149	0.2004	0.1975	0.1829	0.1829	0.1800	0.1888	0.1975	0.2033	0.2091 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.80)			17.0700	0.7752	13.2326		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Heatloss Floor 1			101.2300	0.1000	10.1230	110.0000	11135.3000 (28a)

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External Wall 1	96.8200	17.0700	79.7500	0.1400	11.1650	60.0000	4785.0000 (29a)
External Wall 2	26.4700	1.8900	24.5800	0.1300	3.1954	190.0000	4670.2000 (29a)
Total net area of external elements Aum(A, m2)			224.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	40.3620			(33)
Party Ceiling 1			101.2300			20.0000	2024.6000 (32b)
Internal Wall 1			172.9000			9.0000	1556.1000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24171.2000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 238.7751 (35)

List of Thermal Bridges							
K1 Element			Length	Psi-value		Total	
E16 Corner (normal)			18.2000	0.0340		0.6188	
E17 Corner (inverted - internal area greater than external area)			7.8000	-0.0630		-0.4914	
E2 Other lintels (including other steel lintels)			12.1200	0.0500		0.6060	
E3 Sill			11.2200	0.0060		0.0673	
E4 Jamb			22.1000	0.0100		0.2210	
E5 Ground floor (normal)			46.6900	0.0600		2.8014	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						3.8231 (36)	
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	44.1851 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	19.1706	18.9182	18.6658	17.4036	17.1512	15.8891	15.8891	15.6367	16.3939	17.1512	17.6561	18.1609 (38)	
Average = Sum(39)m / 12 =	63.3557	63.1033	62.8508	61.5887	61.3363	60.0742	60.0742	59.8218	60.5790	61.3363	61.8411	62.3460 (39)	61.5256

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.6259	0.6234	0.6209	0.6084	0.6059	0.5934	0.5934	0.5909	0.5984	0.6059	0.6109	0.6159 (40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7506 (42)
Hot water usage for mixer showers													
Hot water usage for baths	70.3387	69.2817	67.7413	64.7942	62.6192	60.1938	58.8152	60.3438	62.0196	64.6238	67.6342	70.0692 (42a)	
Hot water usage for other uses	30.3712	29.9201	29.2849	28.1138	27.2368	26.2644	25.7392	26.3699	27.0567	28.0972	29.2925	30.2685 (42b)	
Average daily hot water use (litres/day)	42.7991	41.2428	39.6865	38.1301	36.5738	35.0175	35.0175	36.5738	38.1301	39.6865	41.2428	42.7991 (42c)	131.9171 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	143.5090	140.4446	136.7127	131.0381	126.4299	121.4757	119.5718	123.2876	127.2064	132.4074	138.1695	143.1369 (44)	
Energy content (annual)	227.2832	199.9912	210.1224	179.3846	170.1989	149.3686	144.6118	152.6558	156.8582	179.6756	196.8478	224.1177 (45)	
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2191.1158

Water storage loss:													
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.6480 (55)
Total storage loss													

If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)	
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	270.6336	239.1464	253.4728	221.3366	213.5493	191.3206	187.9622	196.0062	198.8102	223.0260	238.7998	267.4681 (62)	
WWHRS	-61.9458	-54.7853	-57.3681	-47.5030	-44.2711	-37.8831	-35.5094	-37.7607	-39.1953	-46.2070	-52.3469	-60.7986 (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)	

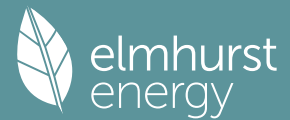
Output from w/h	208.6879	184.3611	196.1047	173.8336	169.2782	153.4375	152.4528	158.2455	159.6149	176.8191	186.4529	206.6695 (64)	
12Total per year (kWh/year)												2125.9576 (64)	2126 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month	110.2520	97.8212	104.5460	93.2070	91.2715	83.2266	82.7637	85.4384	85.7169	94.4225	99.0135	109.1995 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312 (66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	138.2012	153.0085	138.2012	142.8079	138.2012	142.8079	138.2012	138.2012	142.8079	138.2012	142.8079	138.2012 (67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	258.3010	260.9814	254.2270	239.8476	221.6963	204.6366	193.2397	190.5593	197.3137	211.6931	229.8444	246.9041 (68)	

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Pumps, fans	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250 (71)
Total internal gains	148.1882	145.5673	140.5188	129.4541	122.6767	115.5926	111.2416	114.8365	119.0513	126.9119	137.5187	146.7735 (72)
	608.9498	623.8165	597.2064	576.3690	546.8336	527.2964	506.9418	507.8564	523.4323	541.0655	574.4304	596.1381 (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			0.8800	11.2829	0.6800	0.7000	0.7700	3.2753 (75)				
Southeast			6.0800	36.7938	0.6800	0.7000	0.7700	73.7936 (77)				
Northwest			10.1100	11.2829	0.6800	0.7000	0.7700	37.6282 (81)				
Solar gains	114.6971	208.9580	321.9937	459.4550	569.8396	590.0046	558.7208	472.6560	369.0113	240.6735	139.8549	96.5558 (83)
Total gains	723.6468	832.7746	919.2000	1035.8240	1116.6732	1117.3011	1065.6626	980.5124	892.4436	781.7390	714.2853	692.6939 (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	105.9766	106.4006	106.8279	109.0171	109.4657	111.7655	111.7655	112.2371	110.8341	109.4657	108.5721	107.6929
alpha	8.0651	8.0934	8.1219	8.2678	8.2977	8.4510	8.4510	8.4825	8.3889	8.2977	8.2381	8.1795
util living area	0.9847	0.9569	0.8865	0.7055	0.5099	0.3441	0.2480	0.2806	0.4679	0.7833	0.9551	0.9882 (86)
Living	20.6457	20.7612	20.8734	20.9491	20.9615	20.9631	20.9631	20.9633	20.9625	20.9390	20.7996	20.6296
Non living	19.9930	20.1372	20.2710	20.3622	20.3758	20.3886	20.3886	20.3910	20.3836	20.3559	20.1958	19.9808
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.8188	20.7612	20.8734	20.9491	20.9615	20.9631	20.9631	20.9633	20.9625	20.9390	20.7996	20.6814 (87)
Th 2	20.4068	20.4090	20.4113	20.4224	20.4247	20.4359	20.4359	20.4382	20.4314	20.4247	20.4202	20.4157 (88)
util rest of house	0.9810	0.9476	0.8668	0.6754	0.4787	0.3138	0.2162	0.2464	0.4296	0.7485	0.9439	0.9853 (89)
MIT 2	20.2418	20.1372	20.2710	20.3622	20.3758	20.3886	20.3886	20.3910	20.3836	20.3559	20.1958	20.0592 (90)
Living area fraction									fLA = Living area / (4) =			0.3746 (91)
MIT	20.4579	20.3710	20.4967	20.5821	20.5952	20.6038	20.6038	20.6054	20.6004	20.5743	20.4220	20.2923 (92)
Temperature adjustment												0.0000
adjusted MIT	20.4579	20.3710	20.4967	20.5821	20.5952	20.6038	20.6038	20.6054	20.6004	20.5743	20.4220	20.2923 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9813	0.9469	0.8698	0.6838	0.4879	0.3228	0.2257	0.2566	0.4410	0.7578	0.9440	0.9845 (94)
Useful gains	710.1351	788.5471	799.5481	708.3027	544.8652	360.6568	240.5263	251.5723	393.5601	592.4079	674.2567	681.9767 (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	1023.6977	976.2677	879.7027	719.4834	545.5983	360.6741	240.5269	251.5742	393.7902	611.7895	823.8474	1003.2892 (97)
Space heating kWh	233.2906	126.1483	59.6350	8.0501	0.5454	0.0000	0.0000	0.0000	0.0000	14.4199	107.7053	239.0565 (98a)
Space heating requirement - total per year (kWh/year)												788.8510
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	233.2906	126.1483	59.6350	8.0501	0.5454	0.0000	0.0000	0.0000	0.0000	14.4199	107.7053	239.0565 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												788.8510
Space heating per m2										(98c) / (4) =		7.7927 (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 %)												258.4921 (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	233.2906	126.1483	59.6350	8.0501	0.5454	0.0000	0.0000	0.0000	0.0000	14.4199	107.7053	239.0565 (98)
Space heating efficiency (main heating system 1)	258.4921	258.4921	258.4921	258.4921	258.4921	0.0000	0.0000	0.0000	0.0000	258.4921	258.4921	258.4921 (210)
Space heating fuel (main heating system)												

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Space heating efficiency (main heating system 2)	90.2505	48.8016	23.0703	3.1143	0.2110	0.0000	0.0000	0.0000	0.0000	0.0000	5.5785	41.6668	92.4811 (211)
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	0.0000 (212)
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	0.0000 (213)
Water heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	208.6879	184.3611	196.1047	173.8336	169.2782	153.4375	152.4528	158.2455	159.6149	176.8191	186.4529	206.6695	(64)
Efficiency of water heater	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	(216)
Fuel for water heating, kWh/month	117.8484	104.1108	110.7425	98.1658	95.5933	86.6478	86.0918	89.3630	90.1363	99.8517	105.2920	116.7086	(217)
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	(219)
Pumps and Fa	15.8994	14.3607	15.8994	15.3865	15.8994	15.3865	15.8994	15.8994	15.3865	15.8994	15.3865	15.8994	(221)
Lighting	34.0408	27.3088	24.5885	18.0146	13.9150	11.3687	12.6937	16.4998	21.4316	28.1194	31.7608	34.9869	(231)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(232)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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 hydro-electric generators (Appendix M) (negative quantity)	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 used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	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 generated by PVs (Appendix M) (negative quantity)	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 wind turbines (Appendix M) (negative quantity)	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 hydro-electric generators (Appendix M) (negative quantity)	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 used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	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)
Annual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Space heating fuel - main system 1													305.1741 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													177.0817
Water heating fuel used													1200.5520 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5830)													
mechanical ventilation fans (SFP = 0.5830)													187.2022 (230a)
Total electricity for the above, kWh/year													187.2022 (231)
Electricity for lighting (calculated in Appendix L)													274.7287 (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													1967.6571 (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	305.1741	0.1594	48.6468 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1200.5520	0.1407	168.9283 (264)
Space and water heating			217.5751 (265)
Pumps, fans and electric keep-hot	187.2022	0.1387	25.9673 (267)
Energy for lighting	274.7287	0.1443	39.6518 (268)
Total CO2, kg/year			283.1942 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.8000 (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	305.1741	1.5900	485.2217 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1200.5520	1.5203	1825.1756 (278)
Space and water heating			2310.3974 (279)
Pumps, fans and electric keep-hot	187.2022	1.5128	283.1995 (281)
Energy for lighting	274.7287	1.5338	421.3881 (282)
Total Primary energy kWh/year			3014.9850 (286)
Dwelling Primary energy Rate (DPER)			29.7800 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	101.2300 (1b)	x 2.6000 (2b)	= 263.1980 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.1980 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1520 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4020 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3115 (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	0.3972	0.3894	0.3816	0.3427	0.3349	0.2960	0.2960	0.2882	0.3115	0.3349	0.3505	0.3661 (22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.8900	1.0000	1.8900		(26)					
TER Opening Type (Uw = 1.20)			17.0700	1.1450	19.5458		(27)					
Heatloss Floor 1			101.2300	0.1300	13.1599		(28a)					
External Wall 1	96.8200	17.0700	79.7500	0.1800	14.3550		(29a)					
External Wall 2	26.4700	1.8900	24.5800	0.1800	4.4244		(29a)					
Total net area of external elements Aum(A, m2)			224.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.3751		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							248.7751 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E16 Corner (normal)				18.2000	0.0900	1.6380						
E17 Corner (inverted - internal area greater than external area)				7.8000	-0.0900	-0.7020						
E2 Other lintels (including other steel lintels)				12.1200	0.0500	0.6060						
E3 Sill				11.2200	0.0500	0.5610						
E4 Jamb				22.1000	0.0500	1.1050						
E5 Ground floor (normal)				46.6900	0.1600	7.4704						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6784 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	64.0535 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.2793	Feb 50.0132	Mar 49.7524	Apr 48.5275	May 48.2983	Jun 47.2315	Jul 47.2315	Aug 47.0339	Sep 47.6424	Oct 48.2983	Nov 48.7620	Dec 49.2467 (38)
Heat transfer coeff	114.3328	114.0667	113.8059	112.5810	112.3518	111.2850	111.2850	111.0874	111.6959	112.3518	112.8155	113.3002 (39)
Average = Sum(39)m / 12 =												112.5799
HLP	Jan 1.1294	Feb 1.1268	Mar 1.1242	Apr 1.1121	May 1.1099	Jun 1.0993	Jul 1.0993	Aug 1.0974	Sep 1.1034	Oct 1.1099	Nov 1.1144	Dec 1.1192 (40)
HLP (average)												1.1121

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Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7506 (42)
Hot water usage for mixer showers												
70.3387	69.2817	67.7413	64.7942	62.6192	60.1938	58.8152	60.3438	62.0196	64.6238	67.6342	70.0692	(42a)
Hot water usage for baths												
30.3712	29.9201	29.2849	28.1138	27.2368	26.2644	25.7392	26.3699	27.0567	28.0972	29.2925	30.2685	(42b)
Hot water usage for other uses												
42.7991	41.2428	39.6865	38.1301	36.5738	35.0175	35.0175	36.5738	38.1301	39.6865	41.2428	42.7991	(42c)
Average daily hot water use (litres/day)												131.9171 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	143.5090	140.4446	136.7127	131.0381	126.4299	121.4757	119.5718	123.2876	127.2064	132.4074	138.1695	143.1369 (44)
Energy conte	227.2832	199.9912	210.1224	179.3846	170.1989	149.3686	144.6118	152.6558	156.8582	179.6756	196.8478	224.1177 (45)
Energy content (annual)										Total = Sum(45)m =		2191.1158
Distribution loss (46)m = 0.15 x (45)m												
34.0925	29.9987	31.5184	26.9077	25.5298	22.4053	21.6918	22.8984	23.5287	26.9513	29.5272	33.6177	(46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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												
276.5259	244.4685	259.3651	227.0388	219.4416	197.0228	193.8544	201.8985	204.5124	228.9183	244.5020	273.3604	(62)
WWHRS	-32.1559	-28.4390	-29.7796	-24.6587	-22.9810	-19.6650	-18.4328	-19.6015	-20.3462	-23.9859	-27.1732	-31.5604 (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	244.3700	216.0295	229.5854	202.3801	196.4606	177.3577	175.4216	182.2970	184.1662	204.9324	217.3288	241.8000 (64)
								Total per year (kWh/year) = Sum(64)m =				2472.1291 (64)
12Total per year (kWh/year)												2472 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
114.9658	102.0789	109.2598	97.7687	95.9853	87.7884	87.4776	90.1522	90.2787	99.1363	103.5752	113.9133	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
134.5683	148.9863	134.5683	139.0539	134.5683	139.0539	134.5683	134.5683	139.0539	134.5683	139.0539	134.5683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
258.3010	260.9814	254.2270	239.8476	221.6963	204.6366	193.2397	190.5593	197.3137	211.6931	229.8444	246.9041	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	(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)												
-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	(71)
Water heating gains (Table 5)												
154.5239	151.9031	146.8546	135.7899	129.0125	121.9283	117.5774	121.1723	125.3871	133.2477	143.8545	153.1092	(72)
Total internal gains	614.6526	629.1302	602.9093	581.9508	552.5364	529.8782	509.6447	510.5593	526.0141	546.7684	580.0122	601.8410 (73)

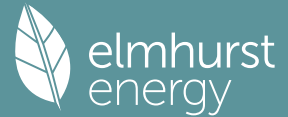
6. Solar gains												

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	Specific data											
	or Table 6c											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
Northeast	0.8800				11.2829			0.6300	0.7000		0.7700	3.0344 (75)
Southeast	6.0800				36.7938			0.6300	0.7000		0.7700	68.3676 (77)
Northwest	10.1100				11.2829			0.6300	0.7000		0.7700	34.8614 (81)

Solar gains	106.2635	193.5935	298.3177	425.6715	527.9396	546.6219	517.6384	437.9019	341.8781	222.9769	129.5715	89.4561 (83)
Total gains	720.9161	822.7237	901.2269	1007.6223	1080.4761	1076.5001	1027.2831	948.4612	867.8922	769.7453	709.5836	691.2971 (84)

7. Mean internal temperature (heating season)												

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.1847	61.3274	61.4679	62.1367	62.2635	62.8604	62.8604	62.9722	62.6291	62.2635	62.0076	61.7423
alpha	5.0790	5.0885	5.0979	5.1424	5.1509	5.1907	5.1907	5.1981	5.1753	5.1509	5.1338	5.1162
util living area	0.9956	0.9907	0.9787	0.9345	0.8231	0.6332	0.4713	0.5286	0.7845	0.9569	0.9906	0.9964 (86)
MIT	19.7284	19.9095	20.1795	20.5498	20.8334	20.9672	20.9941	20.9896	20.9037	20.5375	20.0742	19.7015 (87)
Th 2	19.9769	19.9790	19.9811	19.9909	19.9928	20.0014	20.0014	20.0030	19.9981	19.9928	19.9891	19.9852 (88)
util rest of house	0.9941	0.9876	0.9715	0.9125	0.7697	0.5461	0.3672	0.4192	0.7054	0.9378	0.9870	0.9952 (89)
MIT 2	18.5040	18.7358	19.0783	19.5388	19.8553	19.9831	19.9995	19.9994	19.9339	19.5346	18.9541	18.4755 (90)
Living area fraction	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	18.9348 (92)
MIT	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	18.9348 (93)
Temperature adjustment	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	18.9348 (93)
adjusted MIT	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	18.9348 (93)
8. Space heating requirement												
Utilisation	0.9921	0.9844	0.9671	0.9106	0.7829	0.5777	0.4063	0.4603	0.7310	0.9359	0.9840	0.9935 (94)
Useful gains	715.2292	809.9069	871.5612	917.5497	845.9389	621.8889	417.3815	436.6039	634.4512	720.3731	698.2151	686.8256 (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	1676.4198	1628.3586	1478.4323	1240.3585	957.4294	640.0824	419.7754	441.0510	692.2030	1046.0264	1384.6627	1669.4507 (97)
Space heating kWh	715.1258	549.9995	451.5121	232.4223	82.9489	0.0000	0.0000	0.0000	0.0000	242.2861	494.2423	731.0731 (98a)
Space heating requirement - total per year (kWh/year)												3499.6102
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	715.1258	549.9995	451.5121	232.4223	82.9489	0.0000	0.0000	0.0000	0.0000	242.2861	494.2423	731.0731 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3499.6102
Space heating per m2										(98c) / (4) =		34.5709 (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	715.1258	549.9995	451.5121	232.4223	82.9489	0.0000	0.0000	0.0000	0.0000	242.2861	494.2423	731.0731 (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)	774.7841	595.8825	489.1789	251.8119	89.8689	0.0000	0.0000	0.0000	0.0000	262.4985	535.4737	792.0619 (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	244.3700	216.0295	229.5854	202.3801	196.4606	177.3577	175.4216	182.2970	184.1662	204.9324	217.3288	241.8000 (64)
Efficiency of water heater	86.3205	86.0627	85.5478	84.3710	82.2755	79.8000	79.8000	79.8000	79.8000	84.4363	85.8431	79.8000 (216)
Fuel for water heating, kWh/month	283.0960	251.0141	268.3711	239.8693	238.7837	222.2528	219.8266	228.4423	230.7847	242.7066	253.1699	279.9300 (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	27.9606	22.4311	20.1967	14.7970	11.4296	9.3381	10.4265	13.5527	17.6036	23.0969	26.0879	28.7377 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-33.6816	-48.6199	-71.5264	-82.3502	-90.4239	-84.9516	-83.8741	-78.3684	-68.9440	-56.4308	-37.4184	-28.9859 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-15.7253	-33.4116	-67.0369	-101.6194	-135.2969	-136.3146	-134.7452	-113.6912	-82.7858	-48.1288	-21.1046	-12.4131 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	3791.5603 (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	2958.2471 (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)	225.6583 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1667.8488 (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	5393.6169 (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	3791.5603	0.2100	796.2277 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2958.2471	0.2100	621.2319 (264)
Space and water heating			1417.4596 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	225.6583	0.1443	32.5695 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-765.5752	0.1341	-102.6670
PV Unit electricity exported	-902.2736	0.1256	-113.3424
Total			-216.0093 (269)
Total CO2, kg/year			1245.9489 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3100 (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	3791.5603	1.1300	4284.4632 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2958.2471	1.1300	3342.8192 (278)
Space and water heating			7627.2823 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	225.6583	1.5338	346.1223 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-765.5752	1.4956	-1144.9943
PV Unit electricity exported	-902.2736	0.4611	-416.0321
Total			-1561.0264 (283)
Total Primary energy kWh/year			6542.4790 (286)
Target Primary Energy Rate (TPER)			64.6300 (287)

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Property Reference	002	Issued on Date	12/09/2023
Assessment Reference	02 Be Clean	Prop Type Ref	
Property	Flat 2, 32, Norwich Road, Northwood, HA6 1NB		
SAP Rating	87 B	DER	2.87
Environmental	97 A	TER	11.14
CO ₂ Emissions (t/year)	0.27	% DER < TER	74.24
Compliance Check	See BREL	DFEE	25.92
% DPER < TPER	47.65	TFEE	34.19
		% DFEE < TFEE	24.20
		TPER	58.49
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9600 (1b)	x 2.6000 (2b)	= 111.6960 (1b) -
First floor	55.2600 (1c)	x 2.7000 (2c)	= 149.2020 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	260.8980 (5)

2. Ventilation rate

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

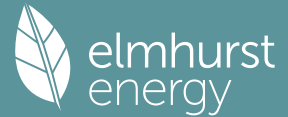
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												85.5000 (23c)
Effective ac	0.2207	0.2178	0.2149	0.2004	0.1975	0.1829	0.1829	0.1800	0.1888	0.1975	0.2033	0.2091 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.80)			10.6400	0.7752	8.2481		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)

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External Wall 1	36.4000	6.9600	29.4400	0.1400	4.1216	60.0000	1766.4000 (29a)
External Wall 2	14.1400	1.8900	12.2500	0.1300	1.5925	190.0000	2327.5000 (29a)
External Wall 3	7.6800	3.6800	4.0000	0.1400	0.5600	9.0000	36.0000 (29a)
External Wall 4	63.3300		63.3300	0.1400	8.8662	9.0000	569.9700 (29a)
External Roof 1	34.8000		34.8000	0.0900	3.1320	9.0000	313.2000 (30)
External Roof 2	24.7600		24.7600	0.1400	3.4664	9.0000	222.8400 (30)
External Roof 3	21.0800		21.0800	0.0900	1.8972	9.0000	189.7200 (30)
External Roof 4	6.2000		6.2000	0.1400	0.8680	9.0000	55.8000 (30)
Total net area of external elements Aum(A, m2)			208.3900				(31)
Fabric heat loss, W/K = Sum(A x U)			(26)...(30) + (32) =	35.3980			(33)
Party Wall 1		19.7600	0.0000	0.0000	180.0000	3556.8000	(32)
Party Floor 1		42.9600			40.0000	1718.4000	(32d)
Party Floor 2		26.1100			40.0000	1044.4000	(32d)
Party Ceiling 1		101.2300			20.0000	2024.6000	(32b)
Internal Wall 1		179.2600			9.0000	1613.3400	(32c)
Internal Floor 1		28.0000			18.0000	504.0000	(32d)
Internal Ceiling 1		42.9600			9.0000	386.6400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16329.6100 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 166.2554 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E18 Party wall between dwellings	2.6000	0.0210	0.0546
E2 Other lintels (including other steel lintels)	9.2500	0.0500	0.4625
E3 Sill	8.3500	0.0140	0.1169
E4 Jamb	16.9000	0.0150	0.2535
E6 Intermediate floor within a dwelling	17.5200	0.0090	0.1577
E7 Party floor between dwellings (in blocks of flats)	35.2500	0.0310	1.0927
E11 Eaves (insulation at rafter level)	23.3200	0.0330	0.7696
E14 Flat roof	5.8000	0.0530	0.3074
E16 Corner (normal)	34.4000	0.0360	1.2384
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0610	-1.3176
E18 Party wall between dwellings	5.2000	0.0210	0.1092
P2 Party wall - Intermediate floor within a dwelling	17.5200	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	23.4100	0.0310	0.7257
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.7000	0.4800	1.2960

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

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 40.6646 (37)

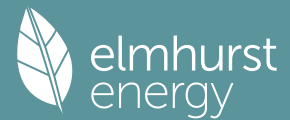
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	19.0031	18.7529	18.5026	17.2516	17.0013	15.7502	15.7502	15.5000	16.2507	17.0013	17.5018	18.0022 (38)
Heat transfer coeff	59.6676	59.4174	59.1672	57.9161	57.6659	56.4148	56.4148	56.1646	56.9152	57.6659	58.1663	58.6668 (39)
Average = Sum(39)m / 12 =												57.8536
HLP	0.6075	0.6049	0.6024	0.5897	0.5871	0.5744	0.5744	0.5718	0.5795	0.5871	0.5922	Dec 0.5973 (40)
HLP (average)												0.5890
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7224 (42)
Hot water usage for mixer showers	69.8659	68.8160	67.2860	64.3586	62.1983	59.7892	58.4198	59.9382	61.6027	64.1894	67.1796	69.5982 (42a)
Hot water usage for baths	30.1678	29.7198	29.0889	27.9256	27.0545	26.0886	25.5669	26.1934	26.8756	27.9091	29.0964	30.0659 (42b)
Hot water usage for other uses	42.5104	40.9645	39.4187	37.8729	36.3270	34.7812	34.7812	36.3270	37.8729	39.4187	40.9645	42.5104 (42c)
Average daily hot water use (litres/day)												131.0302 (43)
Daily hot water use	142.5441	139.5003	135.7936	130.1571	125.5799	120.6590	118.7679	122.4586	126.3511	131.5172	137.2405	142.1744 (44)
Energy conte	225.7550	198.6466	208.7097	178.1785	169.0546	148.3643	143.6395	151.6294	155.8035	178.4675	195.5242	222.6108 (45)
Energy content (annual)										Total = Sum(45)m =		2176.3837
Distribution loss (46)m = 0.15 x (45)m	33.8633	29.7970	31.3064	26.7268	25.3582	22.2546	21.5459	22.7444	23.3705	26.7701	29.3286	33.3916 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage												
Primary loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)
Combi 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)
Total heat required for water heating calculated for each month	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)
WWHRS	269.1054	237.8018	252.0601	220.1305	212.4050	190.3163	186.9899	194.9798	197.7555	221.8179	237.4762	265.9612 (62)
PV diverter	-61.5294	-54.4171	-56.9824	-47.1837	-43.9735	-37.6285	-35.2707	-37.5068	-38.9319	-45.8964	-51.9950	-60.3899 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	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)
	207.5761	183.3847	195.0776	172.9468	168.4315	152.6878	151.7192	157.4730	158.8237	175.9216	185.4812	205.5713 (64)
Total per year (kWh/year) = Sum(64)m =												2115.0944 (64)

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12Total per year (kWh/year)	2115 (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 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	109.7439	97.3741	104.0763	92.8060	90.8910	82.8927	82.4404	85.0971	85.3663	94.0208	108.6984 (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	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.2480	165.2389	149.2480	154.2230	149.2480	154.2230	149.2480	149.2480	154.2230	149.2480	154.2230	149.2480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	253.4176	256.0473	249.4206	235.3131	217.5049	200.7677	189.5863	186.9566	193.5833	207.6908	225.4990	242.2362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	(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)	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	(71)
Water heating gains (Table 5)	147.5052	144.9020	139.8875	128.8972	122.1653	115.1288	110.8071	114.3778	118.5643	126.3720	136.9075	146.1000	(72)
Total internal gains	614.0072	630.0246	602.3924	582.2696	552.7546	533.9559	513.4778	514.4188	530.2069	547.1472	580.4658	601.4206	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			

Southeast				7.9200	36.7938	0.6800	0.7000	0.7700	96.1259 (77)			
Southwest				0.8800	36.7938	0.6800	0.7000	0.7700	10.6807 (79)			
Northwest				1.8400	11.2829	0.6800	0.7000	0.7700	6.8483 (81)			

Solar gains	113.6548	195.8709	274.0412	349.6777	400.9120	402.0789	385.9548	347.1101	300.1374	218.1082	136.5465	96.9968 (83)
Total gains	727.6620	825.8955	876.4336	931.9473	953.6666	936.0347	899.4326	861.5289	830.3444	765.2554	717.0123	698.4174 (84)

7. Mean internal temperature (heating season)

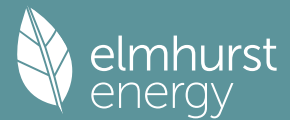
Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)	
tau	Jan 76.0212	Feb 76.3413	Mar 76.6641	Apr 78.3202	May 78.6601	Jun 80.4045	Jul 80.4045	Aug 80.7627	Sep 79.6975	Oct 78.6601	Nov 77.9833	Dec 77.3181	
alpha	6.0681	6.0894	6.1109	6.2213	6.2440	6.3603	6.3603	6.3842	6.3132	6.2440	6.1989	6.1545	
util living area	0.9551	0.9137	0.8500	0.7157	0.5555	0.3852	0.2759	0.2998	0.4707	0.7391	0.9071	0.9618	(86)
Living	20.5611	20.6890	20.8037	20.9064	20.9418	20.9505	20.9511	20.9512	20.9484	20.9061	20.7457	20.5446	
Non living	19.9083	20.0666	20.2052	20.3317	20.3704	20.3900	20.3904	20.3929	20.3836	20.3353	20.1477	19.8961	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.7755	20.6890	20.8037	20.9064	20.9418	20.9505	20.9511	20.9512	20.9484	20.9061	20.7457	20.6083	(87)
Th 2	20.4233	20.4256	20.4278	20.4393	20.4416	20.4531	20.4531	20.4554	20.4485	20.4416	20.4370	20.4324	(88)
util rest of house	0.9480	0.9018	0.8316	0.6889	0.5239	0.3525	0.2417	0.2643	0.4339	0.7081	0.8926	0.9556	(89)
MIT 2	20.2180	20.0666	20.2052	20.3317	20.3704	20.3900	20.3904	20.3929	20.3836	20.3353	20.1477	19.9928	(90)
Living area fraction									fLA = Living area / (4) =			0.2749	(91)
MIT	20.3712	20.2377	20.3697	20.4897	20.5274	20.5441	20.5445	20.5464	20.5389	20.4922	20.3121	20.1620	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3712	20.2377	20.3697	20.4897	20.5274	20.5441	20.5445	20.5464	20.5389	20.4922	20.3121	20.1620	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9473	0.8975	0.8296	0.6914	0.5288	0.3579	0.2474	0.2703	0.4399	0.7110	0.8891	0.9523	(94)
Useful gains	689.3305	741.2589	727.0811	644.3369	504.2821	335.0185	222.5075	232.8409	365.2954	544.1162	637.4866	665.1341	(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	958.9321	911.3247	820.6329	671.2281	509.0419	335.3329	222.5307	232.8810	366.4695	570.4407	768.4967	936.4374	(97)
Space heating kWh	200.5836	114.2842	69.6026	19.3616	3.5413	0.0000	0.0000	0.0000	0.0000	19.5855	94.3272	201.8497	(98a)
Space heating requirement - total per year (kWh/year)												723.1357	
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	200.5836	114.2842	69.6026	19.3616	3.5413	0.0000	0.0000	0.0000	0.0000	19.5855	94.3272	201.8497	(98c)

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

(98c) / (4) = 723.1357
7.3624 (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 %)												257.5104 (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	200.5836	114.2842	69.6026	19.3616	3.5413	0.0000	0.0000	0.0000	0.0000	19.5855	94.3272	201.8497 (98)
Space heating efficiency (main heating system 1)	257.5104	257.5104	257.5104	257.5104	257.5104	0.0000	0.0000	0.0000	0.0000	257.5104	257.5104	257.5104 (210)
Space heating fuel (main heating system)	77.8934	44.3804	27.0290	7.5188	1.3752	0.0000	0.0000	0.0000	0.0000	7.6057	36.6304	78.3851 (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	207.5761	183.3847	195.0776	172.9468	168.4315	152.6878	151.7192	157.4730	158.8237	175.9216	185.4812	205.5713 (64)
Efficiency of water heater	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136 (216)
Fuel for water heating, kWh/month	117.0012	103.3657	109.9564	97.4823	94.9372	86.0632	85.5173	88.7604	89.5217	99.1590	104.5474	115.8712 (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	16.6525	15.0410	16.6525	16.1153	16.6525	16.1153	16.6525	16.6525	16.1153	16.6525	16.1153	16.6525 (231)
Lighting	36.5613	29.3308	26.4092	19.3485	14.9453	12.2105	13.6336	17.7215	23.0185	30.2015	34.1125	37.5774 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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)	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												280.8180 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.4136
Water heating fuel used												1192.1831 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.6160)												
mechanical ventilation fans (SFP = 0.6160)												196.0701 (230a)
Total electricity for the above, kWh/year												196.0701 (231)
Electricity for lighting (calculated in Appendix L)												295.0706 (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												1964.1417 (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	280.8180	0.1586	44.5320 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1192.1831	0.1407	167.7468 (264)
Space and water heating			212.2788 (265)
Pumps, fans and electric keep-hot	196.0701	0.1387	27.1973 (267)
Energy for lighting	295.0706	0.1443	42.5878 (268)
Total CO2, kg/year			282.0639 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.8700 (273)

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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	280.8180	1.5870	445.6522 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1192.1831	1.5203	1812.4380 (278)
Space and water heating			2258.0902 (279)
Pumps, fans and electric keep-hot	196.0701	1.5128	296.6148 (281)
Energy for lighting	295.0706	1.5338	452.5891 (282)
Total Primary energy kWh/year			3007.2941 (286)
Dwelling Primary energy Rate (DPER)			30.6200 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9600 (1b)	x 2.6000 (2b)	= 111.6960 (1b) -
First floor	55.2600 (1c)	x 2.7000 (2c)	= 149.2020 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.8980 (5)

2. Ventilation rate

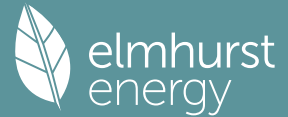
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1150 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3650 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2829 (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	0.3607	0.3536	0.3465	0.3112	0.3041	0.2687	0.2687	0.2617	0.2829	0.3041	0.3182	0.3324 (22b)
Effective ac	0.5650	0.5625	0.5600	0.5484	0.5462	0.5361	0.5361	0.5342	0.5400	0.5462	0.5506	0.5552 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			10.6400	1.1450	12.1832		(27)
External Wall 1	36.4000	6.9600	29.4400	0.1800	5.2992		(29a)
External Wall 2	14.1400	1.8900	12.2500	0.1800	2.2050		(29a)
External Wall 3	7.6800	3.6800	4.0000	0.1800	0.7200		(29a)
External Wall 4	63.3300		63.3300	0.1800	11.3994		(29a)
External Roof 1	34.8000		34.8000	0.1100	3.8280		(30)
External Roof 2	24.7600		24.7600	0.1100	2.7236		(30)
External Roof 3	21.0800		21.0800	0.1100	2.3188		(30)
External Roof 4	6.2000		6.2000	0.1100	0.6820		(30)

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Total net area of external elements Aum(A, m2)	208.3900	(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	43.2492 (33)
Party Wall 1	19.7600 0.0000 0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 176.5619 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E18 Party wall between dwellings	2.6000	0.0600	0.1560
E2 Other lintels (including other steel lintels)	9.2500	0.0500	0.4625
E3 Sill	8.3500	0.0500	0.4175
E4 Jamb	16.9000	0.0500	0.8450
E6 Intermediate floor within a dwelling	17.5200	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	35.2500	0.0700	2.4675
E11 Eaves (insulation at rafter level)	23.3200	0.0400	0.9328
E14 Flat roof	5.8000	0.0800	0.4640
E16 Corner (normal)	34.4000	0.0900	3.0960
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0900	-1.9440
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P2 Party wall - Intermediate floor within a dwelling	17.5200	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	23.4100	0.0700	1.6387
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.7000	0.1200	0.3240

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1720 (36)

Point Thermal bridges

(33a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 52.4212 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	48.6475	48.4301	48.2169	47.2159	47.0286	46.1567	46.1567	45.9953	46.4926	47.0286	47.4075	47.8036	(38)
Average = Sum(39)m / 12 =	101.0687	100.8513	100.6381	99.6371	99.4498	98.5780	98.5780	98.4165	98.9138	99.4498	99.8287	100.2248	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.0290	1.0268	1.0246	1.0144	1.0125	1.0036	1.0036	1.0020	1.0071	1.0125	1.0164	1.0204	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7224 (42)
Hot water usage for mixer showers	69.8659	68.8160	67.2860	64.3586	62.1983	59.7892	58.4198	59.9382	61.6027	64.1894	67.1796	69.5982 (42a)	
Hot water usage for baths	30.1678	29.7198	29.0889	27.9256	27.0545	26.0886	25.5669	26.1934	26.8756	27.9091	29.0964	30.0659 (42b)	
Hot water usage for other uses	42.5104	40.9645	39.4187	37.8729	36.3270	34.7812	34.7812	36.3270	37.8729	39.4187	40.9645	42.5104 (42c)	
Average daily hot water use (litres/day)													131.0302 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.5441	139.5003	135.7936	130.1571	125.5799	120.6590	118.7679	122.4586	126.3511	131.5172	137.2405	142.1744 (44)	
Energy content (annual)	225.7550	198.6466	208.7097	178.1785	169.0546	148.3643	143.6395	151.6294	155.8035	178.4675	195.5242	222.6108 (45)	
Distribution loss (46)m = 0.15 x (45)m	33.8633	29.7970	31.3064	26.7268	25.3582	22.2546	21.5459	22.7444	23.3705	26.7701	29.3286	33.3916 (46)	
Water storage loss:													
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5520 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)	
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	274.9977	243.1238	257.9523	225.8327	218.2973	196.0185	192.8822	200.8721	203.4577	227.7102	243.1784	271.8535 (62)	
WWHRS	-31.9398	-28.2478	-29.5795	-24.4930	-22.8266	-19.5329	-18.3089	-19.4697	-20.2094	-23.8247	-26.9905	-31.3483 (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	243.0579	214.8760	228.3729	201.3398	195.4707	176.4856	174.5732	181.4023	183.2483	203.8855	216.1879	240.5052 (64)	
													Total per year (kWh/year) = Sum(64)m = 2459.4054 (64)
12Total per year (kWh/year)													2459 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
													Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	114.4577	101.6318	108.7901	97.3677	95.6048	87.4545	87.1543	89.8109	89.9280	98.7346	103.1352	113.4122 (65)	

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

Metabolic gains (Table 5), Watts	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.0964	160.6424	145.0964	149.9329	145.0964	149.9329	145.0964	149.9329	145.0964	149.9329	145.0964	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	253.4176	256.0473	249.4206	235.3131	217.5049	200.7677	189.5863	186.9566	193.5833	207.6908	225.4990	242.2362 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	(71)
Water heating gains (Table 5)	153.8410	151.2378	146.2232	135.2329	128.5011	121.4646	117.1428	120.7136	124.9000	132.7078	143.2433	152.4358 (72)
Total internal gains	619.1913	634.7638	607.5766	587.3153	557.9387	536.0016	515.6619	516.6029	532.2526	552.3313	585.5115	606.6047 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Southeast				7.9200	36.7938	0.6300	0.7000	0.7700	89.0578 (77)						
Southwest				0.8800	36.7938	0.6300	0.7000	0.7700	9.8953 (79)						
Northwest				1.8400	11.2829	0.6300	0.7000	0.7700	6.3447 (81)						
Solar gains				105.2978	181.4686	253.8911	323.9661	371.4332	372.5142	357.5758	321.5873	278.0685	202.0708	126.5063	89.8647 (83)
Total gains				724.4892	816.2325	861.4676	911.2814	929.3719	908.5158	873.2376	838.1902	810.3212	754.4021	712.0179	696.4694 (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	47.6626	47.7654	47.8665	48.3474	48.4385	48.8669	48.8669	48.9471	48.7010	48.4385	48.2546	48.0639
alpha	4.1775	4.1844	4.1911	4.2232	4.2292	4.2578	4.2578	4.2631	4.2467	4.2292	4.2170	4.2043
util living area	0.9831	0.9712	0.9519	0.9025	0.8068	0.6418	0.4837	0.5214	0.7343	0.9118	0.9699	0.9855 (86)
MIT	19.5722	19.7832	20.0635	20.4373	20.7428	20.9295	20.9832	20.9769	20.8713	20.4910	19.9767	19.5372 (87)
Th 2	20.0592	20.0611	20.0629	20.0713	20.0729	20.0803	20.0803	20.0817	20.0775	20.0729	20.0697	20.0664 (88)
util rest of house	0.9794	0.9649	0.9410	0.8798	0.7619	0.5664	0.3884	0.4253	0.6657	0.8867	0.9622	0.9823 (89)
MIT 2	18.4006	18.6680	19.0208	19.4846	19.8380	20.0319	20.0729	20.0706	19.9796	19.5579	18.9212	18.3612 (90)
Living area fraction									fLA = Living area / (4) =			0.2749 (91)
MIT	18.7226	18.9745	19.3074	19.7465	20.0867	20.2787	20.3231	20.3198	20.2247	19.8144	19.2114	18.6845 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7226	18.9745	19.3074	19.7465	20.0867	20.2787	20.3231	20.3198	20.2247	19.8144	19.2114	18.6845 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9721	0.9555	0.9301	0.8706	0.7627	0.5835	0.4142	0.4510	0.6775	0.8784	0.9530	0.9757 (94)
Ext temp.	704.3072	779.9214	801.2449	793.3572	708.7965	530.1295	361.6521	378.0222	549.0088	662.6374	678.5186	679.5785 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1457.6776	1419.4357	1288.9138	1080.7143	834.0589	559.7904	367.0181	385.7697	605.8181	916.3672	1209.0634	1451.7061 (97)
Space heating requirement - total per year (kWh/year)	560.5076	429.7537	362.8257	206.8971	93.1952	0.0000	0.0000	0.0000	0.0000	188.7750	381.9923	574.4630 (98a)
Solar heating kWh												2798.4096
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	560.5076	429.7537	362.8257	206.8971	93.1952	0.0000	0.0000	0.0000	0.0000	188.7750	381.9923	574.4630 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2798.4096
Space heating per m2										(98c) / (4) =		28.4912 (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)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	560.5076	429.7537	362.8257	206.8971	93.1952	0.0000	0.0000	0.0000	0.0000	188.7750	381.9923	574.4630 (98)
Space heating fuel (main heating system)	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)

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607.2672	465.6053	393.0939	224.1572	100.9699	0.0000	0.0000	0.0000	0.0000	204.5233	413.8595	622.3867	(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												
243.0579	214.8760	228.3729	201.3398	195.4707	176.4856	174.5732	181.4023	183.2483	203.8855	216.1879	240.5052	(64)
Efficiency of water heater												
(217)m	85.8706	85.5826	85.0928	84.1209	82.4995	79.8000	79.8000	79.8000	79.8000	83.8875	79.8000	(216)
Fuel for water heating, kWh/month												
283.0513	251.0744	268.3809	239.3457	236.9357	221.1600	218.7634	227.3212	229.6344	243.0464	253.3782	279.8535	(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	(221)
Pumps and Fa												
7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting												
30.1482	24.1860	21.7768	15.9546	12.3238	10.0686	11.2422	14.6130	18.9809	24.9039	28.1289	30.9861	(232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-32.8104	-47.4200	-69.8318	-80.4717	-88.4149	-83.0844	-82.0531	-76.6689	-67.4200	-55.1078	-36.4803	(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	(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	(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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-15.1274	-32.1724	-64.6114	-98.0277	-130.5943	-131.6027	-130.0657	-109.6800	-79.7982	-46.3429	-20.3025	(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	(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	(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												
Space heating fuel - main system 2												
Space heating fuel - secondary												
Efficiency of water heater												
Water heating fuel used												
Space cooling fuel												
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												
Electricity for lighting (calculated in Appendix L)												
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												
Wind generation												
Hydro-electric generation (Appendix N)												
Electricity generated - Micro CHP (Appendix N)												
Appendix Q - special features												
Energy saved or generated												
Energy used												
Total delivered energy for all uses												

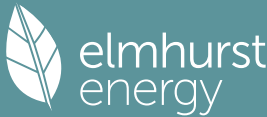
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3031.8630	0.2100	636.6912 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2951.9451	0.2100	619.9085 (264)
Space and water heating			1256.5997 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	243.3129	0.1443	35.1176 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-747.9946	0.1341	-100.2929
PV Unit electricity exported	-870.2619	0.1256	-109.3016
Total			-209.5944 (269)
Total CO2, kg/year			1094.0521 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1400 (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	3031.8630	1.1300	3426.0052 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2951.9451	1.1300	3335.6980 (278)
Space and water heating			6761.7032 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	243.3129	1.5338	373.2014 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-747.9946	1.4955	-1118.6390
PV Unit electricity exported	-870.2619	0.4610	-401.1992

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Total	-1519.8382 (283)
Total Primary energy kWh/year	5745.1673 (286)
Target Primary Energy Rate (TPER)	58.4900 (287)

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Property Reference	003	Issued on Date	18/09/2023
Assessment Reference	03 Be Clean	Prop Type Ref	01 - Be Lean
Property	Flat 3, 32, Norwich Road, Northwood, HA6 1NB		
SAP Rating	87 B	DER	3.53
Environmental	97 A	TER	13.81
CO ₂ Emissions (t/year)	0.21	% DER < TER	74.44
Compliance Check	See BREL	DFEE	28.76
% DPER < TPER	48.20	TFEE	37.30
		% DFEE < TFEE	22.89
		TPER	72.83
Assessor Details	Mrs. Nicola Battista		Assessor ID
Client			L706-0001

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8700 (1b)	x 2.6000 (2b)	= 160.8620 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 160.8620 (5)

2. Ventilation rate

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

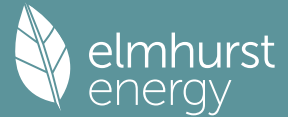
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												86.4000 (23c)
Effective ac	0.2162	0.2133	0.2104	0.1959	0.1930	0.1784	0.1784	0.1755	0.1842	0.1930	0.1988	0.2046 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.80)			20.0600	0.7752	15.5504		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
External Wall 1	57.8500	20.0600	37.7900	0.1400	5.2906	60.0000	2267.4000 (29a)

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External Wall 2	11.4400	1.8900	9.5500	0.1300	1.2415	190.0000	1814.5000 (29a)
External Roof 1	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m2)			106.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	28.0585			(33)
Party Wall 1			19.7600	0.0000	0.0000	180.0000	3556.8000 (32)
Party Floor 1			61.2500			40.0000	2450.0000 (32d)
Party Ceiling 1			24.7500			20.0000	495.0000 (32b)
Internal Wall 1			141.6000			9.0000	1274.4000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12191.1000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 197.0438 (35)

List of Thermal Bridges							
K1 Element	Length	Psi-value	Total				
E16 Corner (normal)	7.8000	0.0270	0.2106				
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0610	-0.1586				
E2 Other lintels (including other steel lintels)	14.3400	0.0500	0.7170				
E3 Sill	13.4400	0.0140	0.1882				
E4 Jamb	27.5000	0.0150	0.4125				
E7 Party floor between dwellings (in blocks of flats)	26.6500	0.0310	0.8261				
E18 Party wall between dwellings	5.2000	0.0210	0.1092				
E10 Eaves (insulation at ceiling level)	22.2500	0.0330	0.7343				
E12 Gable (insulation at ceiling level)	4.4000	0.0390	0.1716				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.5000	0.0000	0.0000				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.2109 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 31.2693 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	11.4779	11.3236	11.1693	10.3979	10.2436	9.4723	9.4723	9.3180	9.7808	10.2436	10.5522	10.8607 (38)
Average = Sum(39)m / 12 =	42.7472	42.5929	42.4386	41.6673	41.5130	40.7416	40.7416	40.5873	41.0502	41.5130	41.8215	42.1301 (39)
												41.6287
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6909	0.6884	0.6859	0.6735	0.6710	0.6585	0.6585	0.6560	0.6635	0.6710	0.6760	0.6809 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

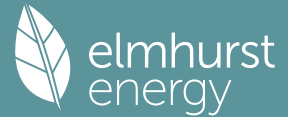
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0340 (42)
Hot water usage for mixer showers												
Hot water usage for baths	58.3228	57.4463	56.1691	53.7254	51.9220	49.9109	48.7678	50.0353	51.4248	53.5841	56.0803	58.0993 (42a)
Hot water usage for other uses	25.2039	24.8296	24.3025	23.3306	22.6029	21.7959	21.3600	21.8835	22.4534	23.3168	24.3088	25.1187 (42b)
Average daily hot water use (litres/day)	35.4600	34.1706	32.8811	31.5917	30.3022	29.0127	29.0127	30.3022	31.5917	32.8811	34.1706	35.4600 (42c)
												109.3761 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	118.9867	116.4465	113.3527	108.6477	104.8271	100.7196	99.1406	102.2210	105.4698	109.7821	114.5596	118.6781 (44)
Distribution loss (46)m = 0.15 x (45)m	188.4459	165.8183	174.2189	148.7332	141.1174	123.8465	119.9019	126.5709	130.0548	148.9732	163.2112	185.8212 (45)
												Total = Sum(45)m = 1816.7135
Water storage loss:	28.2669	24.8727	26.1328	22.3100	21.1676	18.5770	17.9853	18.9856	19.5082	22.3460	24.4817	27.8732 (46)
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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	231.7963	204.9735	217.5693	190.6852	184.4678	165.7985	163.2523	169.9213	172.0068	192.3236	205.1632	229.1716 (62)
WWHRS	-51.3636	-45.4264	-47.5679	-39.3881	-36.7083	-31.4116	-29.4433	-31.3100	-32.4996	-38.3134	-43.4045	-50.4124 (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	180.4327	159.5471	170.0014	151.2971	147.7595	134.3869	133.8090	138.6113	139.5072	154.0102	161.7587	178.7592 (64)
												Total per year (kWh/year) = Sum(64)m = 1849.8803 (64)
12Total per year (kWh/year)												1850 (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	97.3386	86.4587	92.6081	83.0154	81.6019	74.7405	74.5477	76.7652	76.8048	84.2139	87.8293	96.4659 (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

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(66)m	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.5976	99.1974	89.5976	92.5842	89.5976	92.5842	89.5976	89.5976	92.5842	89.5976	92.5842	89.5976	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.6373	179.4806	174.8355	164.9466	152.4637	140.7315	132.8937	131.0503	135.6954	145.5843	158.0673	169.7994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	(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)	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	(71)
Water heating gains (Table 5)	130.8314	128.6588	124.4733	115.2992	109.6799	103.8063	100.1985	103.1790	106.6734	113.1907	121.9852	129.6584	(72)
Total internal gains	451.5761	460.8465	442.4161	426.3397	405.2510	390.6317	376.1995	377.3367	388.4627	401.8824	426.1463	442.5652	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	0.8800	11.2829	0.6800	0.7000	0.7000	0.7700	3.2753 (75)
Southwest	0.8800	36.7938	0.6800	0.7000	0.7000	0.7700	10.6807 (79)
Northwest	18.3000	11.2829	0.6800	0.7000	0.7000	0.7700	68.1104 (81)

Solar gains	82.0663	163.5007	286.6907	460.7909	612.4810	650.4360	609.4513	489.8039	345.9585	197.6847	102.6146	67.4376	(83)
Total gains	533.6424	624.3472	729.1068	887.1306	1017.7319	1041.0677	985.6509	867.1406	734.4213	599.5671	528.7610	510.0028	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.2196	79.5066	79.7956	81.2728	81.5749	83.1194	83.1194	83.4353	82.4946	81.5749	80.9730	80.3800	
alpha	6.2813	6.3004	6.3197	6.4182	6.4383	6.5413	6.5413	6.5624	6.4996	6.4383	6.3982	6.3587	
util living area	0.9539	0.9000	0.7806	0.5617	0.3789	0.2504	0.1819	0.2153	0.3852	0.6934	0.9022	0.9618	(86)
Living	20.5951	20.7357	20.8706	20.9414	20.9509	20.9525	20.9525	20.9526	20.9516	20.9239	20.7698	20.5733	
Non living	19.8812	20.0522	20.2081	20.2929	20.3040	20.3167	20.3167	20.3191	20.3114	20.2796	20.1056	19.8623	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.7929	20.7357	20.8706	20.9414	20.9509	20.9525	20.9525	20.9526	20.9516	20.9239	20.7698	20.6329	(87)
Th 2	20.3489	20.3511	20.3533	20.3643	20.3665	20.3776	20.3776	20.3799	20.3732	20.3665	20.3621	20.3577	(88)
util rest of house	0.9454	0.8847	0.7558	0.5337	0.3532	0.2261	0.1561	0.1863	0.3504	0.6576	0.8846	0.9546	(89)
MIT 2	20.1624	20.0522	20.2081	20.2929	20.3040	20.3167	20.3167	20.3191	20.3114	20.2796	20.1056	19.9516	(90)
Living area fraction									f _{LA} = Living area / (4) =			0.4055	(91)
MIT	20.4181	20.3294	20.4767	20.5558	20.5663	20.5745	20.5745	20.5760	20.5710	20.5409	20.3750	20.2279	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4181	20.3294	20.4767	20.5558	20.5663	20.5745	20.5745	20.5760	20.5710	20.5409	20.3750	20.2279	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9464	0.8841	0.7607	0.5422	0.3613	0.2338	0.1643	0.1955	0.3614	0.6676	0.8850	0.9530	(94)
Useful gains	505.0154	551.9915	554.6314	481.0143	367.7314	243.3965	161.9273	169.4901	265.4084	400.2953	467.9354	486.0129	(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	689.0031	657.1816	593.1540	485.6668	368.0682	243.4103	161.9283	169.4931	265.6370	412.6757	555.1797	675.2562	(97)
Space heating kWh	136.8869	70.6877	28.6608	3.3498	0.2506	0.0000	0.0000	0.0000	0.0000	9.2110	62.8159	140.7970	(98a)
Space heating requirement - total per year (kWh/year)												452.6597	
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	136.8869	70.6877	28.6608	3.3498	0.2506	0.0000	0.0000	0.0000	0.0000	9.2110	62.8159	140.7970	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												452.6597	
Space heating per m ²										(98c) / (4) =		7.3163	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	246.3860	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	136.8869	70.6877	28.6608	3.3498	0.2506	0.0000	0.0000	0.0000	0.0000	9.2110	62.8159	140.7970	(98)
Space heating efficiency (main heating system 1)	246.3860	246.3860	246.3860	246.3860	246.3860	0.0000	0.0000	0.0000	0.0000	246.3860	246.3860	246.3860	(210)
Space heating fuel (main heating system)	55.5579	28.6898	11.6325	1.3596	0.1017	0.0000	0.0000	0.0000	0.0000	3.7385	25.4949	57.1449	(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	180.4327	159.5471	170.0014	151.2971	147.7595	134.3869	133.8090	138.6113	139.5072	154.0102	161.7587	178.7592	(64)
Efficiency of water heater	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	(216)
Fuel for water heating, kWh/month	104.3801	92.2978	98.3456	87.5252	85.4787	77.7426	77.4083	80.1864	80.7047	89.0947	93.5772	103.4119	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.7174	8.7770	9.7174	9.4039	9.7174	9.4039	9.7174	9.7174	9.4039	9.7174	9.4039	9.7174	(231)
Lighting	19.5706	15.7003	14.1363	10.3569	8.0000	6.5360	7.2978	9.4860	12.3214	16.1663	18.2598	20.1145	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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)	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													183.7197 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													172.8613
Water heating fuel used													1070.1532 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5830)													
mechanical ventilation fans (SFP = 0.5830)													114.4147 (230a)
Total electricity for the above, kWh/year													114.4147 (231)
Electricity for lighting (calculated in Appendix L)													157.9460 (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													1526.2336 (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	183.7197	0.1595	29.3067	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1070.1532	0.1406	150.4792	(264)
Space and water heating			179.7859	(265)
Pumps, fans and electric keep-hot	114.4147	0.1387	15.8707	(267)
Energy for lighting	157.9460	0.1443	22.7965	(268)
Total CO2, kg/year			218.4531	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5300	(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	183.7197	1.5904	292.1819	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1070.1532	1.5199	1626.5552	(278)
Space and water heating			1918.7371	(279)
Pumps, fans and electric keep-hot	114.4147	1.5128	173.0866	(281)
Energy for lighting	157.9460	1.5338	242.2628	(282)
Total Primary energy kWh/year			2334.0865	(286)

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Dwelling Primary energy Rate (DPER)

37.7300 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8700 (1b)	x 2.6000 (2b)	= 160.8620 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 160.8620 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1243 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3743 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2901 (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	0.3699	0.3626	0.3554	0.3191	0.3119	0.2756	0.2756	0.2683	0.2901	0.3119	0.3264	0.3409 (22b)
Effective ac	0.5684	0.5658	0.5631	0.5509	0.5486	0.5380	0.5380	0.5360	0.5421	0.5486	0.5533	0.5581 (25)

3. Heat losses and heat loss parameter

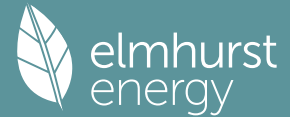
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			13.5900	1.1450	15.5611		(27)
External Wall 1	57.8500	13.5900	44.2600	0.1800	7.9668		(29a)
External Wall 2	11.4400	1.8900	9.5500	0.1800	1.7190		(29a)
External Roof 1	37.0000		37.0000	0.1100	4.0700		(30)
Total net area of external elements Aum(A, m ²)			106.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.2069		(33)
Party Wall 1			19.7600	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 201.0441 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340
E2 Other lintels (including other steel lintels)	14.3400	0.0500	0.7170
E3 Sill	13.4400	0.0500	0.6720
E4 Jamb	27.5000	0.0500	1.3750
E7 Party floor between dwellings (in blocks of flats)	26.6500	0.0700	1.8655
E18 Party wall between dwellings	5.2000	0.0600	0.3120
E10 Eaves (insulation at ceiling level)	22.2500	0.0600	1.3350
E12 Gable (insulation at ceiling level)	4.4000	0.0600	0.2640
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.5000	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.0085 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 38.2154 (37)

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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	30.1736	30.0326	29.8944	29.2452	29.1237	28.5583	28.5583	28.4536	28.7761	29.1237	29.3694	29.6263	(38)
Heat transfer coeff	68.3890	68.2480	68.1097	67.4605	67.3391	66.7736	66.7736	66.6689	66.9914	67.3391	67.5848	67.8417	(39)
Average = Sum(39)m / 12 =												67.4600	
HLP	1.1054	1.1031	1.1009	1.0904	1.0884	1.0793	1.0793	1.0776	1.0828	1.0884	1.0924	1.0965	(40)
HLP (average)												1.0903	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0340 (42)
Hot water usage for mixer showers	58.3228	57.4463	56.1691	53.7254	51.9220	49.9109	48.7678	50.0353	51.4248	53.5841	56.0803	58.0993	(42a)
Hot water usage for baths	25.2039	24.8296	24.3025	23.3306	22.6029	21.7959	21.3600	21.8835	22.4534	23.3168	24.3088	25.1187	(42b)
Hot water usage for other uses	35.4600	34.1706	32.8811	31.5917	30.3022	29.0127	29.0127	30.3022	31.5917	32.8811	34.1706	35.4600	(42c)
Average daily hot water use (litres/day)												109.3761	(43)
Daily hot water use	118.9867	116.4465	113.3527	108.6477	104.8271	100.7196	99.1406	102.2210	105.4698	109.7821	114.5596	118.6781	(44)
Energy conte	188.4459	165.8183	174.2189	148.7332	141.1174	123.8465	119.9019	126.5709	130.0548	148.9732	163.2112	185.8212	(45)
Energy content (annual)										Total = Sum(45)m =		1816.7135	
Distribution loss (46)m = 0.15 x (45)m	28.2669	24.8727	26.1328	22.3100	21.1676	18.5770	17.9853	18.9856	19.5082	22.3460	24.4817	27.8732	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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	237.6886	210.2955	223.4616	196.3874	190.3601	171.5007	169.1446	175.8136	177.7090	198.2159	210.8654	235.0639	(62)
WWHRS	-26.6627	-23.5807	-24.6924	-20.4463	-19.0552	-16.3057	-15.2840	-16.2530	-16.8705	-19.8884	-22.5312	-26.1690	(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	211.0258	186.7148	198.7692	175.9412	171.3049	155.1950	153.8606	159.5606	160.8385	178.3275	188.3342	208.8949	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2148.7671	(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	102.0524	90.7164	97.3219	87.5772	86.3157	79.3023	79.2615	81.4790	81.3666	88.9277	92.3911	101.1797	(65)

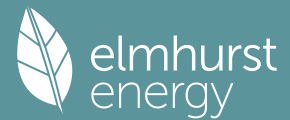
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.6331	99.2366	89.6331	92.6208	89.6331	92.6208	89.6331	89.6331	92.6208	89.6331	92.6208	89.6331	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.6373	179.4806	174.8355	164.9466	152.4637	140.7315	132.8937	131.0503	135.6954	145.5843	158.0673	169.7994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	(71)
Water heating gains (Table 5)	137.1672	134.9946	130.8090	121.6349	116.0157	110.1421	106.5343	109.5147	113.0091	119.5265	128.3209	135.9942	(72)
Total internal gains	460.9473	470.2215	451.7873	435.7121	414.6222	397.0041	382.5708	383.7079	394.8352	411.2536	435.5188	451.9364	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	0.6000	11.2829	0.6300	0.7000	0.7700	2.0689 (75)

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Southwest				0.6000		36.7938		0.6300		0.7000		0.7700		6.7468 (79)
Northwest				12.3900		11.2829		0.6300		0.7000		0.7700		42.7234 (81)
Solar gains	51.5391	102.6683	179.9944	289.2619	384.4584	408.2729	382.5511	307.4645	217.1918	124.1258	64.4414	42.3535 (83)		
Total gains	512.4864	572.8898	631.7818	724.9741	799.0806	805.2770	765.1219	691.1723	612.0270	535.3794	499.9602	494.2899 (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	50.5223	50.6267	50.7294	51.2176	51.3100	51.7445	51.7445	51.8257	51.5762	51.3100	51.1234	50.9298		
alpha	4.3682	4.3751	4.3820	4.4145	4.4207	4.4496	4.4496	4.4550	4.4384	4.4207	4.4082	4.3953		
util living area	0.9831	0.9714	0.9441	0.8602	0.7050	0.5153	0.3806	0.4370	0.6873	0.9063	0.9700	0.9854 (86)		
MIT	19.6789	19.8770	20.1896	20.5999	20.8693	20.9743	20.9946	20.9904	20.9135	20.5531	20.0566	19.6465 (87)		
Th 2	19.9965	19.9983	20.0001	20.0087	20.0103	20.0178	20.0178	20.0192	20.0149	20.0103	20.0071	20.0037 (88)		
util rest of house	0.9789	0.9644	0.9303	0.8286	0.6495	0.4421	0.2973	0.3470	0.6108	0.8771	0.9614	0.9818 (89)		
MIT 2	18.4778	18.7283	19.1182	19.6124	19.9020	20.0025	20.0158	20.0153	19.9552	19.5728	18.9639	18.4420 (90)		
Living area fraction									fLA = Living area / (4) =			0.4055 (91)		
MIT	18.9649	19.1942	19.5527	20.0129	20.2943	20.3966	20.4128	20.4107	20.3438	19.9703	19.4070	18.9304 (92)		
Temperature adjustment												0.0000		
adjusted MIT	18.9649	19.1942	19.5527	20.0129	20.2943	20.3966	20.4128	20.4107	20.3438	19.9703	19.4070	18.9304 (93)		
8. Space heating requirement														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9732	0.9574	0.9230	0.8287	0.6662	0.4709	0.3311	0.3834	0.6377	0.8757	0.9548	0.9766 (94)		
Useful gains	498.7680	548.4604	583.1181	600.7905	532.3220	379.1954	253.3198	264.9940	390.3017	468.8362	477.3704	482.7112 (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	1002.9153	975.5475	889.0143	749.6807	578.7321	387.0584	254.5927	267.3912	418.2805	630.9903	831.7669	999.3372 (97)		
Space heating kWh	375.0856	287.0025	227.5868	107.2010	34.5291	0.0000	0.0000	0.0000	0.0000	120.6426	255.1656	384.3698 (98a)		
Space heating requirement - total per year (kWh/year)												1791.5829		
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	375.0856	287.0025	227.5868	107.2010	34.5291	0.0000	0.0000	0.0000	0.0000	120.6426	255.1656	384.3698 (98c)		
Space heating requirement after solar contribution - total per year (kWh/year)												1791.5829		
Space heating per m2										(98c) / (4) =		28.9572 (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	375.0856	287.0025	227.5868	107.2010	34.5291	0.0000	0.0000	0.0000	0.0000	120.6426	255.1656	384.3698 (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)	406.3766	310.9453	246.5729	116.1441	37.4097	0.0000	0.0000	0.0000	0.0000	130.7071	276.4524	416.4353 (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	211.0258	186.7148	198.7692	175.9412	171.3049	155.1950	153.8606	159.5606	160.8385	178.3275	188.3342	208.8949 (64)		
Efficiency of water heater												79.8000 (216)		
(217)m	85.3349	85.0206	84.3642	82.9843	81.1802	79.8000	79.8000	79.8000	79.8000	83.2028	84.7414	85.4083 (217)		
Fuel for water heating, kWh/month														
	247.2915	219.6112	235.6085	212.0173	211.0180	194.4799	192.8078	199.9507	201.5521	214.3286	222.2457	244.5838 (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	18.6240	14.9408	13.4526	9.8559	7.6130	6.2199	6.9448	9.0272	11.7254	15.3844	17.3766	19.1416 (232)		
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-21.1448	-30.8254	-45.8087	-53.3199	-59.0858	-55.7477	-55.0797	-51.2182	-44.6629	-36.0655	-23.6094	-18.1654 (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)		

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-9.0518	-19.3108	-38.8787	-59.1191	-78.8708	-79.4864	-78.5366	-66.1653	-48.0716	-27.8396	-12.1588	-7.1369		(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													1941.0433	(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													2595.4951	(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)													150.3062	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1019.3599	(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													3753.4846	(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	1941.0433	0.2100	407.6191 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2595.4951	0.2100	545.0540 (264)
Space and water heating			952.6730 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	150.3062	0.1443	21.6938 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-494.7336	0.1339	-66.2313
PV Unit electricity exported	-524.6263	0.1255	-65.8614
Total			-132.0926 (269)
Total CO2, kg/year			854.2035 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8100 (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	1941.0433	1.1300	2193.3789 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2595.4951	1.1300	2932.9094 (278)
Space and water heating			5126.2883 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	150.3062	1.5338	230.5446 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-494.7336	1.4947	-739.4931
PV Unit electricity exported	-524.6263	0.4608	-241.7480
Total			-981.2411 (283)
Total Primary energy kWh/year			4505.6926 (286)
Target Primary Energy Rate (TPER)			72.8300 (287)

APPENDIX C

SAP 10 CALCULATIONS FOR THE BE GREEN CASE

Block Compliance

Block Reference	32 Norwich Road	Issued on Date	18/09/2023
Block Name			
Calculation Type	New Build (As Designed)		
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

Block Compliance Report - DER				
Block Reference: 32 Norwich Road		Block Name:		
Property-Assessment Reference	Floor area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
001 - 01 Be Green	101.23	-0.47	12.31	103.82 %
002 - 02 Be Green	98.22	-0.41	11.14	103.68 %
003 - 03 Be Green	61.87	0.26	13.81	98.12 %
Totals:	261.32		37.26	
Average DER = N/A	% DER/TER	N/A		
Average TER = N/A	N/A			

Block Compliance Report - DFEE				
Block Reference: 32 Norwich Road		Block Name:		
Property-Assessment Reference	Floor area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
001 - 01 Be Green	101.23	27.79	40.74	31.78 %
002 - 02 Be Green	98.22	25.92	34.19	24.20 %
003 - 03 Be Green	61.87	28.76	37.30	22.89 %
Totals:	261.32	82.48	112.24	
Average DFEE = 27.32 kgCO ₂ /m ²	% DFEE/TFEE	PASS		
Average TFEE = 37.47 kgCO ₂ /m ²	27.08 %			

Block Compliance Report - DPER				
Block Reference: 32 Norwich Road		Block Name:		
Property-Assessment Reference	Floor area (m ²)	DPER (kWh/m ² /yr)	TPER (kWh/m ² /yr)	% DPER/TPER
001 - 01 Be Green	101.23	-7.24	64.63	111.20 %
002 - 02 Be Green	98.22	-6.60	58.49	111.28 %
003 - 03 Be Green	61.87	0.68	72.83	99.07 %
Totals:	261.32		195.95	

Block Compliance



Average DPER = N/A	% DPER/TPER	N/A
Average TPER = N/A	N/A	

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Property Reference	001	Issued on Date	15/09/2023
Assessment Reference	01 Be Green	Prop Type Ref	
Property	Flat 1, 32, Norwich Road, Northwood, HA6 1NB		
SAP Rating	104 A	DER	-0.47
Environmental	101 A	% DER < TER	103.82
CO ₂ Emissions (t/year)	-0.08	DFEE	27.79
Compliance Check	See BREL	% DFEE < TFEE	31.78
% DPER < TPER	111.20	DPER	-7.24
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	101.2300 (1b)	x 2.6000 (2b)	= 263.1980 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.1980 (5)

2. Ventilation rate

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

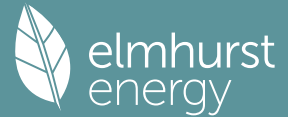
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												85.5000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2207	0.2178	0.2149	0.2004	0.1975	0.1829	0.1829	0.1800	0.1888	0.1975	0.2033	0.2091 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.80)			17.0700	0.7752	13.2326		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Heatloss Floor 1			101.2300	0.1000	10.1230	110.0000	11135.3000 (28a)

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External Wall 1	96.8200	17.0700	79.7500	0.1400	11.1650	60.0000	4785.0000 (29a)
External Wall 2	26.4700	1.8900	24.5800	0.1300	3.1954	190.0000	4670.2000 (29a)
Total net area of external elements Aum(A, m2)			224.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	40.3620			(33)
Party Ceiling 1			101.2300			20.0000	2024.6000 (32b)
Internal Wall 1			172.9000			9.0000	1556.1000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24171.2000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 238.7751 (35)

List of Thermal Bridges							
K1 Element			Length	Psi-value		Total	
E16 Corner (normal)			18.2000	0.0340		0.6188	
E17 Corner (inverted - internal area greater than external area)			7.8000	-0.0630		-0.4914	
E2 Other lintels (including other steel lintels)			12.1200	0.0500		0.6060	
E3 Sill			11.2200	0.0060		0.0673	
E4 Jamb			22.1000	0.0100		0.2210	
E5 Ground floor (normal)			46.6900	0.0600		2.8014	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						3.8231 (36)	
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	44.1851 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	19.1706	18.9182	18.6658	17.4036	17.1512	15.8891	15.8891	15.6367	16.3939	17.1512	17.6561	18.1609 (38)	
Average = Sum(39)m / 12 =	63.3557	63.1033	62.8508	61.5887	61.3363	60.0742	60.0742	59.8218	60.5790	61.3363	61.8411	62.3460 (39)	61.5256

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.6259	0.6234	0.6209	0.6084	0.6059	0.5934	0.5934	0.5909	0.5984	0.6059	0.6109	0.6159 (40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7506 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													131.9171 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	143.5090	140.4446	136.7127	131.0381	126.4299	121.4757	119.5718	123.2876	127.2064	132.4074	138.1695	143.1369 (44)	
Energy content (annual)	227.2832	199.9912	210.1224	179.3846	170.1989	149.3686	144.6118	152.6558	156.8582	179.6756	196.8478	224.1177 (45)	
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2191.1158
Water storage loss:													
Store volume	34.0925	29.9987	31.5184	26.9077	25.5298	22.4053	21.6918	22.8984	23.5287	26.9513	29.5272	33.6177 (46)	
a) If manufacturer declared loss factor is known (kWh/day):													180.0000 (47)
Temperature factor from Table 2b													1.2000 (48)
Enter (49) or (54) in (55)													0.5400 (49)
Total storage loss													0.6480 (55)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)	
Primary loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)	
Combi 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)	
Total heat required for water heating calculated for each month	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)	
WWHRS	270.6336	239.1464	253.4728	221.3366	213.5493	191.3206	187.9622	196.0062	198.8102	223.0260	238.7998	267.4681 (62)	
PV diverter	-61.9458	-54.7853	-57.3681	-47.5030	-44.2711	-37.8831	-35.5094	-37.7607	-39.1953	-46.2070	-52.3469	-60.7986 (63a)	
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
Output from w/h	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)	
Total per year (kWh/year) = Sum(64)m =	208.6879	184.3611	196.1047	173.8336	169.2782	153.4375	152.4528	158.2455	159.6149	176.8191	186.4529	206.6695 (64)	
Electric shower(s)													2125.9576 (64)
Heat gains from water heating, kWh/month	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 =	110.2520	97.8212	104.5460	93.2070	91.2715	83.2266	82.7637	85.4384	85.7169	94.4225	99.0135	109.1995 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312 (66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	138.2012	153.0085	138.2012	142.8079	138.2012	142.8079	138.2012	138.2012	142.8079	138.2012	142.8079	138.2012 (67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	258.3010	260.9814	254.2270	239.8476	221.6963	204.6366	193.2397	190.5593	197.3137	211.6931	229.8444	246.9041 (68)	

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Pumps, fans	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	(71)
Total internal gains	148.1882	145.5673	140.5188	129.4541	122.6767	115.5926	111.2416	114.8365	119.0513	126.9119	137.5187	146.7735	(72)
	608.9498	623.8165	597.2064	576.3690	546.8336	527.2964	506.9418	507.8564	523.4323	541.0655	574.4304	596.1381	(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			0.8800	11.2829	0.6800	0.7000	0.7700	3.2753 (75)				
Southeast			6.0800	36.7938	0.6800	0.7000	0.7700	73.7936 (77)				
Northwest			10.1100	11.2829	0.6800	0.7000	0.7700	37.6282 (81)				

Solar gains	114.6971	208.9580	321.9937	459.4550	569.8396	590.0046	558.7208	472.6560	369.0113	240.6735	139.8549	96.5558 (83)
Total gains	723.6468	832.7746	919.2000	1035.8240	1116.6732	1117.3011	1065.6626	980.5124	892.4436	781.7390	714.2853	692.6939 (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	105.9766	106.4006	106.8279	109.0171	109.4657	111.7655	111.7655	112.2371	110.8341	109.4657	108.5721	107.6929	
alpha	8.0651	8.0934	8.1219	8.2678	8.2977	8.4510	8.4510	8.4825	8.3889	8.2977	8.2381	8.1795	
util living area	0.9847	0.9569	0.8865	0.7055	0.5099	0.3441	0.2480	0.2806	0.4679	0.7833	0.9551	0.9882	(86)
Living	20.6457	20.7612	20.8734	20.9491	20.9615	20.9631	20.9631	20.9633	20.9625	20.9390	20.7996	20.6296	
Non living	19.9930	20.1372	20.2710	20.3622	20.3758	20.3886	20.3886	20.3910	20.3836	20.3559	20.1958	19.9808	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8188	20.7612	20.8734	20.9491	20.9615	20.9631	20.9631	20.9633	20.9625	20.9390	20.7996	20.6814	(87)
Th 2	20.4068	20.4090	20.4113	20.4224	20.4247	20.4359	20.4359	20.4382	20.4314	20.4247	20.4202	20.4157	(88)
util rest of house	0.9810	0.9476	0.8668	0.6754	0.4787	0.3138	0.2162	0.2464	0.4296	0.7485	0.9439	0.9853	(89)
MIT 2	20.2418	20.1372	20.2710	20.3622	20.3758	20.3886	20.3886	20.3910	20.3836	20.3559	20.1958	20.0592	(90)
Living area fraction													
MIT	20.4579	20.3710	20.4967	20.5821	20.5952	20.6038	20.6038	20.6054	20.6004	20.5743	20.4220	20.2923	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4579	20.3710	20.4967	20.5821	20.5952	20.6038	20.6038	20.6054	20.6004	20.5743	20.4220	20.2923	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9813	0.9469	0.8698	0.6838	0.4879	0.3228	0.2257	0.2566	0.4410	0.7578	0.9440	0.9845	(94)
Useful gains	710.1351	788.5471	799.5481	708.3027	544.8652	360.6568	240.5263	251.5723	393.5601	592.4079	674.2567	681.9767	(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	1023.6977	976.2677	879.7027	719.4834	545.5983	360.6741	240.5269	251.5742	393.7902	611.7895	823.8474	1003.2892	(97)
Space heating kWh	233.2906	126.1483	59.6350	8.0501	0.5454	0.0000	0.0000	0.0000	0.0000	14.4199	107.7053	239.0565	(98a)
Space heating requirement - total per year (kWh/year)												788.8510	
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	233.2906	126.1483	59.6350	8.0501	0.5454	0.0000	0.0000	0.0000	0.0000	14.4199	107.7053	239.0565	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												788.8510	
Space heating per m2										(98c) / (4) =		7.7927	(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 %)												258.4921	(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	233.2906	126.1483	59.6350	8.0501	0.5454	0.0000	0.0000	0.0000	0.0000	14.4199	107.7053	239.0565	(98)
Space heating efficiency (main heating system 1)	258.4921	258.4921	258.4921	258.4921	258.4921	0.0000	0.0000	0.0000	0.0000	258.4921	258.4921	258.4921	(210)
Space heating fuel (main heating system)													

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90.2505	48.8016	23.0703	3.1143	0.2110	0.0000	0.0000	0.0000	0.0000	0.0000	5.5785	41.6668	92.4811 (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	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	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	0.0000 (215)
Water heating												
Water heating requirement												
208.6879	184.3611	196.1047	173.8336	169.2782	153.4375	152.4528	158.2455	159.6149	176.8191	186.4529	206.6695	(64)
Efficiency of water heater												
(217)m	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	177.0817	(216)
Fuel for water heating, kWh/month												
117.8484	104.1108	110.7425	98.1658	95.5933	86.6478	86.0918	89.3630	90.1363	99.8517	105.2920	116.7086	(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	(221)
Pumps and Fa												
15.8994	14.3607	15.8994	15.3865	15.8994	15.3865	15.8994	15.8994	15.3865	15.8994	15.3865	15.8994	(231)
Lighting												
34.0408	27.3088	24.5885	18.0146	13.9150	11.3687	12.6937	16.4998	21.4316	28.1194	31.7608	34.9869	(232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-68.3009	-116.9738	-205.6450	-282.0241	-351.5767	-346.4383	-341.2293	-296.2679	-227.9998	-151.3146	-81.6306	(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	(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	(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	(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	(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	(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	(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												305.1741 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.0817
Water heating fuel used												1200.5520 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5830)												
mechanical ventilation fans (SFP = 0.5830)												187.2022 (230a)
Total electricity for the above, kWh/year												187.2022 (231)
Electricity for lighting (calculated in Appendix L)												274.7287 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2526.1090 (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												-558.4519 (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	305.1741	0.1594	48.6468 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1200.5520	0.1407	168.9283 (264)
Space and water heating			217.5751 (265)
Pumps, fans and electric keep-hot	187.2022	0.1387	25.9673 (267)
Energy for lighting	274.7287	0.1443	39.6518 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2526.1090	0.1309	-330.6455
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-330.6455 (269)
Total CO2, kg/year			-47.4513 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.4700 (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	305.1741	1.5900	485.2217 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1200.5520	1.5203	1825.1756 (278)
Space and water heating			2310.3974 (279)
Pumps, fans and electric keep-hot	187.2022	1.5128	283.1995 (281)
Energy for lighting	274.7287	1.5338	421.3881 (282)
Energy saving/generation technologies			

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PV Unit electricity used in dwelling	-2526.1090	1.4835	-3747.5665
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-3747.5665 (283)
Total Primary energy kWh/year			-732.5815 (286)
Dwelling Primary energy Rate (DPER)			-7.2400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	101.2300 (1b)	x 2.6000 (2b)	= 263.1980 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.1980 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1520 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4020	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3115 (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	0.3972	0.3894	0.3816	0.3427	0.3349	0.2960	0.2960	0.2882	0.3115	0.3349	0.3505	0.3661 (22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670 (25)

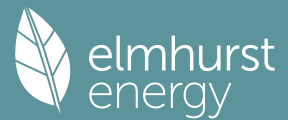
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			17.0700	1.1450	19.5458		(27)
Heatloss Floor 1			101.2300	0.1300	13.1599		(28a)
External Wall 1	96.8200	17.0700	79.7500	0.1800	14.3550		(29a)
External Wall 2	26.4700	1.8900	24.5800	0.1800	4.4244		(29a)
Total net area of external elements Aum(A, m ²)			224.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.3751		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 248.7751 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	18.2000	0.0900	1.6380
E17 Corner (inverted - internal area greater than external area)	7.8000	-0.0900	-0.7020
E2 Other lintels (including other steel lintels)	12.1200	0.0500	0.6060
E3 Sill	11.2200	0.0500	0.5610
E4 Jamb	22.1000	0.0500	1.1050
E5 Ground floor (normal)	46.6900	0.1600	7.4704
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.6784 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	64.0535 (37)

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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	50.2793	50.0132	49.7524	48.5275	48.2983	47.2315	47.2315	47.0339	47.6424	48.2983	48.7620	49.2467	(38)
Heat transfer coeff	114.3328	114.0667	113.8059	112.5810	112.3518	111.2850	111.2850	111.0874	111.6959	112.3518	112.8155	113.3002	(39)
Average = Sum(39)m / 12 =												112.5799	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1294	1.1268	1.1242	1.1121	1.1099	1.0993	1.0993	1.0974	1.1034	1.1099	1.1144	1.1192	(40)
HLP (average)												1.1121	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7506 (42)
Hot water usage for mixer showers	70.3387	69.2817	67.7413	64.7942	62.6192	60.1938	58.8152	60.3438	62.0196	64.6238	67.6342	70.0692	(42a)
Hot water usage for baths	30.3712	29.9201	29.2849	28.1138	27.2368	26.2644	25.7392	26.3699	27.0567	28.0972	29.2925	30.2685	(42b)
Hot water usage for other uses	42.7991	41.2428	39.6865	38.1301	36.5738	35.0175	35.0175	36.5738	38.1301	39.6865	41.2428	42.7991	(42c)
Average daily hot water use (litres/day)												131.9171	(43)
Daily hot water use	143.5090	140.4446	136.7127	131.0381	126.4299	121.4757	119.5718	123.2876	127.2064	132.4074	138.1695	143.1369	(44)
Energy content (annual)	227.2832	199.9912	210.1224	179.3846	170.1989	149.3686	144.6118	152.6558	156.8582	179.6756	196.8478	224.1177	(45)
Distribution loss (46)m = 0.15 x (45)m	34.0925	29.9987	31.5184	26.9077	25.5298	22.4053	21.6918	22.8984	23.5287	26.9513	29.5272	33.6177	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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	276.5259	244.4685	259.3651	227.0388	219.4416	197.0228	193.8544	201.8985	204.5124	228.9183	244.5020	273.3604	(62)
WWHRS	-32.1559	-28.4390	-29.7796	-24.6587	-22.9810	-19.6650	-18.4328	-19.6015	-20.3462	-23.9859	-27.1732	-31.5604	(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	244.3700	216.0295	229.5854	202.3801	196.4606	177.3577	175.4216	182.2970	184.1662	204.9324	217.3288	241.8000	(64)
12Total per year (kWh/year)												2472.1291	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	114.9658	102.0789	109.2598	97.7687	95.9853	87.7884	87.4776	90.1522	90.2787	99.1363	103.5752	113.9133	(65)

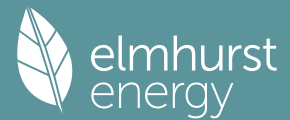
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	137.5312	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.5683	148.9863	134.5683	139.0539	134.5683	139.0539	134.5683	134.5683	139.0539	134.5683	139.0539	134.5683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.3010	260.9814	254.2270	239.8476	221.6963	204.6366	193.2397	190.5593	197.3137	211.6931	229.8444	246.9041	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	36.7531	(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)	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	-110.0250	(71)
Water heating gains (Table 5)	154.5239	151.9031	146.8546	135.7899	129.0125	121.9283	117.5774	121.1723	125.3871	133.2477	143.8545	153.1092	(72)
Total internal gains	614.6526	629.1302	602.9093	581.9508	552.5364	529.8782	509.6447	510.5593	526.0141	546.7684	580.0122	601.8410	(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	0.8800	11.2829	0.6300	0.7000	0.7700	3.0344 (75)
Southeast	6.0800	36.7938	0.6300	0.7000	0.7700	68.3676 (77)

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Northwest			10.1100		11.2829		0.6300		0.7000		0.7700		34.8614 (81)	
Solar gains	106.2635	193.5935	298.3177	425.6715	527.9396	546.6219	517.6384	437.9019	341.8781	222.9769	129.5715	89.4561 (83)		
Total gains	720.9161	822.7237	901.2269	1007.6223	1080.4761	1076.5001	1027.2831	948.4612	867.8922	769.7453	709.5836	691.2971 (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	61.1847	61.3274	61.4679	62.1367	62.2635	62.8604	62.8604	62.9722	62.6291	62.2635	62.0076	61.7423		
alpha	5.0790	5.0885	5.0979	5.1424	5.1509	5.1907	5.1907	5.1981	5.1753	5.1509	5.1338	5.1162		
util living area	0.9956	0.9907	0.9787	0.9345	0.8231	0.6332	0.4713	0.5286	0.7845	0.9569	0.9906	0.9964 (86)		
MIT	19.7284	19.9095	20.1795	20.5498	20.8334	20.9672	20.9941	20.9896	20.9037	20.5375	20.0742	19.7015 (87)		
Th 2	19.9769	19.9790	19.9811	19.9909	19.9928	20.0014	20.0014	20.0030	19.9981	19.9928	19.9891	19.9852 (88)		
util rest of house	0.9941	0.9876	0.9715	0.9125	0.7697	0.5461	0.3672	0.4192	0.7054	0.9378	0.9870	0.9952 (89)		
MIT 2	18.5040	18.7358	19.0783	19.5388	19.8553	19.9831	19.9995	19.9994	19.9339	19.5346	18.9541	18.4755 (90)		
Living area fraction	fLA = Living area / (4) =													
MIT	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	18.9348 (92)		
Temperature adjustment	0.0000													
adjusted MIT	18.9626	19.1755	19.4908	19.9175	20.2217	20.3517	20.3721	20.3703	20.2972	19.9103	19.3737	18.9348 (93)		

8. Space heating requirement														

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9921	0.9844	0.9671	0.9106	0.7829	0.5777	0.4063	0.4603	0.7310	0.9359	0.9840	0.9935 (94)		
Useful gains	715.2292	809.9069	871.5612	917.5497	845.9389	621.8889	417.3815	436.6039	634.4512	720.3731	698.2151	686.8256 (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	1676.4198	1628.3586	1478.4323	1240.3585	957.4294	640.0824	419.7754	441.0510	692.2030	1046.0264	1384.6627	1669.4507 (97)		
Space heating kWh	715.1258	549.9995	451.5121	232.4223	82.9489	0.0000	0.0000	0.0000	0.0000	242.2861	494.2423	731.0731 (98a)		
Space heating requirement - total per year (kWh/year)	3499.6102													
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	715.1258	549.9995	451.5121	232.4223	82.9489	0.0000	0.0000	0.0000	0.0000	242.2861	494.2423	731.0731 (98c)		
Space heating requirement after solar contribution - total per year (kWh/year)	3499.6102													
Space heating per m2	(98c) / (4) = 34.5709 (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	715.1258	549.9995	451.5121	232.4223	82.9489	0.0000	0.0000	0.0000	0.0000	242.2861	494.2423	731.0731 (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)	774.7841	595.8825	489.1789	251.8119	89.8689	0.0000	0.0000	0.0000	0.0000	262.4985	535.4737	792.0619 (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	244.3700	216.0295	229.5854	202.3801	196.4606	177.3577	175.4216	182.2970	184.1662	204.9324	217.3288	241.8000 (64)		
Efficiency of water heater (217)m	86.3205	86.0627	85.5478	84.3710	82.2755	79.8000	79.8000	79.8000	79.8000	84.4363	85.8431	79.8000 (216)		
Fuel for water heating, kWh/month	283.0960	251.0141	268.3711	239.8693	238.7837	222.2528	219.8266	228.4423	230.7847	242.7066	253.1699	279.9300 (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	27.9606	22.4311	20.1967	14.7970	11.4296	9.3381	10.4265	13.5527	17.6036	23.0969	26.0879	28.7377 (232)		
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-33.6816	-48.6199	-71.5264	-82.3502	-90.4239	-84.9516	-83.8741	-78.3684	-68.9440	-56.4308	-37.4184	-28.9859 (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)														

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(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-15.7253	-33.4116	-67.0369	-101.6194	-135.2969	-136.3146	-134.7452	-113.6912	-82.7858	-48.1288	-21.1046	-12.4131	(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													3791.5603 (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													2958.2471 (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)													225.6583 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1667.8488 (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													5393.6169 (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	3791.5603	0.2100	796.2277	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2958.2471	0.2100	621.2319	(264)
Space and water heating			1417.4596	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	225.6583	0.1443	32.5695	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-765.5752	0.1341	-102.6670	
PV Unit electricity exported	-902.2736	0.1256	-113.3424	
Total			-216.0093	(269)
Total CO2, kg/year			1245.9489	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3100	(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	3791.5603	1.1300	4284.4632	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2958.2471	1.1300	3342.8192	(278)
Space and water heating			7627.2823	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	225.6583	1.5338	346.1223	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-765.5752	1.4956	-1144.9943	
PV Unit electricity exported	-902.2736	0.4611	-416.0321	
Total			-1561.0264	(283)
Total Primary energy kWh/year			6542.4790	(286)
Target Primary Energy Rate (TPER)			64.6300	(287)

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Property Reference	002	Issued on Date	15/09/2023
Assessment Reference	02 Be Green	Prop Type Ref	
Property	Flat 2, 32, Norwich Road, Northwood, HA6 1NB		
SAP Rating	104 A	DER	-0.41
Environmental	100 A	TER	11.14
CO ₂ Emissions (t/year)	-0.07	% DER < TER	103.68
Compliance Check	See BREL	DFEE	25.92
% DPER < TPER	111.29	TFEE	34.19
		% DFEE < TFEE	24.20
		DPER	-6.60
		TPER	58.49
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9600 (1b)	x 2.6000 (2b)	= 111.6960 (1b) -
First floor	55.2600 (1c)	x 2.7000 (2c)	= 149.2020 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	260.8980 (5)

2. Ventilation rate

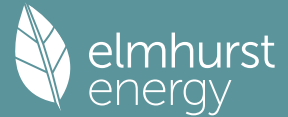
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												85.5000 (23c)
Effective ac	0.2207	0.2178	0.2149	0.2004	0.1975	0.1829	0.1829	0.1800	0.1888	0.1975	0.2033	0.2091 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.80)			10.6400	0.7752	8.2481		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)

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External Wall 1	36.4000	6.9600	29.4400	0.1400	4.1216	60.0000	1766.4000 (29a)
External Wall 2	14.1400	1.8900	12.2500	0.1300	1.5925	190.0000	2327.5000 (29a)
External Wall 3	7.6800	3.6800	4.0000	0.1400	0.5600	9.0000	36.0000 (29a)
External Wall 4	63.3300		63.3300	0.1400	8.8662	9.0000	569.9700 (29a)
External Roof 1	34.8000		34.8000	0.0900	3.1320	9.0000	313.2000 (30)
External Roof 2	24.7600		24.7600	0.1400	3.4664	9.0000	222.8400 (30)
External Roof 3	21.0800		21.0800	0.0900	1.8972	9.0000	189.7200 (30)
External Roof 4	6.2000		6.2000	0.1400	0.8680	9.0000	55.8000 (30)
Total net area of external elements Aum(A, m2)			208.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	35.3980			(33)
Party Wall 1		19.7600	0.0000	0.0000	180.0000	3556.8000	(32)
Party Floor 1		42.9600			40.0000	1718.4000	(32d)
Party Floor 2		26.1100			40.0000	1044.4000	(32d)
Party Ceiling 1		101.2300			20.0000	2024.6000	(32b)
Internal Wall 1		179.2600			9.0000	1613.3400	(32c)
Internal Floor 1		28.0000			18.0000	504.0000	(32d)
Internal Ceiling 1		42.9600			9.0000	386.6400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16329.6100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 166.2554 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E18 Party wall between dwellings	2.6000	0.0210	0.0546
E2 Other lintels (including other steel lintels)	9.2500	0.0500	0.4625
E3 Sill	8.3500	0.0140	0.1169
E4 Jamb	16.9000	0.0150	0.2535
E6 Intermediate floor within a dwelling	17.5200	0.0090	0.1577
E7 Party floor between dwellings (in blocks of flats)	35.2500	0.0310	1.0927
E11 Eaves (insulation at rafter level)	23.3200	0.0330	0.7696
E14 Flat roof	5.8000	0.0530	0.3074
E16 Corner (normal)	34.4000	0.0360	1.2384
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0610	-1.3176
E18 Party wall between dwellings	5.2000	0.0210	0.1092
P2 Party wall - Intermediate floor within a dwelling	17.5200	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	23.4100	0.0310	0.7257
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.7000	0.4800	1.2960

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2666 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 40.6646 (37)

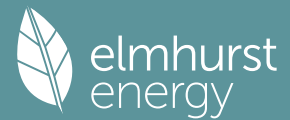
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	19.0031	18.7529	18.5026	17.2516	17.0013	15.7502	15.7502	15.5000	16.2507	17.0013	17.5018	18.0022 (38)
Heat transfer coeff	59.6676	59.4174	59.1672	57.9161	57.6659	56.4148	56.4148	56.1646	56.9152	57.6659	58.1663	58.6668 (39)
Average = Sum(39)m / 12 =												57.8536
HLP	0.6075	0.6049	0.6024	0.5897	0.5871	0.5744	0.5744	0.5718	0.5795	0.5871	0.5922	Dec 0.5973 (40)
HLP (average)												0.5890
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7224 (42)
Hot water usage for mixer showers	69.8659	68.8160	67.2860	64.3586	62.1983	59.7892	58.4198	59.9382	61.6027	64.1894	67.1796	69.5982 (42a)
Hot water usage for baths	30.1678	29.7198	29.0889	27.9256	27.0545	26.0886	25.5669	26.1934	26.8756	27.9091	29.0964	30.0659 (42b)
Hot water usage for other uses	42.5104	40.9645	39.4187	37.8729	36.3270	34.7812	34.7812	36.3270	37.8729	39.4187	40.9645	42.5104 (42c)
Average daily hot water use (litres/day)												131.0302 (43)
Daily hot water use	142.5441	139.5003	135.7936	130.1571	125.5799	120.6590	118.7679	122.4586	126.3511	131.5172	137.2405	142.1744 (44)
Energy conte	225.7550	198.6466	208.7097	178.1785	169.0546	148.3643	143.6395	151.6294	155.8035	178.4675	195.5242	222.6108 (45)
Energy content (annual)										Total = Sum(45)m =		2176.3837
Distribution loss (46)m = 0.15 x (45)m	33.8633	29.7970	31.3064	26.7268	25.3582	22.2546	21.5459	22.7444	23.3705	26.7701	29.3286	33.3916 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage												
Primary loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)
Combi 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)
Total heat required for water heating calculated for each month	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)
WWHRS	269.1054	237.8018	252.0601	220.1305	212.4050	190.3163	186.9899	194.9798	197.7555	221.8179	237.4762	265.9612 (62)
PV diverter	-61.5294	-54.4171	-56.9824	-47.1837	-43.9735	-37.6285	-35.2707	-37.5068	-38.9319	-45.8964	-51.9950	-60.3899 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	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)
	207.5761	183.3847	195.0776	172.9468	168.4315	152.6878	151.7192	157.4730	158.8237	175.9216	185.4812	205.5713 (64)
Total per year (kWh/year) = Sum(64)m =												2115.0944 (64)

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12Total per year (kWh/year)	2115 (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 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	109.7439	97.3741	104.0763	92.8060	90.8910	82.8927	82.4404	85.0971	85.3663	94.0208	108.6984 (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	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.2480	165.2389	149.2480	154.2230	149.2480	154.2230	149.2480	149.2480	154.2230	149.2480	154.2230	149.2480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	253.4176	256.0473	249.4206	235.3131	217.5049	200.7677	189.5863	186.9566	193.5833	207.6908	225.4990	242.2362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	(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)	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	(71)
Water heating gains (Table 5)	147.5052	144.9020	139.8875	128.8972	122.1653	115.1288	110.8071	114.3778	118.5643	126.3720	136.9075	146.1000	(72)
Total internal gains	614.0072	630.0246	602.3924	582.2696	552.7546	533.9559	513.4778	514.4188	530.2069	547.1472	580.4658	601.4206	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			

Southeast				7.9200	36.7938	0.6800	0.7000	0.7700	96.1259 (77)			
Southwest				0.8800	36.7938	0.6800	0.7000	0.7700	10.6807 (79)			
Northwest				1.8400	11.2829	0.6800	0.7000	0.7700	6.8483 (81)			

Solar gains	113.6548	195.8709	274.0412	349.6777	400.9120	402.0789	385.9548	347.1101	300.1374	218.1082	136.5465	96.9968 (83)
Total gains	727.6620	825.8955	876.4336	931.9473	953.6666	936.0347	899.4326	861.5289	830.3444	765.2554	717.0123	698.4174 (84)

7. Mean internal temperature (heating season)

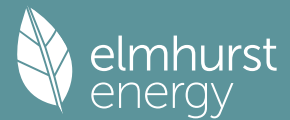
Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)	
tau	Jan 76.0212	Feb 76.3413	Mar 76.6641	Apr 78.3202	May 78.6601	Jun 80.4045	Jul 80.4045	Aug 80.7627	Sep 79.6975	Oct 78.6601	Nov 77.9833	Dec 77.3181	
alpha	6.0681	6.0894	6.1109	6.2213	6.2440	6.3603	6.3603	6.3842	6.3132	6.2440	6.1989	6.1545	
util living area	0.9551	0.9137	0.8500	0.7157	0.5555	0.3852	0.2759	0.2998	0.4707	0.7391	0.9071	0.9618	(86)
Living	20.5611	20.6890	20.8037	20.9064	20.9418	20.9505	20.9511	20.9512	20.9484	20.9061	20.7457	20.5446	
Non living	19.9083	20.0666	20.2052	20.3317	20.3704	20.3900	20.3904	20.3929	20.3836	20.3353	20.1477	19.8961	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.7755	20.6890	20.8037	20.9064	20.9418	20.9505	20.9511	20.9512	20.9484	20.9061	20.7457	20.6083	(87)
Th 2	20.4233	20.4256	20.4278	20.4393	20.4416	20.4531	20.4531	20.4554	20.4485	20.4416	20.4370	20.4324	(88)
util rest of house	0.9480	0.9018	0.8316	0.6889	0.5239	0.3525	0.2417	0.2643	0.4339	0.7081	0.8926	0.9556	(89)
MIT 2	20.2180	20.0666	20.2052	20.3317	20.3704	20.3900	20.3904	20.3929	20.3836	20.3353	20.1477	19.9928	(90)
Living area fraction									fLA =	Living area / (4) =		0.2749	(91)
MIT	20.3712	20.2377	20.3697	20.4897	20.5274	20.5441	20.5445	20.5464	20.5389	20.4922	20.3121	20.1620	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3712	20.2377	20.3697	20.4897	20.5274	20.5441	20.5445	20.5464	20.5389	20.4922	20.3121	20.1620	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9473	0.8975	0.8296	0.6914	0.5288	0.3579	0.2474	0.2703	0.4399	0.7110	0.8891	0.9523	(94)
Useful gains	689.3305	741.2589	727.0811	644.3369	504.2821	335.0185	222.5075	232.8409	365.2954	544.1162	637.4866	665.1341	(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													
	958.9321	911.3247	820.6329	671.2281	509.0419	335.3329	222.5307	232.8810	366.4695	570.4407	768.4967	936.4374	(97)
Space heating kWh													
	200.5836	114.2842	69.6026	19.3616	3.5413	0.0000	0.0000	0.0000	0.0000	19.5855	94.3272	201.8497	(98a)
Space heating requirement - total per year (kWh/year)	723.1357												
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													
	200.5836	114.2842	69.6026	19.3616	3.5413	0.0000	0.0000	0.0000	0.0000	19.5855	94.3272	201.8497	(98c)

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

(98c) / (4) = 723.1357
7.3624 (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 %)												257.5104 (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	200.5836	114.2842	69.6026	19.3616	3.5413	0.0000	0.0000	0.0000	0.0000	19.5855	94.3272	201.8497 (98)
Space heating efficiency (main heating system 1)	257.5104	257.5104	257.5104	257.5104	257.5104	0.0000	0.0000	0.0000	0.0000	257.5104	257.5104	257.5104 (210)
Space heating fuel (main heating system)	77.8934	44.3804	27.0290	7.5188	1.3752	0.0000	0.0000	0.0000	0.0000	7.6057	36.6304	78.3851 (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	207.5761	183.3847	195.0776	172.9468	168.4315	152.6878	151.7192	157.4730	158.8237	175.9216	185.4812	205.5713 (64)
Efficiency of water heater	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136	177.4136 (216)
Fuel for water heating, kWh/month	117.0012	103.3657	109.9564	97.4823	94.9372	86.0632	85.5173	88.7604	89.5217	99.1590	104.5474	115.8712 (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	15.7604	14.2352	15.7604	15.2520	15.7604	15.2520	15.7604	15.7604	15.2520	15.7604	15.2520	15.7604 (231)
Lighting	36.5613	29.3308	26.4092	19.3485	14.9453	12.2105	13.6336	17.7215	23.0185	30.2015	34.1125	37.5774 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-66.3180	-113.5810	-199.7119	-273.9600	-341.5517	-336.5610	-331.5033	-287.7911	-221.4415	-146.9414	-79.2618	-55.0616 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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												280.8180 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.4136
Water heating fuel used												1192.1831 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5830)												
mechanical ventilation fans (SFP = 0.5830)												185.5663 (230a)
Total electricity for the above, kWh/year												185.5663 (231)
Electricity for lighting (calculated in Appendix L)												295.0706 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2453.6842 (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												-500.0462 (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	280.8180	0.1586	44.5320 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1192.1831	0.1407	167.7468 (264)
Space and water heating			212.2788 (265)
Pumps, fans and electric keep-hot	185.5663	0.1387	25.7403 (267)
Energy for lighting	295.0706	0.1443	42.5878 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2453.6842	0.1309	-321.1601

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PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-321.1601 (269)
Total CO2, kg/year			-40.5531 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.4100 (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	280.8180	1.5870	445.6522 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1192.1831	1.5203	1812.4380 (278)
Space and water heating			2258.0902 (279)
Pumps, fans and electric keep-hot	185.5663	1.5128	280.7247 (281)
Energy for lighting	295.0706	1.5338	452.5891 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2453.6842	1.4835	-3640.1005
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-3640.1005 (283)
Total Primary energy kWh/year			-648.6964 (286)
Dwelling Primary energy Rate (DPER)			-6.6000 (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	42.9600 (1b)	x 2.6000 (2b)	= 111.6960 (1b) -
First floor	55.2600 (1c)	x 2.7000 (2c)	= 149.2020 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	260.8980 (5)

2. Ventilation rate

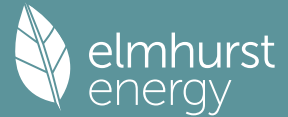
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1150 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3650 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2829 (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	0.3607	0.3536	0.3465	0.3112	0.3041	0.2687	0.2687	0.2617	0.2829	0.3041	0.3182	0.3324 (22b)
Effective ac	0.5650	0.5625	0.5600	0.5484	0.5462	0.5361	0.5361	0.5342	0.5400	0.5462	0.5506	0.5552 (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
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TER Opaque door			1.8900	1.0000	1.8900	(26)
TER Opening Type (Uw = 1.20)			10.6400	1.1450	12.1832	(27)
External Wall 1	36.4000	6.9600	29.4400	0.1800	5.2992	(29a)
External Wall 2	14.1400	1.8900	12.2500	0.1800	2.2050	(29a)
External Wall 3	7.6800	3.6800	4.0000	0.1800	0.7200	(29a)
External Wall 4	63.3300		63.3300	0.1800	11.3994	(29a)
External Roof 1	34.8000		34.8000	0.1100	3.8280	(30)
External Roof 2	24.7600		24.7600	0.1100	2.7236	(30)
External Roof 3	21.0800		21.0800	0.1100	2.3188	(30)
External Roof 4	6.2000		6.2000	0.1100	0.6820	(30)
Total net area of external elements Aum(A, m2)			208.3900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.2492	(33)
Party Wall 1			19.7600	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 176.5619 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E18 Party wall between dwellings	2.6000	0.0600	0.1560
E2 Other lintels (including other steel lintels)	9.2500	0.0500	0.4625
E3 Sill	8.3500	0.0500	0.4175
E4 Jamb	16.9000	0.0500	0.8450
E6 Intermediate floor within a dwelling	17.5200	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	35.2500	0.0700	2.4675
E11 Eaves (insulation at rafter level)	23.3200	0.0400	0.9328
E14 Flat roof	5.8000	0.0800	0.4640
E16 Corner (normal)	34.4000	0.0900	3.0960
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0900	-1.9440
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P2 Party wall - Intermediate floor within a dwelling	17.5200	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	23.4100	0.0700	1.6387
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	23.4100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.7000	0.1200	0.3240

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1720 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 52.4212 (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	48.6475	48.4301	48.2169	47.2159	47.0286	46.1567	46.1567	45.9953	46.4926	47.0286	47.4075	47.8036
Heat transfer coeff	101.0687	100.8513	100.6381	99.6371	99.4498	98.5780	98.5780	98.4165	98.9138	99.4498	99.8287	100.2248
Average = Sum(39)m / 12 =												99.6362

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0290	1.0268	1.0246	1.0144	1.0125	1.0036	1.0036	1.0020	1.0071	1.0125	1.0164	1.0204
HLP (average)												1.0144
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7224
Hot water usage for mixer showers												69.5982
Hot water usage for baths												30.0659
Hot water usage for other uses												42.5104
Average daily hot water use (litres/day)												131.0302

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	142.5441	139.5003	135.7936	130.1571	125.5799	120.6590	118.7679	122.4586	126.3511	131.5172	137.2405	142.1744
Energy conte	225.7550	198.6466	208.7097	178.1785	169.0546	148.3643	143.6395	151.6294	155.8035	178.4675	195.5242	222.6108
Energy content (annual)												2176.3837
Distribution loss (46)m = 0.15 x (45)m	33.8633	29.7970	31.3064	26.7268	25.3582	22.2546	21.5459	22.7444	23.3705	26.7701	29.3286	33.3916

Water storage loss:

Store volume												180.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.5520
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												0.8381
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803

If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803
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
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
Total heat required for water heating calculated for each month	274.9977	243.1238	257.9523	225.8327	218.2973	196.0185	192.8822	200.8721	203.4577	227.7102	243.1784	271.8535
WWHRS	-31.9398	-28.2478	-29.5795	-24.4930	-22.8266	-19.5329	-18.3089	-19.4697	-20.2094	-23.8247	-26.9905	-31.3483
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
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
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
Output from w/h	243.0579	214.8760	228.3729	201.3398	195.4707	176.4856	174.5732	181.4023	183.2483	203.8855	216.1879	240.5052
Total per year (kWh/year) = Sum(64)m =												2459.4054

12Total per year (kWh/year) 2459 (64)

Electric shower(s) 0.0000 (64a)

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

Heat gains from water heating, kWh/month

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114.4577 101.6318 108.7901 97.3677 95.6048 87.4545 87.1543 89.8109 89.9280 98.7346 103.1352 113.4122 (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	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213	136.1213 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.0964	160.6424	145.0964	149.9329	145.0964	149.9329	145.0964	145.0964	149.9329	145.0964	149.9329	145.0964 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	253.4176	256.0473	249.4206	235.3131	217.5049	200.7677	189.5863	186.9566	193.5833	207.6908	225.4990	242.2362 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121	36.6121 (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)	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970	-108.8970 (71)
Water heating gains (Table 5)	153.8410	151.2378	146.2232	135.2329	128.5011	121.4646	117.1428	120.7136	124.9000	132.7078	143.2433	152.4358 (72)
Total internal gains	619.1913	634.7638	607.5766	587.3153	557.9387	536.0016	515.6619	516.6029	532.2526	552.3313	585.5115	606.6047 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			

Southeast				7.9200	36.7938	0.6300	0.7000	0.7700	89.0578 (77)			
Southwest				0.8800	36.7938	0.6300	0.7000	0.7700	9.8953 (79)			
Northwest				1.8400	11.2829	0.6300	0.7000	0.7700	6.3447 (81)			

Solar gains	105.2978	181.4686	253.8911	323.9661	371.4332	372.5142	357.5758	321.5873	278.0685	202.0708	126.5063	89.8647 (83)
Total gains	724.4892	816.2325	861.4676	911.2814	929.3719	908.5158	873.2376	838.1902	810.3212	754.4021	712.0179	696.4694 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	47.6626	47.7654	47.8665	48.3474	48.4385	48.8669	48.8669	48.9471	48.7010	48.4385	48.2546	48.0639
alpha	4.1775	4.1844	4.1911	4.2232	4.2292	4.2578	4.2578	4.2631	4.2467	4.2292	4.2170	4.2043
util living area	0.9831	0.9712	0.9519	0.9025	0.8068	0.6418	0.4837	0.5214	0.7343	0.9118	0.9699	0.9855 (86)
MIT	19.5722	19.7832	20.0635	20.4373	20.7428	20.9295	20.9832	20.9769	20.8713	20.4910	19.9767	19.5372 (87)
Th 2	20.0592	20.0611	20.0629	20.0713	20.0729	20.0803	20.0803	20.0817	20.0775	20.0729	20.0697	20.0664 (88)
util rest of house	0.9794	0.9649	0.9410	0.8798	0.7619	0.5664	0.3884	0.4253	0.6657	0.8867	0.9622	0.9823 (89)
MIT 2	18.4006	18.6680	19.0208	19.4846	19.8380	20.0319	20.0729	20.0706	19.9796	19.5579	18.9212	18.3612 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	18.7226	18.9745	19.3074	19.7465	20.0867	20.2787	20.3231	20.3198	20.2247	19.8144	19.2114	18.6845 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7226	18.9745	19.3074	19.7465	20.0867	20.2787	20.3231	20.3198	20.2247	19.8144	19.2114	18.6845 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9721	0.9555	0.9301	0.8706	0.7627	0.5835	0.4142	0.4510	0.6775	0.8784	0.9530	0.9757 (94)
Useful gains	704.3072	779.9214	801.2449	793.3572	708.7965	530.1295	361.6521	378.0222	549.0088	662.6374	678.5186	679.5785 (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	1457.6776	1419.4357	1288.9138	1080.7143	834.0589	559.7904	367.0181	385.7697	605.8181	916.3672	1209.0634	1451.7061 (97)
Space heating kWh	560.5076	429.7537	362.8257	206.8971	93.1952	0.0000	0.0000	0.0000	0.0000	188.7750	381.9923	574.4630 (98a)
Space heating requirement - total per year (kWh/year)	2798.4096											
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	560.5076	429.7537	362.8257	206.8971	93.1952	0.0000	0.0000	0.0000	0.0000	188.7750	381.9923	574.4630 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2798.4096											
Space heating per m2	(98c) / (4) = 28.4912 (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)

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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	560.5076	429.7537	362.8257	206.8971	93.1952	0.0000	0.0000	0.0000	0.0000	188.7750	381.9923	574.4630	(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)	607.2672	465.6053	393.0939	224.1572	100.9699	0.0000	0.0000	0.0000	0.0000	204.5233	413.8595	622.3867	(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	243.0579	214.8760	228.3729	201.3398	195.4707	176.4856	174.5732	181.4023	183.2483	203.8855	216.1879	240.5052	(64)
Efficiency of water heater	85.8706	85.5826	85.0928	84.1209	82.4995	79.8000	79.8000	79.8000	79.8000	83.8875	85.3222	79.8000	(216)
Fuel for water heating, kWh/month	283.0513	251.0744	268.3809	239.3457	236.9357	221.1600	218.7634	227.3212	229.6344	243.0464	253.3782	279.8535	(217)
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	(219)
(217)m	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(221)
Pumps and Fa	30.1482	24.1860	21.7768	15.9546	12.3238	10.0686	11.2422	14.6130	18.9809	24.9039	28.1289	30.9861	(231)
Lighting	-32.8104	-47.4200	-69.8318	-80.4717	-88.4149	-83.0844	-82.0531	-76.6689	-67.4200	-55.1078	-36.4803	-28.2312	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	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)
(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	(234a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)
(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	(235c)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	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)
(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	(235d)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	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)
(235c)m	-15.1274	-32.1724	-64.6114	-98.0277	-130.5943	-131.6027	-130.0657	-109.6800	-79.7982	-46.3429	-20.3025	-11.9368	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)
(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	(235b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	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)
(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	(235d)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	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)
(235d)m													
Annual totals kWh/year													
Space heating fuel - main system 1												3031.8630	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	(216)
Water heating fuel used												2951.9451	(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)												243.3129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1618.2565	(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												4694.8645	(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	3031.8630	0.2100	636.6912	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2951.9451	0.2100	619.9085	(264)
Space and water heating			1256.5997	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	243.3129	0.1443	35.1176	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-747.9946	0.1341	-100.2929	
PV Unit electricity exported	-870.2619	0.1256	-109.3016	
Total			-209.5944	(269)
Total CO2, kg/year			1094.0521	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
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Space heating - main system 1	3031.8630	1.1300	3426.0052 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2951.9451	1.1300	3335.6980 (278)
Space and water heating			6761.7032 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	243.3129	1.5338	373.2014 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-747.9946	1.4955	-1118.6390
PV Unit electricity exported	-870.2619	0.4610	-401.1992
Total			-1519.8382 (283)
Total Primary energy kWh/year			5745.1673 (286)
Target Primary Energy Rate (TPER)			58.4900 (287)

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Property Reference	003	Issued on Date	18/09/2023
Assessment Reference	03 Be Green	Prop Type Ref	01 - Be Lean
Property	Flat 3, 32, Norwich Road, Northwood, HA6 1NB		
SAP Rating	101 A	DER	0.26
Environmental	100 A	TER	13.81
CO ₂ Emissions (t/year)	-0.01	% DER < TER	98.12
Compliance Check	See BREL	DFEE	28.76
% DPER < TPER	99.06	TFEE	37.30
		% DFEE < TFEE	22.89
		TPER	72.83
Assessor Details	Mrs. Nicola Battista		Assessor ID
Client			L706-0001

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8700 (1b)	x 2.6000 (2b)	= 160.8620 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 160.8620 (5)

2. Ventilation rate

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

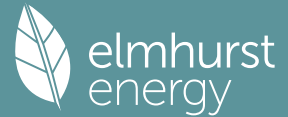
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												86.4000 (23c)
Effective ac	0.2162	0.2133	0.2104	0.1959	0.1930	0.1784	0.1784	0.1755	0.1842	0.1930	0.1988	0.2046 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 0.80)			20.0600	0.7752	15.5504		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
External Wall 1	57.8500	20.0600	37.7900	0.1400	5.2906	60.0000	2267.4000 (29a)

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External Wall 2	11.4400	1.8900	9.5500	0.1300	1.2415	190.0000	1814.5000 (29a)
External Roof 1	37.0000		37.0000	0.0900	3.3300	9.0000	333.0000 (30)
Total net area of external elements Aum(A, m2)			106.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	28.0585			(33)
Party Wall 1			19.7600	0.0000	0.0000	180.0000	3556.8000 (32)
Party Floor 1			61.2500			40.0000	2450.0000 (32d)
Party Ceiling 1			24.7500			20.0000	495.0000 (32b)
Internal Wall 1			141.6000			9.0000	1274.4000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12191.1000 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 197.0438 (35)

List of Thermal Bridges							
K1 Element	Length	Psi-value	Total				
E16 Corner (normal)	7.8000	0.0270	0.2106				
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0610	-0.1586				
E2 Other lintels (including other steel lintels)	14.3400	0.0500	0.7170				
E3 Sill	13.4400	0.0140	0.1882				
E4 Jamb	27.5000	0.0150	0.4125				
E7 Party floor between dwellings (in blocks of flats)	26.6500	0.0310	0.8261				
E18 Party wall between dwellings	5.2000	0.0210	0.1092				
E10 Eaves (insulation at ceiling level)	22.2500	0.0330	0.7343				
E12 Gable (insulation at ceiling level)	4.4000	0.0390	0.1716				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.5000	0.0000	0.0000				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.2109 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 31.2693 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	11.4779	11.3236	11.1693	10.3979	10.2436	9.4723	9.4723	9.3180	9.7808	10.2436	10.5522	10.8607 (38)
Average = Sum(39)m / 12 =	42.7472	42.5929	42.4386	41.6673	41.5130	40.7416	40.7416	40.5873	41.0502	41.5130	41.8215	42.1301 (39)
												41.6287
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6909	0.6884	0.6859	0.6735	0.6710	0.6585	0.6585	0.6560	0.6635	0.6710	0.6760	0.6809 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

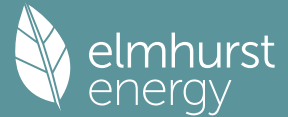
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0340 (42)
Hot water usage for mixer showers													
Hot water usage for baths	58.3228	57.4463	56.1691	53.7254	51.9220	49.9109	48.7678	50.0353	51.4248	53.5841	56.0803	58.0993	(42a)
Hot water usage for other uses	25.2039	24.8296	24.3025	23.3306	22.6029	21.7959	21.3600	21.8835	22.4534	23.3168	24.3088	25.1187	(42b)
Average daily hot water use (litres/day)	35.4600	34.1706	32.8811	31.5917	30.3022	29.0127	29.0127	30.3022	31.5917	32.8811	34.1706	35.4600	(42c)
												109.3761	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	118.9867	116.4465	113.3527	108.6477	104.8271	100.7196	99.1406	102.2210	105.4698	109.7821	114.5596	118.6781	(44)
Distribution loss (46)m = 0.15 x (45)m	188.4459	165.8183	174.2189	148.7332	141.1174	123.8465	119.9019	126.5709	130.0548	148.9732	163.2112	185.8212	(45)
										Total = Sum(45)m =		1816.7135	
Water storage loss:	28.2669	24.8727	26.1328	22.3100	21.1676	18.5770	17.9853	18.9856	19.5082	22.3460	24.4817	27.8732	(46)
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6480	(55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(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	231.7963	204.9735	217.5693	190.6852	184.4678	165.7985	163.2523	169.9213	172.0068	192.3236	205.1632	229.1716	(62)
WVHRS	-51.3636	-45.4264	-47.5679	-39.3881	-36.7083	-31.4116	-29.4433	-31.3100	-32.4996	-38.3134	-43.4045	-50.4124	(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	180.4327	159.5471	170.0014	151.2971	147.7595	134.3869	133.8090	138.6113	139.5072	154.0102	161.7587	178.7592	(64)
										Total per year (kWh/year) = Sum(64)m =		1849.8803	(64)
12Total per year (kWh/year)												1850	(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	97.3386	86.4587	92.6081	83.0154	81.6019	74.7405	74.5477	76.7652	76.8048	84.2139	87.8293	96.4659	(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

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(66)m	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.5976	99.1974	89.5976	92.5842	89.5976	92.5842	89.5976	89.5976	92.5842	89.5976	92.5842	89.5976	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.6373	179.4806	174.8355	164.9466	152.4637	140.7315	132.8937	131.0503	135.6954	145.5843	158.0673	169.7994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	(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)	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	(71)
Water heating gains (Table 5)	130.8314	128.6588	124.4733	115.2992	109.6799	103.8063	100.1985	103.1790	106.6734	113.1907	121.9852	129.6584	(72)
Total internal gains	451.5761	460.8465	442.4161	426.3397	405.2510	390.6317	376.1995	377.3367	388.4627	401.8824	426.1463	442.5652	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	0.8800	11.2829	0.6800	0.7000	0.7000	0.7700	3.2753 (75)
Southwest	0.8800	36.7938	0.6800	0.7000	0.7000	0.7700	10.6807 (79)
Northwest	18.3000	11.2829	0.6800	0.7000	0.7000	0.7700	68.1104 (81)

Solar gains	82.0663	163.5007	286.6907	460.7909	612.4810	650.4360	609.4513	489.8039	345.9585	197.6847	102.6146	67.4376	(83)
Total gains	533.6424	624.3472	729.1068	887.1306	1017.7319	1041.0677	985.6509	867.1406	734.4213	599.5671	528.7610	510.0028	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	79.2196	79.5066	79.7956	81.2728	81.5749	83.1194	83.1194	83.4353	82.4946	81.5749	80.9730	80.3800	
util living area	6.2813	6.3004	6.3197	6.4182	6.4383	6.5413	6.5413	6.5624	6.4996	6.4383	6.3982	6.3587	
	0.9539	0.9000	0.7806	0.5617	0.3789	0.2504	0.1819	0.2153	0.3852	0.6934	0.9022	0.9618	(86)
Living	20.5951	20.7357	20.8706	20.9414	20.9509	20.9525	20.9525	20.9526	20.9516	20.9239	20.7698	20.5733	
Non living	19.8812	20.0522	20.2081	20.2929	20.3040	20.3167	20.3167	20.3191	20.3114	20.2796	20.1056	19.8623	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.7929	20.7357	20.8706	20.9414	20.9509	20.9525	20.9525	20.9526	20.9516	20.9239	20.7698	20.6329	(87)
Th 2	20.3489	20.3511	20.3533	20.3643	20.3665	20.3776	20.3776	20.3799	20.3732	20.3665	20.3621	20.3577	(88)
util rest of house	0.9454	0.8847	0.7558	0.5337	0.3532	0.2261	0.1561	0.1863	0.3504	0.6576	0.8846	0.9546	(89)
MIT 2	20.1624	20.0522	20.2081	20.2929	20.3040	20.3167	20.3167	20.3191	20.3114	20.2796	20.1056	19.9516	(90)
Living area fraction									f _{LA} = Living area / (4) =			0.4055	(91)
MIT	20.4181	20.3294	20.4767	20.5558	20.5663	20.5745	20.5745	20.5760	20.5710	20.5409	20.3750	20.2279	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4181	20.3294	20.4767	20.5558	20.5663	20.5745	20.5745	20.5760	20.5710	20.5409	20.3750	20.2279	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9464	0.8841	0.7607	0.5422	0.3613	0.2338	0.1643	0.1955	0.3614	0.6676	0.8850	0.9530	(94)
Ext temp.	505.0154	551.9915	554.6314	481.0143	367.7314	243.3965	161.9273	169.4901	265.4084	400.2953	467.9354	486.0129	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
	689.0031	657.1816	593.1540	485.6668	368.0682	243.4103	161.9283	169.4931	265.6370	412.6757	555.1797	675.2562	(97)
Space heating kWh	136.8869	70.6877	28.6608	3.3498	0.2506	0.0000	0.0000	0.0000	0.0000	9.2110	62.8159	140.7970	(98a)
Space heating requirement - total per year (kWh/year)												452.6597	
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	136.8869	70.6877	28.6608	3.3498	0.2506	0.0000	0.0000	0.0000	0.0000	9.2110	62.8159	140.7970	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												452.6597	
Space heating per m ²										(98c) / (4) =		7.3163	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	246.3860	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	136.8869	70.6877	28.6608	3.3498	0.2506	0.0000	0.0000	0.0000	0.0000	9.2110	62.8159	140.7970	(98)
Space heating efficiency (main heating system 1)	246.3860	246.3860	246.3860	246.3860	246.3860	0.0000	0.0000	0.0000	0.0000	246.3860	246.3860	246.3860	(210)
Space heating fuel (main heating system)	55.5579	28.6898	11.6325	1.3596	0.1017	0.0000	0.0000	0.0000	0.0000	3.7385	25.4949	57.1449	(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	180.4327	159.5471	170.0014	151.2971	147.7595	134.3869	133.8090	138.6113	139.5072	154.0102	161.7587	178.7592	(64)
Efficiency of water heater	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	172.8613	(216)
Fuel for water heating, kWh/month	104.3801	92.2978	98.3456	87.5252	85.4787	77.7426	77.4083	80.1864	80.7047	89.0947	93.5772	103.4119	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.7174	8.7770	9.7174	9.4039	9.7174	9.4039	9.7174	9.4039	9.7174	9.4039	9.7174	9.4039	(231)
Lighting	19.5706	15.7003	14.1363	10.3569	8.0000	6.5360	7.2978	9.4860	12.3214	16.1663	18.2598	20.1145	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-41.6454	-71.3413	-125.5038	-172.3773	-215.2675	-212.3019	-209.1024	-181.3200	-139.3215	-92.3306	-49.7783	-34.5760	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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												183.7197	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												172.8613	
Water heating fuel used												1070.1532	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5830)													
mechanical ventilation fans (SFP = 0.5830)												114.4147	(230a)
Total electricity for the above, kWh/year												114.4147	(231)
Electricity for lighting (calculated in Appendix L)												157.9460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1544.8660	(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												-18.6323	(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	183.7197	0.1595	29.3067	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1070.1532	0.1406	150.4792	(264)
Space and water heating			179.7859	(265)
Pumps, fans and electric keep-hot	114.4147	0.1387	15.8707	(267)
Energy for lighting	157.9460	0.1443	22.7965	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1544.8660	0.1309	-202.1712	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-202.1712	(269)
Total CO2, kg/year			16.2820	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.2600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	183.7197	1.5904	292.1819	(275)
Total CO2 associated with community systems			0.0000	(473)

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Water heating (other fuel)	1070.1532	1.5199	1626.5552 (278)
Space and water heating			1918.7371 (279)
Pumps, fans and electric keep-hot	114.4147	1.5128	173.0866 (281)
Energy for lighting	157.9460	1.5338	242.2628 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1544.8660	1.4834	-2291.7157
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2291.7157 (283)
Total Primary energy kWh/year			42.3708 (286)
Dwelling Primary energy Rate (DPER)			0.6800 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.8700 (1b)	x 2.6000 (2b)	= 160.8620 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 160.8620 (5)

2. Ventilation rate

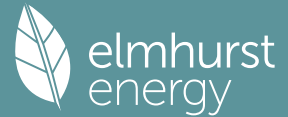
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1243 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3743 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2901 (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	0.3699	0.3626	0.3554	0.3191	0.3119	0.2756	0.2756	0.2683	0.2901	0.3119	0.3264	0.3409 (22b)
Effective ac	0.5684	0.5658	0.5631	0.5509	0.5486	0.5380	0.5380	0.5360	0.5421	0.5486	0.5533	0.5581 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			13.5900	1.1450	15.5611		(27)
External Wall 1	57.8500	13.5900	44.2600	0.1800	7.9668		(29a)
External Wall 2	11.4400	1.8900	9.5500	0.1800	1.7190		(29a)
External Roof 1	37.0000		37.0000	0.1100	4.0700		(30)
Total net area of external elements Aum(A, m ²)			106.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.2069		(33)
Party Wall 1			19.7600	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							201.0441 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E16 Corner (normal)				7.8000	0.0900		0.7020
E17 Corner (inverted - internal area greater than external area)				2.6000	-0.0900		-0.2340
E2 Other lintels (including other steel lintels)				14.3400	0.0500		0.7170

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E3 Sill						13.4400	0.0500	0.6720				
E4 Jamb						27.5000	0.0500	1.3750				
E7 Party floor between dwellings (in blocks of flats)						26.6500	0.0700	1.8655				
E18 Party wall between dwellings						5.2000	0.0600	0.3120				
E10 Eaves (insulation at ceiling level)						22.2500	0.0600	1.3350				
E12 Gable (insulation at ceiling level)						4.4000	0.0600	0.2640				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)						7.5000	0.0000	0.0000				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											7.0085	(36)
Point Thermal bridges											0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	38.2154 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	30.1736	30.0326	29.8944	29.2452	29.1237	28.5583	28.5583	28.4536	28.7761	29.1237	29.3694	29.6263 (38)
Average = Sum(39)m / 12 =	68.3890	68.2480	68.1097	67.4605	67.3391	66.7736	66.7736	66.6689	66.9914	67.3391	67.5848	67.8417 (39)
												67.4600
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1054	1.1031	1.1009	1.0904	1.0884	1.0793	1.0793	1.0776	1.0828	1.0884	1.0924	1.0965 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
												1.0903
												31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.0340 (42)
Hot water usage for mixer showers												
Hot water usage for baths	58.3228	57.4463	56.1691	53.7254	51.9220	49.9109	48.7678	50.0353	51.4248	53.5841	56.0803	58.0993 (42a)
Hot water usage for other uses	25.2039	24.8296	24.3025	23.3306	22.6029	21.7959	21.3600	21.8835	22.4534	23.3168	24.3088	25.1187 (42b)
Average daily hot water use (litres/day)	35.4600	34.1706	32.8811	31.5917	30.3022	29.0127	29.0127	30.3022	31.5917	32.8811	34.1706	35.4600 (42c)
												109.3761 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	118.9867	116.4465	113.3527	108.6477	104.8271	100.7196	99.1406	102.2210	105.4698	109.7821	114.5596	118.6781 (44)
Energy content (annual)	188.4459	165.8183	174.2189	148.7332	141.1174	123.8465	119.9019	126.5709	130.0548	148.9732	163.2112	185.8212 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m =
Water storage loss:	28.2669	24.8727	26.1328	22.3100	21.1676	18.5770	17.9853	18.9856	19.5082	22.3460	24.4817	27.8732 (46)
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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	237.6886	210.2955	223.4616	196.3874	190.3601	171.5007	169.1446	175.8136	177.7090	198.2159	210.8654	235.0639 (62)
WWHRS	-26.6627	-23.5807	-24.6924	-20.4463	-19.0552	-16.3057	-15.2840	-16.2530	-16.8705	-19.8884	-22.5312	-26.1690 (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	211.0258	186.7148	198.7692	175.9412	171.3049	155.1950	153.8606	159.5606	160.8385	178.3275	188.3342	208.8949 (64)
												Total per year (kWh/year) = Sum(64)m =
12Total per year (kWh/year)												2148.7671 (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	102.0524	90.7164	97.3219	87.5772	86.3157	79.3023	79.2615	81.4790	81.3666	88.9277	92.3911	101.1797 (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	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991	101.6991 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.6331	99.2366	89.6331	92.6208	89.6331	92.6208	89.6331	89.6331	92.6208	89.6331	92.6208	89.6331 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.6373	179.4806	174.8355	164.9466	152.4637	140.7315	132.8937	131.0503	135.6954	145.5843	158.0673	169.7994 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699	33.1699 (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)	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593	-81.3593 (71)
Water heating gains (Table 5)	137.1672	134.9946	130.8090	121.6349	116.0157	110.1421	106.5343	109.5147	113.0091	119.5265	128.3209	135.9942 (72)
Total internal gains	460.9473	470.2215	451.7873	435.7121	414.6222	397.0041	382.5708	383.7079	394.8352	411.2536	435.5188	451.9364 (73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF		Access factor Table 6d	Gains W	
Northeast				0.6000	11.2829	0.6300		0.7000		0.7700	2.0689 (75)	
Southwest				0.6000	36.7938	0.6300		0.7000		0.7700	6.7468 (79)	
Northwest				12.3900	11.2829	0.6300		0.7000		0.7700	42.7234 (81)	
Solar gains	51.5391	102.6683	179.9944	289.2619	384.4584	408.2729	382.5511	307.4645	217.1918	124.1258	64.4414	42.3535 (83)
Total gains	512.4864	572.8898	631.7818	724.9741	799.0806	805.2770	765.1219	691.1723	612.0270	535.3794	499.9602	494.2899 (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	50.5223	50.6267	50.7294	51.2176	51.3100	51.7445	51.7445	51.8257	51.5762	51.3100	51.1234	50.9298	
alpha	4.3682	4.3751	4.3820	4.4145	4.4207	4.4496	4.4496	4.4550	4.4384	4.4207	4.4082	4.3953	
util living area	0.9831	0.9714	0.9441	0.8602	0.7050	0.5153	0.3806	0.4370	0.6873	0.9063	0.9700	0.9854 (86)	
MIT	19.6789	19.8770	20.1896	20.5999	20.8693	20.9743	20.9946	20.9904	20.9135	20.5531	20.0566	19.6465 (87)	
Th 2	19.9965	19.9983	20.0001	20.0087	20.0103	20.0178	20.0178	20.0192	20.0149	20.0103	20.0071	20.0037 (88)	
util rest of house	0.9789	0.9644	0.9303	0.8286	0.6495	0.4421	0.2973	0.3470	0.6108	0.8771	0.9614	0.9818 (89)	
MIT 2	18.4778	18.7283	19.1182	19.6124	19.9020	20.0025	20.0158	20.0153	19.9552	19.5728	18.9639	18.4420 (90)	
Living area fraction									fLA = Living area / (4) =			0.4055 (91)	
MIT	18.9649	19.1942	19.5527	20.0129	20.2943	20.3966	20.4128	20.4107	20.3438	19.9703	19.4070	18.9304 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.9649	19.1942	19.5527	20.0129	20.2943	20.3966	20.4128	20.4107	20.3438	19.9703	19.4070	18.9304 (93)	

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9732	0.9574	0.9230	0.8287	0.6662	0.4709	0.3311	0.3834	0.6377	0.8757	0.9548	0.9766 (94)
Useful gains	498.7680	548.4604	583.1181	600.7905	532.3220	379.1954	253.3198	264.9940	390.3017	468.8362	477.3704	482.7112 (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	1002.9153	975.5475	889.0143	749.6807	578.7321	387.0584	254.5927	267.3912	418.2805	630.9903	831.7669	999.3372 (97)
Space heating kWh	375.0856	287.0025	227.5868	107.2010	34.5291	0.0000	0.0000	0.0000	0.0000	120.6426	255.1656	384.3698 (98a)
Space heating requirement - total per year (kWh/year)												1791.5829
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	375.0856	287.0025	227.5868	107.2010	34.5291	0.0000	0.0000	0.0000	0.0000	120.6426	255.1656	384.3698 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1791.5829
Space heating per m2										(98c) / (4) =		28.9572 (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	375.0856	287.0025	227.5868	107.2010	34.5291	0.0000	0.0000	0.0000	0.0000	120.6426	255.1656	384.3698 (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)	406.3766	310.9453	246.5729	116.1441	37.4097	0.0000	0.0000	0.0000	0.0000	130.7071	276.4524	416.4353 (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	211.0258	186.7148	198.7692	175.9412	171.3049	155.1950	153.8606	159.5606	160.8385	178.3275	188.3342	208.8949 (64)
Efficiency of water heater (217)m	85.3349	85.0206	84.3642	82.9843	81.1802	79.8000	79.8000	79.8000	79.8000	83.2028	84.7414	79.8000 (216)
Fuel for water heating, kWh/month	247.2915	219.6112	235.6085	212.0173	211.0180	194.4799	192.8078	199.9507	201.5521	214.3286	222.2457	244.5838 (219)

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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	18.6240	14.9408	13.4526	9.8559	7.6130	6.2199	6.9448	9.0272	11.7254	15.3844	17.3766	19.1416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-21.1448	-30.8254	-45.8087	-53.3199	-59.0858	-55.7477	-55.0797	-51.2182	-44.6629	-36.0655	-23.6094	-18.1654	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-9.0518	-19.3108	-38.8787	-59.1191	-78.8708	-79.4864	-78.5366	-66.1653	-48.0716	-27.8396	-12.1588	-7.1369	(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												1941.0433	(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												2595.4951	(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)												150.3062	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1019.3599	(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												3753.4846	(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	1941.0433	0.2100	407.6191 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2595.4951	0.2100	545.0540 (264)
Space and water heating			952.6730 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	150.3062	0.1443	21.6938 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-494.7336	0.1339	-66.2313
PV Unit electricity exported	-524.6263	0.1255	-65.8614
Total			-132.0926 (269)
Total CO2, kg/year			854.2035 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8100 (273)

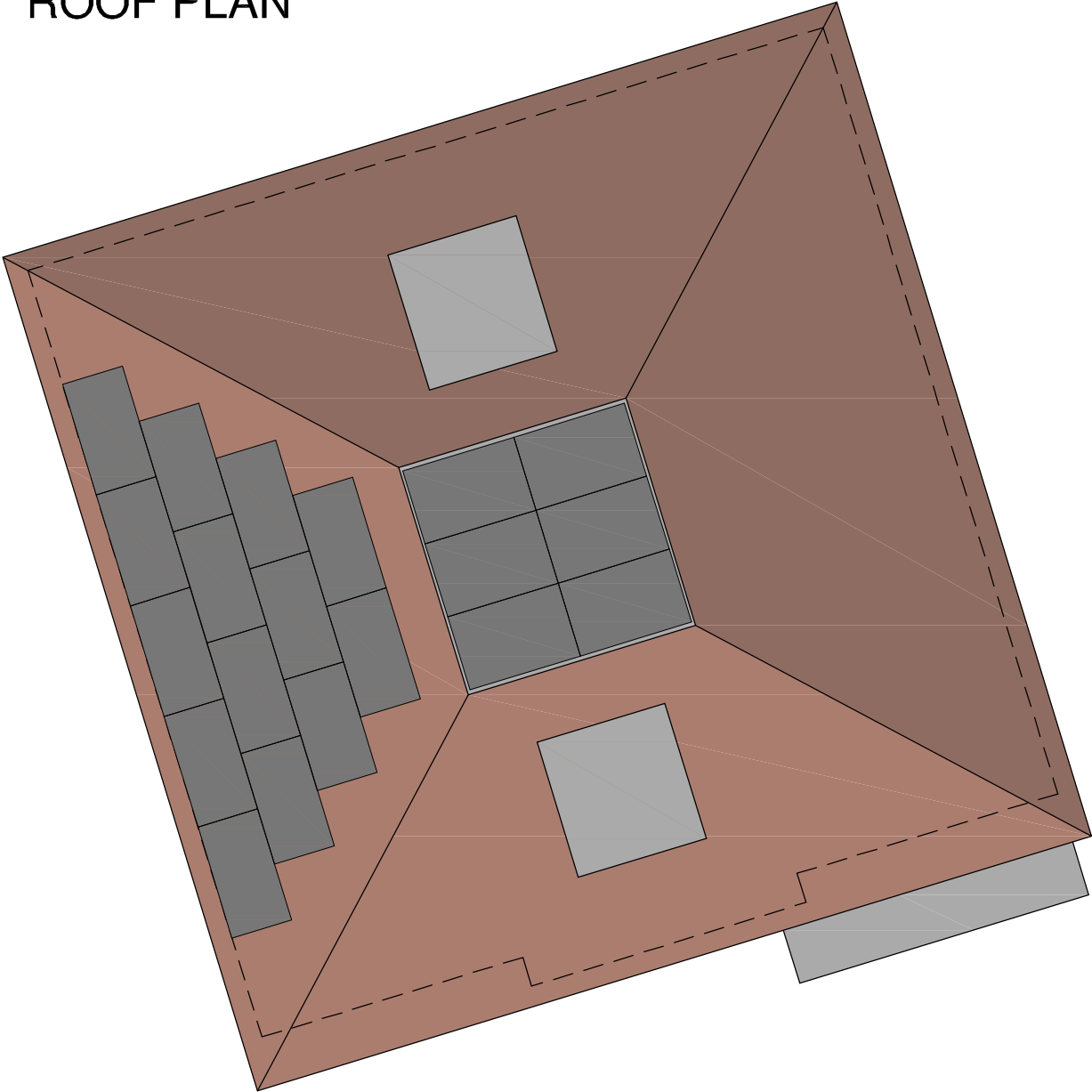
13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1941.0433	1.1300	2193.3789 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2595.4951	1.1300	2932.9094 (278)
Space and water heating			5126.2883 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	150.3062	1.5338	230.5446 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-494.7336	1.4947	-739.4931
PV Unit electricity exported	-524.6263	0.4608	-241.7480
Total			-981.2411 (283)
Total Primary energy kWh/year			4505.6926 (286)
Target Primary Energy Rate (TPER)			72.8300 (287)

APPENDIX D

ROOF PLAN SHOWING PROPOSED LAYOUT OF PV PANELS

PROPOSED
ROOF PLAN



DEEP BLUE 3.0 Light

Mono

405W MBB
Half-cell Black Module
JAM54S31 380-405/MR Series

Introduction

Assembled with 11BB PERC cells, the half-cell configuration of the modules offers the advantages of higher power output, better temperature-dependent performance, reduced shading effect on the energy generation, lower risk of hot spot, as well as enhanced tolerance for mechanical loading.



Higher output power



Lower LCOE



Less shading and lower resistive loss

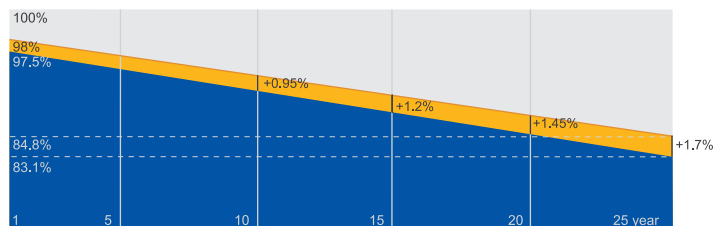


Better mechanical loading tolerance

Superior Warranty

- 12-year product warranty
- 25-year linear power output warranty

0.55% Annual Degradation
Over 25 years



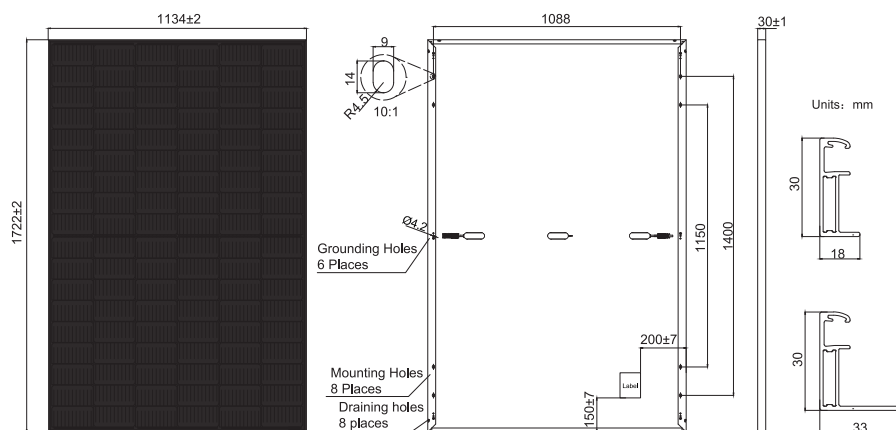
■ New linear power warranty ■ Standard module linear power warranty

Comprehensive Certificates

- IEC 61215, IEC 61730, UL 61215, UL 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- ISO 45001: 2018 Occupational health and safety management systems
- IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules – Guidelines for increased confidence in PV module design qualification and type approval



MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono
Weight	21.5kg±3%
Dimensions	1722±2mm×1134±2mm×30±1mm
Cable Cross Section Size	4mm ² (IEC) , 12 AWG(UL)
No. of cells	108(6x18)
Junction Box	IP68, 3 diodes
Connector	MC4(1000V) MC4-EVO2(1500V)
Cable Length (Including Connector)	Portrait: 300mm(+)/400mm(-); Landscape: 1200mm(+)/1200mm(-)
Packaging Configuration	36pcs/Pallet, 936pcs/40ft Container

ELECTRICAL PARAMETERS AT STC

TYPE	JAM54S31 -380/MR	JAM54S31 -385/MR	JAM54S31 -390/MR	JAM54S31 -395/MR	JAM54S31 -400/MR	JAM54S31 -405/MR
Rated Maximum Power(P _{max}) [W]	380	385	390	395	400	405
Open Circuit Voltage(V _{oc}) [V]	36.58	36.71	36.85	36.98	37.07	37.23
Maximum Power Voltage(V _{mp}) [V]	30.28	30.46	30.64	30.84	31.01	31.21
Short Circuit Current(I _{sc}) [A]	13.44	13.52	13.61	13.70	13.79	13.87
Maximum Power Current(I _{mp}) [A]	12.55	12.64	12.73	12.81	12.90	12.98
Module Efficiency [%]	19.5	19.7	20.0	20.2	20.5	20.7
Power Tolerance	0~+5W					
Temperature Coefficient of I _{sc} (α _{Isc})	+0.045%/°C					
Temperature Coefficient of V _{oc} (β _{Voc})	-0.275%/°C					
Temperature Coefficient of P _{max} (γ _{Pmp})	-0.350%/°C					
STC	Irradiance 1000W/m ² , cell temperature 25°C, AM1.5G					

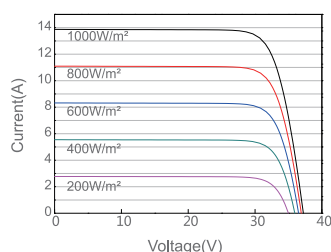
Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer. They only serve for comparison among different module types.

ELECTRICAL PARAMETERS AT NOCT

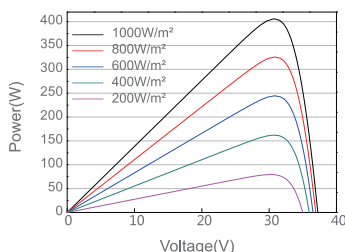
TYPE	JAM54S31 -380/MR	JAM54S31 -385/MR	JAM54S31 -390/MR	JAM54S31 -395/MR	JAM54S31 -400/MR	JAM54S31 -405/MR	OPERATING CONDITIONS
Rated Max Power(P _{max}) [W]	286	290	294	298	302	306	Maximum System Voltage 1000V/1500V DC
Open Circuit Voltage(V _{oc}) [V]	34.36	34.49	34.62	34.75	34.88	35.12	Operating Temperature -40°C~+85°C
Max Power Voltage(V _{mp}) [V]	28.51	28.68	28.87	29.08	29.26	29.47	Maximum Series Fuse Rating 25A
Short Circuit Current(I _{sc}) [A]	10.75	10.82	10.89	10.96	11.03	11.10	Maximum Static Load, Front* 5400Pa(112lb/ft ²) Maximum Static Load, Back* 2400Pa(50lb/ft ²)
Max Power Current(I _{mp}) [A]	10.03	10.11	10.18	10.25	10.32	10.38	NOCT 45±2°C
NOCT	Irradiance 800W/m ² , ambient temperature 20°C, wind speed 1m/s, AM1.5G						Safety Class Class II
							Fire Performance UL Type 1

CHARACTERISTICS

Current-Voltage Curve JAM54S31-405/MR



Power-Voltage Curve JAM54S31-405/MR



Current-Voltage Curve JAM54S31-405/MR

