

JS LEWIS LTD

Energy and Sustainability Assessment
Ascot House, Wokingham - 10 Unit Extension

Revision A

February 2024

Klara Ascot Ltd

Client: Klara Ascot Ltd

Report: Ascot House – Energy and Sustainability Statement

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Author: Johnny Lewis, Director

Contact: JS Lewis Ltd
2 Stanley Hill Cottages
Freshford
Bath
BA2 7US

Registered Company No. 0706 6238
VAT Registration No. 121 2714 62

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EXECUTIVE SUMMARY

Klara Ascot Ltd is seeking full planning permission for a 10 unit extension to Ascot House, Finchampstead Road, Wokingham RG40 2NW. The proposals are for a 1.5 storey extension with 3 additional units to the first floor and 7 units to the second floor and the roof space.

As part of the design process, the scheme seeks to address energy and sustainability matters from the outset, and this document sets out the proposed strategy. *It should be recognised that as schemes are developed post-planning, some of the details may change as the detailed design considerations are resolved in more depth. Accordingly, any related planning conditions should be worded to allow flexibility in how the details are resolved.*

The first section of this report sets out the purpose and scope of the Energy and Sustainability Strategy, the context within which it sits, and the description of development. An accommodation schedule is provided to inform the energy/CO₂ assessment.

The second section sets out the planning policy and regulatory framework against which the development will be assessed. This covers national policy, local policy, emerging local policy, national building regulation and emerging national guidance that relates to property developments and policymaking.

Section 3 considers the energy hierarchy, the heating hierarchy, the cooling hierarchy, the energy demand assessment and the CO₂ strategy. Through a proposed strategy of individual hot water heat pumps and rooftop solar PV, the carbon savings are estimated as follows:

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	5.9		
Be lean	4.9	1.0	17%
Be clean	4.9	0.0	0%
Be green	2.9	2.1	35%
Total Savings	-	3.0	52%

Figure 1 – CO₂ Emissions Estimate

The scheme will substantially exceed the carbon targets set under Part L with the suggested strategy of efficiency measures, hot water heat pumps and rooftop solar PV.

The fourth section considers the sustainability strategy for the development. Flood, water conservation, sustainable transport, materials and resource efficiency, waste and ecology are all considered.

The final section sets out the conclusions for the scheme. The applicant is aiming to deliver a sustainable development that addresses the environmental, social and economic issues in the round. Through the provision of this strategy, the proposed development is considered to address fully the planning policy framework.

1 INTRODUCTION

1.1 Context

This document has been prepared on behalf of Klara Ascot Ltd to help assess the energy and sustainability aspects of the proposed development at Ascot House, Finchampstead Road, Wokingham RG40 2NW. The development is for 10 units by extension to the existing building. This document, a combined energy and sustainability strategy, forms one of a suite of documents that form a planning application to be submitted to Wokingham Borough Council.

The scheme has addressed national, regional and the Council's policy on energy and sustainability. It also has to address the regulatory framework at the post-planning detailed design stage. This document sets out the energy strategy and the sustainability strategy. The strategy puts in place an approach to addressing both policy and regulatory expectations. However, it should be recognised that as schemes are developed post-planning, some of the details may change as the detailed design considerations are resolved in more depth.

1.2 Location and Scheme Details

The site is located to the East of the Finchampstead Road and to the South and West of Kendrick Close South of the centre of Wokingham. The existing Ascot House building is a 2 storey residential building accessed from Kendrick Close.

The proposals are for a 1.5 storey extension to Ascot House with 3 additional units to the first floor and 7 units to the second floor and the roof space.

To minimise CO2 emissions, each apartment will integrate a hot water heat pump, and 8kWp solar PV has been incorporated into the roof. The client has appointed a design team to develop the proposals that address local, regional and national policy, and to submit the planning application.

2 POLICY REVIEW

2.1 National Policy

National Planning Policy Framework (December 2023)

The National Planning Policy Framework sets out a framework for positive growth, making progress in environmental, social and economic areas, and enhancing existing areas. It is a material consideration in planning decisions and reinforces the need for decisions to be determined in accordance with the local plan, unless material considerations indicate otherwise. The policies throughout the NPPF constitute the government's view of what sustainable development is, and requires the planning process to perform a number of roles:

1. An economic role – building a strong economy, supporting growth and innovation;
2. A social role – supporting communities through providing housing supply, a high-quality built environment, and accessible local services;
3. An environmental role – contributing to natural and built environments, improving biodiversity, using resources prudently, minimizing waste and addressing climate change, including moving to a low carbon economy.

The 2023 National Planning Policy Framework retains a presumption in favour of sustainable development. Section 14 concerns itself with climate change:

158. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

159. New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

162. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

The NPPF sets out the importance of dealing with climate change, and the use renewable energy. Development should be in sustainable locations to reduce CO2 emissions. It notes the need to align local policies with the national timeline for low carbon buildings.

2.2 Local Policy

Wokingham District Council is working on a new Local Plan. Its adopted planning policy that relates to sustainable development consists of the 2014 adopted Managing Development Delivery, the 2010 Core Strategy, and the 2010 Sustainable Construction SPD. The 2010 checklist is largely out of date too due to the fast moving nature of sustainability policy in recent years.

2014 MDD

Policy CC04: Sustainable Design and Construction

Planning permission will only be granted for proposals that seek to deliver high quality sustainably designed and constructed developments by:

- *In respect of all new homes:*
 - a) *Seeking to achieve the requirements of the full Code for Sustainable Homes Level 4;*
 - b) *Meet internal potable water consumption targets of 105 litres or less per person per day (as part of the requirement to meet full Code for Sustainable Homes Level 4).*
 - *All new non-residential proposals of more than 100 sq m gross non-residential floorspace shall at least:*
 - a) *Achieve the necessary mandatory Building Research Establishment Assessment Method (BREEAM) requirements or any future national equivalent*
 - b) *Meet or exceed statutory requirements for water resource management.*
 - *All development, including conversions, alterations and extensions shall incorporate suitable waste management facilities, including on-site recycling.*

Policy CC05: Renewable energy and decentralised energy networks

- *Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged*
- *Planning permission will only be granted for proposals that deliver a minimum 10% reduction in carbon emissions through renewable energy or low carbon technology where the development is for:*
 - a) *Schemes of more than 10 dwellings (gross), or*
 - b) *Non-residential proposals of more than 1,000 sq m gross floorspace.*
 - *Proposals for renewable energy and decentralised energy works, including wind turbines, must demonstrate that:*
 - a) *They are appropriate in scale, location and technology type;*
 - b) *Are compatible with the surrounding area, including the impact of noise and odour;*
 - c) *Do not have a damaging impact on the local topography and landscape;*
 - d) *There is no significant impact upon heritage assets, including views important to their setting;*
 - e) *In the case of wind turbines, take account of their cumulative effect and properly reflect their increasing impact on the landscape and on local amenity*

2.3 Analysis and Interpretation

The national policy framework supports energy efficiency, renewables and decentralised energy where feasible. This document seeks to balance the requirements of high sustainability standards and good design. The proposals are for 10 residential units so the 10% renewable energy requirement does not apply. The Code for Sustainable Homes no longer applies following the Ministerial Statement of 2015.

3 CLIMATE CHANGE

3.1 Mitigation

Energy in building use is a key contributor to the UK's carbon emissions. The energy hierarchy sets out the order of importance for the adoption of different carbon saving measures:

- Reduce energy use;
- Use renewable energy;
- Use low carbon energy sources.

The development will also strive to utilise low CO2 impact materials in its construction. Key measures will include:

- Using low climate change impact building materials;
- Sourcing sustainable timber;
- Using low or zero global warming impact insulation materials;

Further details are set out in the Sustainability section.

3.2 Adaptation

Climate change will impact on the new development. Weather patterns will become less predictable – for example rainfall will become more extreme, and summer temperatures are likely to increase. Biodiversity will alter as conditions change. Water management is a key issue in adaptation, as is designing out the requirement for cooling in buildings. Key mitigation measures employed in the development will be:

- Design surface water run-off attenuation;
- Harvest water for irrigation in low rainfall periods;
- Meter water use to increase awareness of consumption.

The scheme makes use of the extant building footprint thus minimising its impact on the flood plain as well as maximising its resource efficiency. Rainwater could be harvested for irrigation, and internal water use will be metered.

4 ENERGY

4.1 Siting and Orientation and Passive Design

As a form of development, extending an existing building is inherently sustainable from a thermal efficiency perspective. There are many shared party floors and walls, reducing heat loss areas. The design incorporated overhangs and reasonable levels of glazing.

4.2 Efficient Services

The proposals will incorporate the following measures to maximize energy efficiency:

- Building fabric in line with Part L 2022;
- Low energy lighting using LEDs throughout;
- Smart heating and hot water controls;
- Low energy appliances where provided;
- Clothes drying facilities.

4.3 Renewable Energy Appraisal

All low and zero carbon technologies have been reviewed and assessed for their applicability to the development. The key findings are set out below.

4.3.1 Communal Renewable Heat

All renewable heating technology that requires communal heating is not recommended at this stage. This discounts biomass, biogas and communal heat pumps.

4.3.2 Individual Heat Pumps

Hot water heat pumps are proposed for the 10 apartments for sustainable hot water provision.

4.3.3 Solar Photo-Voltaics

At this stage, 8kWp has been allowed for to the South East roof pitch. The roof plan sets out how the panels might be arranged.

4.3.4 Wind Energy

The urban profile for wind power is very poor. This is technically not a practical solution for the urban environment.

4.3.5 Carbon Emissions Summary

The proposed system integrates hot water heat pumps and solar PV to achieve substantial onsite savings. The outputs from SAP 10.2 provided the following:

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	5.9		
Be lean	4.9	1.0	17%
Be clean	4.9	0.0	0%
Be green	2.9	2.1	35%
Total Savings	-	3.0	52%

Figure 2 – Emissions Summary Table

The figures above demonstrate that if individual heat pumps for hot water and solar PV were used, the scheme could achieve savings in the region of 52%. The exact figures would vary depending upon the final specification to be determined at the Building Control stage.

5 SUSTAINABILITY

5.1 Social and Economic Sustainability

The delivery of new homes is a key social and economic benefit of the scheme. It will create jobs, and increase the housing supply, thus helping to address supply and demand issues that are widely publicized in the press. The individual homes will be highly energy efficient and will therefore have longevity, as they will be cheap to run as well as low carbon. Good daylighting levels will also be achieved.

5.2 Transport

Cycle parking is included. The scheme also promotes walking and cycling as it is close to the centre of Wokingham. Home working facilities will allow occupants to reduce the number of journeys required.

5.3 Water

Water conservation in dwellings will be driven through the specification of efficient fittings, and the installation of water meters. This will include taps with flow restrictors, managed flow rates for showers and dual flush WCs. Rainwater harvesting could be incorporated through water butts for irrigation. Internal water use will be less than 105 lpppd. Extending an existing building creates a sustainable route to developing new residences as it allows for efficiency of materials but also minimizes the impact on the flood plain where vertical extensions are proposed such as in this case.

5.4 Materials

The proposed materials include brick, slate and timber panelling. The widespread use of recycled materials is not practical, although elements such as sub-base materials/hardcore for landscaping are likely to have some recycled content. All timber will be certified as sustainable through PEFC or FSC certification.

5.5 Waste

Waste and recycling in construction will be managed in accordance with the applicant's commitment to sustainable construction waste management. Household waste will be managed through waste disposal facilities in line with the local authority standards. The refuse store is located on the northern edge of the site and will have a 1,100 litre general waste bin and 7 no. 240 litre recycling bins added to serve the additional apartments. Within the flats, waste segregation facilities will be provided.

5.6 Pollution

Air quality will be controlled during the construction phase through the use of wheel-washing to reduce dust. During the operational phase, the absence of gas boilers will mean zero local NOx emissions from boilers. Greenhouse gas emissions are covered in the earlier sections of this report. Light pollution will be controlled through the detailed design of any external lighting requirements, and through time and dusk sensor controls.

6 CONCLUSION

6.1 Proposals

This document has been prepared to help inform and assess the energy and sustainability aspects of the proposed development of 10 new apartments at Ascot House. The applicant has taken a pro-active approach to addressing both energy and sustainability during the design stage of the development.

6.2 Sustainable Development

The proposed development addresses the Local Plan policies. The following measures are suggested:

- 52% CO₂ savings onsite;
- Energy efficiency measures:
 - LED lighting throughout;
 - Demanding U-values;
 - Detailing to address thermal bridging;
 - High air tightness;
- Renewable energy through hot water heat pumps and some solar PV;
- Sustainable materials;
- Cycle parking;
- Waste segregation;
- Low water usage.

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	5.9		
Be lean	4.9	1.0	17%
Be clean	4.9	0.0	0%
Be green	2.9	2.1	35%
Total Savings	-	3.0	52%

Figure 3 – Emissions Summary Table

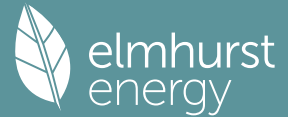
6.3 Compliance

The scheme addresses planning standards in terms of sustainability as set out above. It also complies with policy, addressing the planning documents set out below:

- NPPF;
- Wokingham MDD 2014;
- Wokingham SPD on Sustainable Design and Construction.

APPENDIX – EXAMPLE SAP CALCULATIONS

Full SAP Calculation Printout



Property Reference	1.01 EDL				Issued on Date	15/12/2023
Assessment Reference	1.01	Prop Type Ref		1.01		
Property	1.01, 1.01					
SAP Rating	77 C	DER	6.16	TER	12.99	
Environmental	95 A	% DER < TER				52.58
CO ₂ Emissions (t/year)	0.38	DFEE	27.42	TFEE	30.21	
Compliance Check	See BREL	% DFEE < TFEE				9.23
% DPER < TPER	6.38	DPER	64.55	TPER	68.95	
Assessor Details	Mr. Jonathan Lewis				Assessor ID	AZ32-0001
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	64.9000 (1b)	2.5000 (2b)	162.2500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	162.2500 (5)

2. Ventilation rate

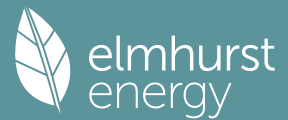
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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
Door			2.1000	1.0000	2.1000		(26)
Window (Uw = 1.20)			10.5000	1.1450	12.0229		(27)
External Wall 1	44.0000	10.5000	33.5000	0.1700	5.6950		(29a)
Corridor	10.0000	2.1000	7.9000	0.1300	1.0270		(29a)
External Roof 1	12.0000		12.0000	0.1000	1.2000		(30)
Total net area of external elements Aum (A, m ²)			66.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 22.0449		(33)
Party Floor 1			64.9000				(32d)
Party Ceiling 1			52.9000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							5.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				8.0000	0.0410	0.3280	
E3 Sill				8.0000	0.0460	0.3680	
E4 Jamb				18.0000	0.0470	0.8460	

Full SAP Calculation Printout



E7 Party floor between dwellings (in blocks of flats)	33.6000	0.0350	1.1760
E16 Corner (normal)	5.0000	0.0000	0.0000
E14 Flat roof	10.0000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0310	-0.0775
E18 Party wall between dwellings	5.0000	0.0340	0.1700
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.8105 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	24.8554 (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	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713
Average = Sum(39)m / 12 =	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.1163 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	68.8140	67.7920	66.3528	63.6993	61.7123	59.5091	58.3190	59.7481	61.3042	63.6617	66.3699	68.5814	(42b)
Hot water usage for other uses	36.3026	34.9825	33.6624	32.3423	31.0222	29.7021	29.7021	31.0222	32.3423	33.6624	34.9825	36.3026	(42c)
Average daily hot water use (litres/day)													96.8038 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	105.1166	102.7745	100.0153	96.0416	92.7346	89.2112	88.0212	90.7704	93.6465	97.3241	101.3524	104.8840	(44)
Energy content (annual)	166.4790	146.3496	153.7198	131.4762	124.8385	109.6956	106.4540	112.3927	115.4755	132.0679	144.3951	164.2230	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1607.5669
Water storage loss:	24.9719	21.9524	23.0580	19.7214	18.7258	16.4543	15.9681	16.8589	17.3213	19.8102	21.6593	24.6334	(46)
Store volume													170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	216.5254	191.5528	203.7662	179.9082	174.8849	158.1276	156.5004	162.4391	163.9075	182.1143	192.8271	214.2694	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	216.5254	191.5528	203.7662	179.9082	174.8849	158.1276	156.5004	162.4391	163.9075	182.1143	192.8271	214.2694	(64)
12Total per year (kWh/year)													2196.8229 (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	95.3914	84.8238	91.1489	82.4614	81.5459	75.2194	75.4331	77.4077	77.1412	83.9497	86.7570	94.6413	(65)

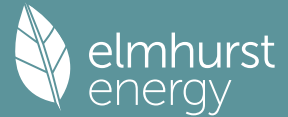
5. Internal gains (see Table 5 and 5a)

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	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	97.1983	107.6124	97.1983	100.4382	97.1983	100.4382	97.1983	97.1983	100.4382	97.1983	100.4382	97.1983	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	185.1147	187.0356	182.1950	171.8899	158.8815	146.6554	138.4877	136.5668	141.4074	151.7125	164.7209	176.9470	(68)
Pumps, fans	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	(69)
Losses e.g. evaporation (negative values) (Table 5)	9.7350	9.7350	9.7350	9.7350	9.7350	0.0000	0.0000	0.0000	0.0000	9.7350	9.7350	9.7350	(70)
Water heating gains (Table 5)	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	(71)
Total internal gains	128.2142	126.2259	122.5120	114.5298	109.6048	104.4714	101.3885	104.0426	107.1406	112.8356	120.4958	127.2060	(72)
	475.0061	485.3528	466.3842	451.3367	430.1634	406.3089	391.8184	392.5515	403.7301	426.2253	450.1338	465.8301	(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						6.2000	11.2829	0.6300	0.7000	0.7700	21.3789 (75)	
Northwest						4.3000	11.2829	0.6300	0.7000	0.7700	14.8273 (81)	
Solar gains	36.2062	73.6989	132.7819	218.0660	293.1235	312.5007	292.3380	233.0552	161.7968	90.0658	45.5568	29.5678 (83)
Total gains	511.2124	559.0516	599.1661	669.4027	723.2869	718.8096	684.1564	625.6067	565.5269	516.2912	495.6906	495.3980 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	
alpha	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	
util living area	0.6606	0.6298	0.5857	0.5092	0.4202	0.3304	0.2603	0.2879	0.4069	0.5378	0.6232	0.6695 (86)	
MIT	16.5287	16.9155	17.6098	18.5805	19.4980	20.2080	20.5816	20.5111	19.9248	18.7898	17.5155	16.4332 (87)	
Th 2	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573 (88)	
util rest of house	0.6496	0.6180	0.5721	0.4925	0.3991	0.3026	0.2252	0.2520	0.3785	0.5183	0.6093	0.6587 (89)	
MIT 2	15.2713	15.7213	16.5312	17.6550	18.7049	19.5016	19.9048	19.8365	19.2042	17.9151	16.4323	15.1605 (90)	
Living area fraction	fLA = Living area / (4) =												0.4160 (91)
MIT	15.7944	16.2181	16.9799	18.0400	19.0349	19.7955	20.1864	20.1171	19.5040	18.2790	16.8830	15.6900 (92)	
Temperature adjustment													0.0000
adjusted MIT	15.7944	16.2181	16.9799	18.0400	19.0349	19.7955	20.1864	20.1171	19.5040	18.2790	16.8830	15.6900 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.5666	0.5391	0.5006	0.4357	0.3611	0.2843	0.2217	0.2448	0.3469	0.4579	0.5324	0.5747 (94)
Useful gains	289.6700	301.4096	299.9184	291.6516	261.2080	204.3578	151.6574	153.1611	196.2038	236.4234	263.9238	284.7083 (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	593.4180	584.3151	541.0444	471.8691	378.6745	268.2266	185.1544	191.9021	278.9904	396.4412	505.0610	593.1901 (97)
Space heating kWh	225.9885	190.1125	179.3977	129.7566	87.3951	0.0000	0.0000	0.0000	0.0000	119.0532	173.6188	229.5105 (98a)
Space heating requirement - total per year (kWh/year)												1334.8329
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	225.9885	190.1125	179.3977	129.7566	87.3951	0.0000	0.0000	0.0000	0.0000	119.0532	173.6188	229.5105 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1334.8329
Space heating per m2	(98c) / (4) =											20.5675 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0010 (203)
Fraction of total heating from main system 1												0.9990 (204)
Fraction of total heating from main system 2												0.0010 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	225.9885	190.1125	179.3977	129.7566	87.3951	0.0000	0.0000	0.0000	0.0000	119.0532	173.6188	229.5105 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	225.7625	189.9224	179.2183	129.6268	87.3077	0.0000	0.0000	0.0000	0.0000	118.9342	173.4452	229.2810 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	216.5254	191.5528	203.7662	179.9082	174.8849	158.1276	156.5004	162.4391	163.9075	182.1143	192.8271	214.2694 (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	127.3679	112.6781	119.8625	105.8283	102.8735	93.0163	92.0590	95.5524	96.4162	107.1261	113.4277	126.0408 (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	11.2133	10.1282	11.2133	10.8516	11.2133	10.8516	11.2133	11.2133	10.8516	11.2133	10.8516	11.2133 (231)
Lighting	18.7924	15.0759	13.5742	9.9451	7.6818	6.2761	7.0076	9.1088	11.8314	15.5235	17.5337	19.3147 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-6.3464	-10.4199	-17.5085	-22.8117	-27.2012	-25.3924	-25.0257	-22.2472	-17.7961	-12.9896	-7.4310	-5.3167 (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												1333.4981 (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												1292.2488 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.6790, total flow = 21.0000, SFP = 0.1752)												
mechanical ventilation fans (SFP = 0.1752)												34.6781 (230a)
warm air heating system fans												97.3500 (230b)
Total electricity for the above, kWh/year												132.0281 (231)

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Electricity for lighting (calculated in Appendix L)	151.6653 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-200.4863 (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	2708.9538 (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	1333.4981	0.1533	204.4066 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (263)
Water heating (other fuel)	1292.2488	0.1408	181.9277 (264)
Space and water heating			386.3343 (265)
Pumps, fans and electric keep-hot	132.0281	0.1387	18.3139 (267)
Energy for lighting	151.6653	0.1443	21.8900 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-200.4863	0.1321	-26.4761
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-26.4761 (269)
Total CO2, kg/year			400.0621 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.1600 (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	1333.4981	1.5675	2090.2591 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1292.2488	1.5206	1964.9439 (278)
Space and water heating			4055.2029 (279)
Pumps, fans and electric keep-hot	132.0281	1.5128	199.7321 (281)
Energy for lighting	151.6653	1.5338	232.6293 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-200.4863	1.4879	-298.3095
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-298.3095 (283)
Total Primary energy kWh/year			4189.2548 (286)
Dwelling Primary energy Rate (DPER)			64.5500 (287)

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

1. Overall dwelling characteristics

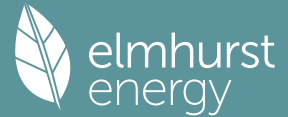
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	64.9000 (1b)	2.5000 (2b)	162.2500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	162.2500 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1233 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3733 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3173 (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)

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Adj infilt rate	0.4045	0.3966	0.3887	0.3490	0.3411	0.3014	0.3014	0.2935	0.3173	0.3411	0.3569	0.3728 (22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5582	0.5454	0.5454	0.5431	0.5503	0.5582	0.5637	0.5695 (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			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			10.5000	1.1450	12.0229		(27)
External Wall 1	44.0000	10.5000	33.5000	0.1800	6.0300		(29a)
Corridor	10.0000	2.1000	7.9000	0.1800	1.4220		(29a)
External Roof 1	12.0000		12.0000	0.1100	1.3200		(30)
Total net area of external elements Aum(A, m2)			66.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	22.8949	(33)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.0000	0.0500	0.4000
E3 Sill	8.0000	0.0500	0.4000
E4 Jamb	18.0000	0.0500	0.9000
E7 Party floor between dwellings (in blocks of flats)	33.6000	0.0700	2.3520
E16 Corner (normal)	5.0000	0.0900	0.4500
E14 Flat roof	10.0000	0.0800	0.8000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	5.0000	0.0600	0.3000

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

Point Thermal bridges

Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 31.1522	Feb 30.9821	Mar 30.8153	Apr 30.0321	May 29.8856	Jun 29.2034	Jul 29.2034	Aug 29.0771	Sep 29.4662	Oct 29.8856	Nov 30.1820	Dec 30.4919 (38)
Heat transfer coeff	59.4241	59.2540	59.0872	58.3040	58.1575	57.4753	57.4753	57.3490	57.7381	58.1575	58.4539	58.7638 (39)
Average = Sum(39)m / 12 =												58.3033
HLP	Jan 0.9156	Feb 0.9130	Mar 0.9104	Apr 0.8984	May 0.8961	Jun 0.8856	Jul 0.8856	Aug 0.8837	Sep 0.8896	Oct 0.8961	Nov 0.9007	Dec 0.9055 (40)
HLP (average)												0.8984
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

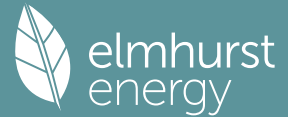
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1163 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	68.8140	67.7920	66.3528	63.6993	61.7123	59.5091	58.3190	59.7481	61.3042	63.6617	66.3699	68.5814 (42b)
Hot water usage for other uses	36.3026	34.9825	33.6624	32.3423	31.0222	29.7021	29.7021	31.0222	32.3423	33.6624	34.9825	36.3026 (42c)
Average daily hot water use (litres/day)												96.8038 (43)
Daily hot water use	Jan 105.1166	Feb 102.7745	Mar 100.0153	Apr 96.0416	May 92.7346	Jun 89.2112	Jul 88.0212	Aug 90.7704	Sep 93.6465	Oct 97.3241	Nov 101.3524	Dec 104.8840 (44)
Energy conte	166.4790	146.3496	153.7198	131.4762	124.8385	109.6956	106.4540	112.3927	115.4755	132.0679	144.3951	164.2230 (45)
Energy content (annual)										Total = Sum(45)m =		1607.5669
Distribution loss (46)m = 0.15 x (45)m	24.9719	21.9524	23.0580	19.7214	18.7258	16.4543	15.9681	16.8589	17.3213	19.8102	21.6593	24.6334 (46)
Water storage loss:												170.0000 (47)
Store volume												1.5003 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8102 (55)
Enter (49) or (54) in (55)												
Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (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	214.8567	190.0456	202.0975	178.2933	173.2162	156.5128	154.8317	160.7704	162.2926	180.4456	191.2122	212.6007 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	214.8567	190.0456	202.0975	178.2933	173.2162	156.5128	154.8317	160.7704	162.2926	180.4456	191.2122	212.6007 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2177.1753 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	94.0564	83.6180	89.8140	81.1695	80.2110	73.9275	74.0981	76.0727	75.8493	82.6147	85.4651	93.3063 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan 105.8130	Feb 105.8130	Mar 105.8130	Apr 105.8130	May 105.8130	Jun 105.8130	Jul 105.8130	Aug 105.8130	Sep 105.8130	Oct 105.8130	Nov 105.8130	Dec 105.8130 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	97.1983	107.6124	97.1983	100.4382	97.1983	100.4382	97.1983	97.1983	100.4382	97.1983	100.4382	97.1983 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.1147	187.0356	182.1950	171.8899	158.8815	146.6554	138.4877	136.5668	141.4074	151.7125	164.7209	176.9470 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813 (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)												

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	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504 (71)
Water heating gains (Table 5)	126.4199	124.4316	120.7177	112.7355	107.8105	102.6771	99.5942	102.2483	105.3463	111.0413	118.7015	125.4117 (72)
Total internal gains	466.4768	476.8235	457.8549	442.8074	421.6341	404.5146	390.0241	390.7572	401.9358	417.6960	441.6045	457.3008 (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	6.2000		11.2829		0.6300		0.7000		0.7700		21.3789 (75)	
Northwest	4.3000		11.2829		0.6300		0.7000		0.7700		14.8273 (81)	
Solar gains	36.2062	73.6989	132.7819	218.0660	293.1235	312.5007	292.3380	233.0552	161.7968	90.0658	45.5568	29.5678 (83)
Total gains	502.6831	550.5223	590.6368	660.8734	714.7576	717.0153	682.3621	623.8124	563.7326	507.7619	487.1613	486.8687 (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	1.5169	1.5212	1.5255	1.5460	1.5499	1.5683	1.5683	1.5718	1.5612	1.5499	1.5421	1.5339
alpha	1.1011	1.1014	1.1017	1.1031	1.1033	1.1046	1.1046	1.1048	1.1041	1.1033	1.1028	1.1023
util living area	0.6932	0.6631	0.6199	0.5416	0.4516	0.3546	0.2817	0.3102	0.4341	0.5702	0.6543	0.6995 (86)
MIT	16.2045	16.6018	17.3260	18.3639	19.3420	20.1265	20.5333	20.4581	19.8234	18.6025	17.2642	16.1320 (87)
Th 2	20.1542	20.1565	20.1586	20.1689	20.1708	20.1798	20.1798	20.1814	20.1763	20.1708	20.1669	20.1629 (88)
util rest of house	0.6813	0.6502	0.6049	0.5230	0.4276	0.3227	0.2406	0.2685	0.4018	0.5486	0.6393	0.6879 (89)
MIT 2	14.8477	15.3107	16.1562	17.3618	18.4807	19.3634	19.7999	19.7292	19.0451	17.6582	16.0995	14.7677 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	15.4122	15.8479	16.6429	17.7787	18.8390	19.6809	20.1050	20.0324	19.3689	18.0511	16.5840	15.3353 (92)
Temperature adjustment												0.0000
adjusted MIT	15.4122	15.8479	16.6429	17.7787	18.8390	19.6809	20.1050	20.0324	19.3689	18.0511	16.5840	15.3353 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.5947	0.5669	0.5280	0.4605	0.3845	0.3019	0.2367	0.2604	0.3667	0.4830	0.5582	0.6008 (94)
Useful gains	298.9622	312.0980	311.8663	304.3558	274.8579	216.4348	161.4896	162.4533	206.7093	245.2359	271.9386	292.5238 (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	660.3323	648.7036	599.3152	517.6653	415.1863	292.0267	201.4514	208.3169	304.2149	433.3361	554.3789	654.3511 (97)
Space heating kWh	268.8594	226.1990	213.8620	153.5829	104.4043	0.0000	0.0000	0.0000	0.0000	139.9466	203.3570	269.1995 (98a)
Space heating requirement - total per year (kWh/year)												1579.4107
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	268.8594	226.1990	213.8620	153.5829	104.4043	0.0000	0.0000	0.0000	0.0000	139.9466	203.3570	269.1995 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1579.4107
Space heating per m2												(98c) / (4) = 24.3361 (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	268.8594	226.1990	213.8620	153.5829	104.4043	0.0000	0.0000	0.0000	0.0000	139.9466	203.3570	269.1995 (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)	291.2886	245.0693	231.7031	166.3953	113.1141	0.0000	0.0000	0.0000	0.0000	151.6214	220.3218	291.6571 (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	214.8567	190.0456	202.0975	178.2933	173.2162	156.5128	154.8317	160.7704	162.2926	180.4456	191.2122	212.6007 (64)
Efficiency of water heater (217)m	84.5637	84.4513	84.1869	83.7270	82.9621	79.8000	79.8000	79.8000	79.8000	83.4964	84.1981	79.8000 (216)
Fuel for water heating, kWh/month	254.0767	225.0356	240.0581	212.9460	208.7896	196.1313	194.0247	201.4666	203.3742	216.1119	227.0980	84.5902 (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	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	20.1959	16.2019	14.5880	10.6878	8.2556	6.7449	7.5310	9.7891	12.7150	16.6828	18.8432	20.7572 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-17.4474	-25.8797	-39.1169	-46.3267	-52.0240	-49.3261	-48.7350	-44.9860	-38.7270	-30.6251	-19.6351	-14.9392 (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)												

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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	-6.3092	-13.5640	-27.5093	-42.1325	-56.5107	-57.0666	-56.3850	-47.3632	-34.2301	-19.6510	-8.5048	-4.9669	(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												1711.1709	(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												2630.4427	(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)												162.9923	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-801.9613	(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												3788.6446	(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	1711.1709	0.2100	359.3459	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2630.4427	0.2100	552.3930	(264)
Space and water heating			911.7388	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	162.9923	0.1443	23.5248	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-427.7682	0.1335	-57.1183	
PV Unit electricity exported	-374.1930	0.1253	-46.8982	
Total			-104.0165	(269)
Total CO2, kg/year			843.1764	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.9900	(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	1711.1709	1.1300	1933.6231	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2630.4427	1.1300	2972.4002	(278)
Space and water heating			4906.0233	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	162.9923	1.5338	250.0030	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-427.7682	1.4934	-638.8420	
PV Unit electricity exported	-374.1930	0.4600	-172.1387	
Total			-810.9807	(283)
Total Primary energy kWh/year			4475.1464	(286)
Target Primary Energy Rate (TPER)			68.9500	(287)

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Property Reference	1.01 Gas				Issued on Date	15/12/2023
Assessment Reference	1.01 Gas		Prop Type Ref	1.01		
Property	1.01, 1.01					
SAP Rating	87 B	DER	12.52	TER	13.06	
Environmental	90 B	% DER < TER				4.13
CO ₂ Emissions (t/year)	0.77	DFEE	27.42	TFEE	30.21	
Compliance Check	See BREL	% DFEE < TFEE				9.23
% DPER < TPER	1.35	DPER	68.37	TPER	69.31	
Assessor Details	Mr. Jonathan Lewis				Assessor ID	AZ32-0001
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	64.9000 (1b)	2.5000 (2b)	162.2500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.9000		162.2500 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 162.2500 (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	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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
Door			2.1000	1.0000	2.1000		(26)
Window (Uw = 1.20)			10.5000	1.1450	12.0229		(27)
External Wall 1	44.0000	10.5000	33.5000	0.1700	5.6950		(29a)
Corridor	10.0000	2.1000	7.9000	0.1300	1.0270		(29a)
External Roof 1	12.0000		12.0000	0.1000	1.2000		(30)
Total net area of external elements Aum (A, m ²)			66.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 22.0449		(33)
Party Floor 1			64.9000				(32d)
Party Ceiling 1			52.9000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							5.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				8.0000	0.0410	0.3280	
E3 Sill				8.0000	0.0460	0.3680	
E4 Jamb				18.0000	0.0470	0.8460	

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E7 Party floor between dwellings (in blocks of flats)	33.6000	0.0350	1.1760
E16 Corner (normal)	5.0000	0.0000	0.0000
E14 Flat roof	10.0000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0310	-0.0775
E18 Party wall between dwellings	5.0000	0.0340	0.1700
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.8105 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	24.8554 (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	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713	26.7713 (38)
Average = Sum(39)m / 12 =	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267	51.6267 (39)
HLP	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955	0.7955 (40)
HLP (average)												0.7955
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1163 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	68.8140	67.7920	66.3528	63.6993	61.7123	59.5091	58.3190	59.7481	61.3042	63.6617	66.3699	68.5814 (42b)
Hot water usage for other uses	36.3026	34.9825	33.6624	32.3423	31.0222	29.7021	29.7021	31.0222	32.3423	33.6624	34.9825	36.3026 (42c)
Average daily hot water use (litres/day)												96.8038 (43)
Daily hot water use	105.1166	102.7745	100.0153	96.0416	92.7346	89.2112	88.0212	90.7704	93.6465	97.3241	101.3524	104.8840 (44)
Energy content (annual)	166.4790	146.3496	153.7198	131.4762	124.8385	109.6956	106.4540	112.3927	115.4755	132.0679	144.3951	164.2230 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9719	21.9524	23.0580	19.7214	18.7258	16.4543	15.9681	16.8589	17.3213	19.8102	21.6593	24.6334 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	25.4866	23.0105	25.4593	24.6043	25.4024	24.5617	25.3693	25.3818	24.5771	25.4215	24.6332	25.4828 (61)
Total heat required for water heating calculated for each month	191.9657	169.3601	179.1791	156.0805	150.2409	134.2573	131.8233	137.7744	140.0526	157.4894	169.0283	189.7057 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	191.9657	169.3601	179.1791	156.0805	150.2409	134.2573	131.8233	137.7744	140.0526	157.4894	169.0283	189.7057 (64)
12Total per year (kWh/year)												1906.9573 (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	61.7259	54.4139	57.4766	49.8669	47.8594	42.6142	41.7383	43.7160	44.5399	50.2680	54.1697	60.9748 (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	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	97.1983	107.6124	97.1983	100.4382	97.1983	100.4382	97.1983	97.1983	100.4382	97.1983	100.4382	97.1983 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	185.1147	187.0356	182.1950	171.8899	158.8815	146.6554	138.4877	136.5668	141.4074	151.7125	164.7209	176.9470 (68)
Pumps, fans	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504 (71)
Total internal gains	82.9650	80.9730	77.2536	69.2596	64.3272	59.1864	56.0998	58.7581	61.8609	67.5645	75.2356	81.9554 (72)
	423.0219	433.3649	414.3907	399.3316	378.1508	361.0239	346.5297	347.2670	358.4504	374.2192	398.1387	413.8446 (73)

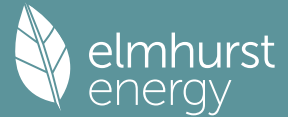
6. Solar gains

[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				6.2000	11.2829		0.6300		0.7000		0.7700		21.3789 (75)
Northwest				4.3000	11.2829		0.6300		0.7000		0.7700		14.8273 (81)
Solar gains	36.2062	73.6989	132.7819	218.0660	293.1235	312.5007	292.3380	233.0552	161.7968	90.0658	45.5568		29.5678 (83)
Total gains	459.2281	507.0638	547.1726	617.3976	671.2743	673.5246	638.8676	580.3222	520.2473	464.2850	443.6955	443.4124	(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)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460	1.7460
alpha	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164	1.1164
util living area	0.6858	0.6538	0.6089	0.5306	0.4395	0.3456	0.2742	0.3042	0.4282	0.5657	0.6505	0.6952 (86)
MIT	16.3347	16.7398	17.4585	18.4671	19.4216	20.1676	20.5569	20.4805	19.8622	18.6615	17.3427	16.2337 (87)
Th 2	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573	20.2573 (88)
util rest of house	0.6752	0.6423	0.5955	0.5139	0.4180	0.3171	0.2378	0.2669	0.3992	0.5463	0.6371	0.6849 (89)
MIT 2	15.0482	15.5202	16.3597	17.5289	18.6231	19.4616	19.8830	19.8088	19.1400	17.7735	16.2358	14.9308 (90)
Living area fraction	15.5834	16.0276	16.8168	17.9192	18.9553	19.7553	20.1634	20.0882	FLA = Living area / (4) =	18.1429	16.6963	0.4160 (91)
MIT	15.5834	16.0276	16.8168	17.9192	18.9553	19.7553	20.1634	20.0882	19.4405	18.1429	16.6963	15.4729 (92)
Temperature adjustment												0.0000
adjusted MIT	15.5834	16.0276	16.8168	17.9192	18.9553	19.7553	20.1634	20.0882	19.4405	18.1429	16.6963	15.4729 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.5896	0.5603	0.5204	0.4532	0.3767	0.2966	0.2329	0.2579	0.3641	0.4811	0.5565	0.5984 (94)
Useful gains	270.7656	284.1055	284.7414	279.8257	252.8377	199.7485	148.8121	149.6895	189.4124	223.3648	246.9117	265.3193 (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	582.5254	574.4799	532.6212	465.6328	374.5685	266.1521	183.9649	190.4101	275.7101	389.4160	495.4235	581.9796 (97)
Space heating kWh	231.9492	195.1316	184.4225	133.7811	90.5677	0.0000	0.0000	0.0000	0.0000	123.5421	178.9285	235.5953 (98a)
Space heating requirement - total per year (kWh/year)												1373.9180
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	231.9492	195.1316	184.4225	133.7811	90.5677	0.0000	0.0000	0.0000	0.0000	123.5421	178.9285	235.5953 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1373.9180
Space heating per m2										(98c) / (4) =		21.1698 (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 %)												84.2000 (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	231.9492	195.1316	184.4225	133.7811	90.5677	0.0000	0.0000	0.0000	0.0000	123.5421	178.9285	235.5953 (98)
Space heating efficiency (main heating system 1)	84.2000	84.2000	84.2000	84.2000	84.2000	0.0000	0.0000	0.0000	0.0000	84.2000	84.2000	84.2000 (210)
Space heating fuel (main heating system)	275.4742	231.7477	219.0291	158.8849	107.5626	0.0000	0.0000	0.0000	0.0000	146.7246	212.5042	279.8044 (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	191.9657	169.3601	179.1791	156.0805	150.2409	134.2573	131.8233	137.7744	140.0526	157.4894	169.0283	189.7057 (64)
Efficiency of water heater	88.2831	88.2594	88.2031	88.1118	87.9416	87.2000	87.2000	87.2000	87.2000	88.0680	88.2171	88.2967 (216)
Fuel for water heating, kWh/month	217.4434	191.8890	203.1438	177.1391	170.8417	153.9648	151.1735	157.9982	160.6108	178.8270	191.6048	214.8504 (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	10.2494	9.2575	10.2494	9.9187	10.2494	9.9187	10.2494	10.2494	9.9187	10.2494	9.9187	10.2494 (231)
Lighting	18.7924	15.0759	13.5742	9.9451	7.6818	6.2761	7.0076	9.1088	11.8314	15.5235	17.5337	19.3147 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-5.9776	-9.6114	-15.8450	-20.3580	-24.1711	-23.3955	-23.0585	-20.5754	-16.6326	-11.9344	-6.9476	-5.0241 (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												1631.7316 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												87.2000
Water heating fuel used												2169.4865 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 3.6790, total flow = 21.0000, SFP = 0.1752)												
mechanical ventilation fans (SFP = 0.1752)												34.6781 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												120.6781 (231)
Electricity for lighting (calculated in Appendix L)												151.6653 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-183.5312 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)

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Appendix Q - special features
Energy saved or generated
Energy used
Total delivered energy for all uses

-0.0000 (236)
0.0000 (237)
3890.0302 (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	1631.7316	0.2100	342.6636 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2169.4865	0.2100	455.5922 (264)
Space and water heating			798.2558 (265)
Pumps, fans and electric keep-hot	120.6781	0.1387	16.7395 (267)
Energy for lighting	151.6653	0.1443	21.8900 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-183.5312	0.1320	-24.2299
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-24.2299 (269)
Total CO2, kg/year			812.6554 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.5200 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1631.7316	1.1300	1843.8567 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2169.4865	1.1300	2451.5197 (278)
Space and water heating			4295.3764 (279)
Pumps, fans and electric keep-hot	120.6781	1.5128	182.5618 (281)
Energy for lighting	151.6653	1.5338	232.6293 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-183.5312	1.4878	-273.0536
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-273.0536 (283)
Total Primary energy kWh/year			4437.5139 (286)
Dwelling Primary energy Rate (DPER)			68.3700 (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	64.9000 (1b)	x 2.5000 (2b)	= 162.2500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 162.2500 (5)

2. Ventilation rate

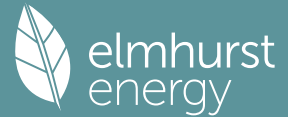
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1233 (8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000 (17)		
Infiltration rate	0.3733 (18)		
Number of sides sheltered	2 (19)		
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3173 (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 infiltr rate	0.4045	0.3966	0.3887	0.3490	0.3411	0.3014	0.3014	0.2935	0.3173	0.3411	0.3569	0.3728 (22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5582	0.5454	0.5454	0.5431	0.5503	0.5582	0.5637	0.5695 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			10.5000	1.1450	12.0229		(27)
External Wall 1	44.0000	10.5000	33.5000	0.1800	6.0300		(29a)
Corridor	10.0000	2.1000	7.9000	0.1800	1.4220		(29a)
External Roof 1	12.0000		12.0000	0.1100	1.3200		(30)
Total net area of external elements Aum(A, m2)			66.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8949		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				5.0000 (35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.0000	0.0500	0.4000	
E3 Sill	8.0000	0.0500	0.4000	
E4 Jamb	18.0000	0.0500	0.9000	
E7 Party floor between dwellings (in blocks of flats)	33.6000	0.0700	2.3520	
E16 Corner (normal)	5.0000	0.0900	0.4500	
E14 Flat roof	10.0000	0.0800	0.8000	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250	
E18 Party wall between dwellings	5.0000	0.0600	0.3000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				5.3770 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 28.2719 (37)

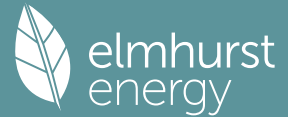
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.1522	30.9821	30.8153	30.0321	29.8856	29.2034	29.2034	29.0771	29.4662	29.8856	30.1820	30.4919 (38)
Heat transfer coeff	59.4241	59.2540	59.0872	58.3040	58.1575	57.4753	57.4753	57.3490	57.7381	58.1575	58.4539	58.7638 (39)
Average = Sum(39)m / 12 =												58.3033
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9156	0.9130	0.9104	0.8984	0.8961	0.8856	0.8856	0.8837	0.8896	0.8961	0.9007	0.9055 (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												2.1163 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	68.8140	67.7920	66.3528	63.6993	61.7123	59.5091	58.3190	59.7481	61.3042	63.6617	66.3699	68.5814 (42b)
Hot water usage for other uses	36.3026	34.9825	33.6624	32.3423	31.0222	29.7021	29.7021	31.0222	32.3423	33.6624	34.9825	36.3026 (42c)
Average daily hot water use (litres/day)												96.8038 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	105.1166	102.7745	100.0153	96.0416	92.7346	89.2112	88.0212	90.7704	93.6465	97.3241	101.3524	104.8840 (44)
Energy content (annual)	166.4790	146.3496	153.7198	131.4762	124.8385	109.6956	106.4540	112.3927	115.4755	132.0679	144.3951	164.2230 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1607.5669
Water storage loss:	24.9719	21.9524	23.0580	19.7214	18.7258	16.4543	15.9681	16.8589	17.3213	19.8102	21.6593	24.6334 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	50.9589	46.0274	50.9589	47.3630	47.2565	43.9946	44.8546	46.2556	46.1818	49.5953	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	217.4379	192.3770	204.6787	178.8392	172.0951	153.6902	151.3086	158.6483	161.6573	181.6632	193.7102	215.1819 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	217.4379	192.3770	204.6787	178.8392	172.0951	153.6902	151.3086	158.6483	161.6573	181.6632	193.7102	215.1819 (64)
12Total per year (kWh/year)												2181.2875 (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)
Heat gains from water heating, kWh/month	68.0940	60.1681	63.8515	55.5566	53.3229	47.4724	46.6096	48.9345	49.9411	56.3114	60.3401	67.3439 (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	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130	105.8130 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	97.1983	107.6124	97.1983	100.4382	97.1983	97.1983	97.1983	97.1983	100.4382	97.1983	100.4382	97.1983 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	185.1147	187.0356	182.1950	171.8899	158.8815	146.6554	138.4877	136.5668	141.4074	151.7125	164.7209	176.9470 (68)
Pumps, fans	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813	33.5813 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504	-84.6504 (71)
Total internal gains	91.5242	89.5358	85.8220	77.1619	71.6706	65.9339	62.6473	65.7721	69.3626	75.6874	83.8058	90.5160 (72)
	431.5811	441.9277	422.9591	407.2339	385.4943	367.7715	353.0772	354.2811	365.9521	382.3421	406.7088	422.4051 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						

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				m2	Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W
Northeast				6.2000	11.2829	0.6300		0.7000		0.7700		21.3789 (75)
Northwest				4.3000	11.2829	0.6300		0.7000		0.7700		14.8273 (81)
Solar gains	36.2062	73.6989	132.7819	218.0660	293.1235	312.5007	292.3380	233.0552	161.7968	90.0658	45.5568	29.5678 (83)
Total gains	467.7873	515.6266	555.7410	625.2999	678.6178	680.2722	645.4151	587.3363	527.7489	472.4079	452.2656	451.9729 (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	1.5169	1.5212	1.5255	1.5460	1.5499	1.5683	1.5683	1.5718	1.5612	1.5499	1.5421	1.5339
alpha	1.1011	1.1014	1.1017	1.1031	1.1033	1.1046	1.1046	1.1048	1.1041	1.1033	1.1028	1.1023
util living area	0.7092	0.6784	0.6349	0.5560	0.4651	0.3672	0.2935	0.3237	0.4511	0.5887	0.6719	0.7159 (86)
MIT	16.0802	16.4881	17.2267	18.2862	19.2875	20.0924	20.5119	20.4321	19.7726	18.5159	17.1517	16.0040 (87)
Th 2	20.1542	20.1565	20.1586	20.1689	20.1708	20.1798	20.1798	20.1814	20.1763	20.1708	20.1669	20.1629 (88)
util rest of house	0.6977	0.6658	0.6201	0.5375	0.4409	0.3348	0.2513	0.2809	0.4185	0.5674	0.6573	0.7047 (89)
MIT 2	14.7051	15.1808	16.0440	17.2759	18.4228	19.3300	19.7815	19.7063	18.9935	17.5631	15.9719	14.6205 (90)
Living area fraction	fLA = Living area / (4) =											0.4160 (91)
MIT	15.2772	15.7247	16.5360	17.6962	18.7825	19.6472	20.0853	20.0083	19.3176	17.9595	16.4628	15.1961 (92)
Temperature adjustment												0.0000
adjusted MIT	15.2772	15.7247	16.5360	17.6962	18.7825	19.6472	20.0853	20.0083	19.3176	17.9595	16.4628	15.1961 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.6098	0.5809	0.5412	0.4725	0.3954	0.3120	0.2461	0.2712	0.3804	0.4987	0.5741	0.6164 (94)
Useful gains	285.2737	299.5148	300.7547	295.4702	268.3540	212.2353	158.8448	159.3002	200.7401	235.5684	259.6561	278.5884 (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	652.3079	641.4064	593.0000	512.8529	411.9005	290.0878	200.3203	206.9303	301.2555	428.0081	547.2893	646.1710 (97)
Space heating kWh	273.0734	229.7512	217.4305	156.5156	106.7986	0.0000	0.0000	0.0000	0.0000	143.1751	207.0959	273.4814 (98a)
Space heating requirement - total per year (kWh/year)												1607.3217
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	273.0734	229.7512	217.4305	156.5156	106.7986	0.0000	0.0000	0.0000	0.0000	143.1751	207.0959	273.4814 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1607.3217
Space heating per m2	(98c) / (4) =											24.7661 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	273.0734	229.7512	217.4305	156.5156	106.7986	0.0000	0.0000	0.0000	0.0000	143.1751	207.0959	273.4814 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	295.5340	248.6485	235.3144	169.3891	115.5829	0.0000	0.0000	0.0000	0.0000	154.9514	224.1297	295.9756 (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	217.4379	192.3770	204.6787	178.8392	172.0951	153.6902	151.3086	158.6483	161.6573	181.6632	193.7102	215.1819 (64)
Efficiency of water heater (217)m	84.8707	84.7629	84.5112	84.0969	83.3891	80.3000	80.3000	80.3000	80.3000	83.8763	84.5249	80.3000 (216)
Fuel for water heating, kWh/month	256.1990	226.9590	242.1912	212.6584	206.3760	191.3950	188.4291	197.5694	201.3167	216.5846	229.1752	84.8962 (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	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	20.1959	16.2019	14.5880	10.6878	8.2556	6.7449	7.5310	9.7891	12.7150	16.6828	18.8432	20.7572 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-17.4474	-25.8797	-39.1169	-46.3267	-52.0240	-49.3261	-48.7350	-44.9860	-38.7270	-30.6251	-19.6351	-14.9392 (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)	-6.3092	-13.5640	-27.5093	-42.1325	-56.5107	-57.0666	-56.3850	-47.3632	-34.2301	-19.6510	-8.5048	-4.9669 (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												1739.5257 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

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Efficiency of water heater	80.3000	
Water heating fuel used	2622.3183	(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)	162.9923	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-801.9613	(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	3808.8750	(238)

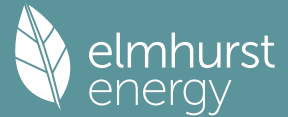
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1739.5257	0.2100	365.3004 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2622.3183	0.2100	550.6868 (264)
Space and water heating			915.9872 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	162.9923	0.1443	23.5248 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-427.7682	0.1335	-57.1183
PV Unit electricity exported	-374.1930	0.1253	-46.8982
Total			-104.0165 (269)
Total CO2, kg/year			847.4248 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.0600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1739.5257	1.1300	1965.6640 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2622.3183	1.1300	2963.2196 (278)
Space and water heating			4928.8836 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	162.9923	1.5338	250.0030 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-427.7682	1.4934	-638.8420
PV Unit electricity exported	-374.1930	0.4600	-172.1387
Total			-810.9807 (283)
Total Primary energy kWh/year			4498.0068 (286)
Target Primary Energy Rate (TPER)			69.3100 (287)

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Property Reference	2.02 EDL				Issued on Date	15/12/2023	
Assessment Reference	2.02 EDL			Prop Type Ref	2.02 EDL		
Property	1.01, 1.01						
SAP Rating	76 C	DER	5.37	TER	10.83		
Environmental	95 A	% DER < TER				50.42	
CO ₂ Emissions (t/year)	0.51	DFEE	29.55	TFEE	32.51		
Compliance Check	See BREL	% DFEE < TFEE				9.09	
% DPER < TPER	2.17	DPER	55.81	TPER	57.05		
Assessor Details	Mr. Jonathan Lewis				Assessor ID	AZ32-0001	
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	59.4000 (1b)	x 2.8000 (2b)	= 166.3200 (1b) - (3b)
First floor	42.4000 (1c)	x 2.2000 (2c)	= 93.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 259.6000 (5)

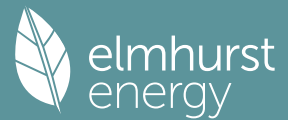
2. Ventilation rate

											m3 per hour		
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =											0.0000 (8)	
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												3.0000 (17)	
Infiltration rate												0.1500 (18)	
Number of sides sheltered												2 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross 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
Door			2.1000	1.0000	2.1000		(26)
Window (Uw = 1.20)			10.8000	1.1450	12.3664		(27)
NW Roof Light			3.2000	1.1450	3.6641		(27a)
SW Roof Light			1.6000	1.1450	1.8321		(27a)
External Wall 1	67.4000	10.8000	56.6000	0.1700	9.6220		(29a)
Corridor	26.0000	2.1000	23.9000	0.1300	3.1070		(29a)
External Roof 1	59.4000	4.8000	54.6000	0.1600	8.7360		(30)
Total net area of external elements Aum(A, m ²)			152.8000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 41.4276		(33)
Party Floor 1			59.4000				(32d)
Party Ceiling 1			52.9000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							5.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)	8.0000	0.0410	0.3280										
E3 Sill	8.0000	0.0460	0.3680										
E4 Jamb	18.0000	0.0470	0.8460										
E7 Party floor between dwellings (in blocks of flats)	33.6000	0.0350	1.1760										
E16 Corner (normal)	5.0000	0.0000	0.0000										
E14 Flat roof	10.0000	0.0000	0.0000										
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0310	-0.0775										
E18 Party wall between dwellings	5.0000	0.0340	0.1700										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				2.8105 (36)									
Point Thermal bridges				0.0000									
Total fabric heat loss		(33) + (36) + (36a) =		44.2381 (37)									
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 42.8340	Feb 42.8340	Mar 42.8340	Apr 42.8340	May 42.8340	Jun 42.8340	Jul 42.8340	Aug 42.8340	Sep 42.8340	Oct 42.8340	Nov 42.8340	Dec 42.8340	(38)
Heat transfer coeff	87.0721	87.0721	87.0721	87.0721	87.0721	87.0721	87.0721	87.0721	87.0721	87.0721	87.0721	87.0721	(39)
Average = Sum(39)m / 12 =													87.0721
HLP	Jan 0.8553	Feb 0.8553	Mar 0.8553	Apr 0.8553	May 0.8553	Jun 0.8553	Jul 0.8553	Aug 0.8553	Sep 0.8553	Oct 0.8553	Nov 0.8553	Dec 0.8553	(40)
HLP (average)													0.8553
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.7556 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	81.2247	80.0184	78.3197	75.1875	72.8422	70.2416	68.8369	70.5238	72.3604	75.1431	78.3398	80.9501	(42b)
Hot water usage for other uses	42.8498	41.2917	39.7335	38.1753	36.6171	35.0590	35.0590	36.6171	38.1753	39.7335	41.2917	42.8498	(42c)
Average daily hot water use (litres/day)													114.2625 (43)
Daily hot water use	Jan 124.0745	Feb 121.3101	Mar 118.0532	Apr 113.3628	May 109.4594	Jun 105.3006	Jul 103.8959	Aug 107.1409	Sep 110.5358	Oct 114.8766	Nov 119.6315	Dec 123.7999	(44)
Energy conte	196.5037	172.7439	181.4433	155.1881	147.3533	129.4794	125.6531	132.6628	136.3016	155.8865	170.4369	193.8408	(45)
Energy content (annual)										Total = Sum(45)m =		1897.4935	
Distribution loss (46)m = 0.15 x (45)m	29.4756	25.9116	27.2165	23.2782	22.1030	19.4219	18.8480	19.8994	20.4452	23.3830	25.5655	29.0761	(46)
Water storage loss:													170.0000 (47)
Store volume													1.6000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.8640 (55)
Enter (49) or (54) in (55)													
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(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	246.5501	217.9471	231.4897	203.6201	197.3997	177.9114	175.6995	182.7092	184.7336	205.9329	218.8689	243.8872	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	246.5501	217.9471	231.4897	203.6201	197.3997	177.9114	175.6995	182.7092	184.7336	205.9329	218.8689	243.8872	(64)
									Total per year (kWh/year) = Sum(64)m =			2486.7495	(64)
12Total per year (kWh/year)												2487	(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 =
Heat gains from water heating, kWh/month	105.3746	93.5999	100.3670	90.3456	89.0321	81.7975	81.8168	84.1475	84.0659	91.8694	95.4159	104.4892	(65)

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

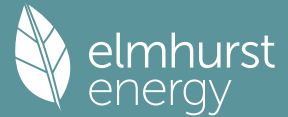
Metabolic gains (Table 5), Watts													
(66)m	Jan 137.7788	Feb 137.7788	Mar 137.7788	Apr 137.7788	May 137.7788	Jun 137.7788	Jul 137.7788	Aug 137.7788	Sep 137.7788	Oct 137.7788	Nov 137.7788	Dec 137.7788	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.9205	150.4834	135.9205	140.4512	135.9205	140.4512	135.9205	135.9205	140.4512	135.9205	140.4512	135.9205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.2053	261.8950	255.1170	240.6873	222.4724	205.3530	193.9162	191.2264	198.0045	212.4342	230.6490	247.7685	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	(69)
Pumps, fans	15.5760	15.5760	15.5760	15.5760	15.5760	0.0000	0.0000	0.0000	0.0000	15.5760	15.5760	15.5760	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	(71)
Water heating gains (Table 5)	141.6325	139.2856	134.9019	125.4800	119.6668	113.6076	109.9688	113.1015	116.7582	123.4804	132.5221	140.4425	(72)
Total internal gains	616.6680	631.5737	605.8490	586.5282	557.9694	523.7455	504.1391	504.5821	519.5475	551.7447	583.5319	604.0411	(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
Southwest			7.2000		36.7938		0.6300		0.7000		0.7700		80.9616 (79)
Northwest			3.6000		11.2829		0.6300		0.7000		0.7700		12.4136 (81)
Southwest			1.6000		26.0000		0.6300		0.7000		1.0000		16.5110 (82)
Northwest			3.2000		26.0000		0.6300		0.7000		1.0000		33.0221 (82)

Solar gains	142.9083	266.0523	417.1080	594.3311	728.1553	748.1462	710.9454	608.7107	478.8747	309.0350	175.4618	119.4314	(83)

Full SAP Calculation Printout



Total gains 759.5763 897.6260 1022.9570 1180.8593 1286.1247 1271.8916 1215.0845 1113.2928 998.4222 860.7796 758.9938 723.4724 (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	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238
alpha	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083
util living area	0.6881	0.6398	0.5805	0.4957	0.4054	0.3185	0.2494	0.2759	0.3941	0.5390	0.6449	0.7005 (86)
MIT	16.2780	16.8047	17.6101	18.6261	19.5383	20.2285	20.5944	20.5264	19.9489	18.7613	17.3457	16.1533 (87)
Th 2	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056 (88)
util rest of house	0.6769	0.6273	0.5660	0.4778	0.3832	0.2894	0.2130	0.2385	0.3641	0.5181	0.6305	0.6895 (89)
MIT 2	14.9576	15.5677	16.5028	17.6736	18.7122	19.4825	19.8733	19.8086	19.1923	17.8528	16.2123	14.8131 (90)
Living area fraction	fLA = Living area / (4) = 0.2652 (91)											
MIT	15.3078	15.8958	16.7965	17.9262	18.9313	19.6804	20.0646	19.9990	19.3929	18.0938	16.5129	15.1686 (92)
Temperature adjustment	0.0000											
adjusted MIT	15.3078	15.8958	16.7965	17.9262	18.9313	19.6804	20.0646	19.9990	19.3929	18.0938	16.5129	15.1686 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.5862	0.5426	0.4910	0.4195	0.3440	0.2689	0.2062	0.2282	0.3304	0.4530	0.5458	0.5978 (94)
Useful gains	445.2984	487.0519	502.2470	495.3759	442.4906	342.0329	250.5385	254.0214	329.8509	389.9431	414.2798	432.4832 (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	958.4706	957.4285	896.5375	785.9315	629.6454	442.3585	301.6671	313.3737	460.8675	652.4984	819.6026	955.0556 (97)
Space heating kWh	381.8002	316.0931	293.3521	209.2000	139.2432	0.0000	0.0000	0.0000	0.0000	195.3411	291.8324	388.7939 (98a)
Space heating requirement - total per year (kWh/year)	2215.6559											
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	381.8002	316.0931	293.3521	209.2000	139.2432	0.0000	0.0000	0.0000	0.0000	195.3411	291.8324	388.7939 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2215.6559											
Space heating per m2	(98c) / (4) = 21.7648 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)

0.0000 (201)

Fraction of space heat from main system(s)

1.0000 (202)

Fraction of main heating from main system 2

0.0010 (203)

Fraction of total heating from main system 1

0.9990 (204)

Fraction of total heating from main system 2

0.0010 (205)

Efficiency of main space heating system 1 (in %)

100.0000 (206)

Efficiency of main space heating system 2 (in %)

0.0000 (207)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	381.8002	316.0931	293.3521	209.2000	139.2432	0.0000	0.0000	0.0000	0.0000	195.3411	291.8324	388.7939 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	381.4184	315.7770	293.0588	208.9908	139.1039	0.0000	0.0000	0.0000	0.0000	195.1457	291.5406	388.4051 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2	0.0000 (213)											
Water heating												
Water heating requirement	246.5501	217.9471	231.4897	203.6201	197.3997	177.9114	175.6995	182.7092	184.7336	205.9329	218.8689	243.8872 (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	145.0295	128.2042	136.1704	119.7765	116.1175	104.6537	103.3526	107.4760	108.6668	121.1370	128.7464	143.4631 (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	17.9413	16.2051	17.9413	17.3626	17.9413	17.3626	17.9413	17.9413	17.3626	17.9413	17.3626	17.9413 (231)
Lighting	27.5933	22.1364	19.9314	14.6026	11.2794	9.2154	10.2895	13.3747	17.3724	22.7935	25.7452	28.3602 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-15.3377	-24.8098	-40.9668	-52.2293	-60.9545	-55.0614	-54.2708	-48.7706	-39.7086	-30.4300	-17.8213	-12.8890 (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	2213.4403 (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	1462.7938 (219)											
Space cooling fuel	0.0000 (221)											

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Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 3.6790, total flow = 21.0000, SFP = 0.1752)	
mechanical ventilation fans (SFP = 0.1752)	55.4849 (230a)
warm air heating system fans	155.7600 (230b)
Total electricity for the above, kWh/year	211.2449 (231)
Electricity for lighting (calculated in Appendix L)	222.6940 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-453.2500 (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	3656.9230 (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	2213.4403	0.1535	339.6534 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1462.7938	0.1409	206.0672 (264)
Space and water heating			545.7206 (265)
Pumps, fans and electric keep-hot	211.2449	0.1387	29.3023 (267)
Energy for lighting	222.6940	0.1443	32.1416 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-453.2500	0.1326	-60.1209
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-60.1209 (269)
Total CO2, kg/year			547.0435 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.3700 (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	2213.4403	1.5681	3470.9058 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1462.7938	1.5209	2224.7534 (278)
Space and water heating			5695.6592 (279)
Pumps, fans and electric keep-hot	211.2449	1.5128	319.5713 (281)
Energy for lighting	222.6940	1.5338	341.5754 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-453.2500	1.4901	-675.4016
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-675.4016 (283)
Total Primary energy kWh/year			5681.4043 (286)
Dwelling Primary energy Rate (DPER)			55.8100 (287)

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

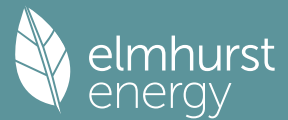
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	59.4000 (1b)	x 2.8000 (2b)	= 166.3200 (1b) - (3b)
First floor	42.4000 (1c)	x 2.2000 (2c)	= 93.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 259.6000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1541 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4041 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)

Full SAP Calculation Printout



Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3435 (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													
	0.4379	0.4293	0.4208	0.3778	0.3692	0.3263	0.3263	0.3177	0.3435	0.3692	0.3864	0.4036	(22b)
Effective ac	0.5959	0.5922	0.5885	0.5714	0.5682	0.5532	0.5532	0.5505	0.5590	0.5682	0.5747	0.5814	(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			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.20)			10.8000	1.1450	12.3664			(27)
NW Roof Light			3.2000	2.0221	6.4706			(27a)
SW Roof Light			1.6000	2.0221	3.2353			(27a)
External Wall 1	67.4000	10.8000	56.6000	0.1800	10.1880			(29a)
Corridor	26.0000	2.1000	23.9000	0.1800	4.3020			(29a)
External Roof 1	59.4000	4.8000	54.6000	0.1100	6.0060			(30)
Total net area of external elements Aum(A, m2)			152.8000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.6683		(33)

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

5.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.0000	0.0500	0.4000	
E3 Sill	8.0000	0.0500	0.4000	
E4 Jamb	18.0000	0.0500	0.9000	
E7 Party floor between dwellings (in blocks of flats)	33.6000	0.0700	2.3520	
E16 Corner (normal)	5.0000	0.0900	0.4500	
E14 Flat roof	10.0000	0.0800	0.8000	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250	
E18 Party wall between dwellings	5.0000	0.0600	0.3000	

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

5.3770 (36)

Point Thermal bridges

(33a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 50.0453 (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	51.0486	50.7297	50.4170	48.9484	48.6736	47.3945	47.3945	47.1577	47.8872	48.6736	49.2295	49.8106	(38)
Heat transfer coeff													
	101.0939	100.7749	100.4623	98.9937	98.7189	97.4398	97.4398	97.2030	97.9325	98.7189	99.2748	99.8559	(39)
Average = Sum(39)m / 12 =												98.9924	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9931	0.9899	0.9869	0.9724	0.9697	0.9572	0.9572	0.9548	0.9620	0.9697	0.9752	0.9809	(40)
HLP (average)												0.9724	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7556 (42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	81.2247	80.0184	78.3197	75.1875	72.8422	70.2416	68.8369	70.5238	72.3604	75.1431	78.3398	80.9501	(42b)
Hot water usage for other uses													
	42.8498	41.2917	39.7335	38.1753	36.6171	35.0590	35.0590	36.6171	38.1753	39.7335	41.2917	42.8498	(42c)
Average daily hot water use (litres/day)												114.2625	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.0745	121.3101	118.0532	113.3628	109.4594	105.3006	103.8959	107.1409	110.5358	114.8766	119.6315	123.7999	(44)
Energy conte	196.5037	172.7439	181.4433	155.1881	147.3533	129.4794	125.6531	132.6628	136.3016	155.8865	170.4369	193.8408	(45)
Energy content (annual)													
													Total = Sum(45)m = 1897.4935
Distribution loss (46)m = 0.15 x (45)m													
	29.4756	25.9116	27.2165	23.2782	22.1030	19.4219	18.8480	19.8994	20.4452	23.3830	25.5655	29.0761	(46)

Water storage loss:

170.0000 (47)

Store volume

1.5003 (48)

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

0.5400 (49)

Temperature factor from Table 2b

0.8102 (55)

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

Total storage loss

0.8102 (55)

	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(56)
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If cylinder contains dedicated solar storage

	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(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

	244.8814	216.4399	229.8210	202.0052	195.7310	176.2965	174.0308	181.0405	183.1188	204.2642	217.2541	242.2185	(62)
--	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	------

WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	-------

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
-------------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Output from w/h	244.8814	216.4399	229.8210	202.0052	195.7310	176.2965	174.0308	181.0405	183.1188	204.2642	217.2541	242.2185	(64)
-----------------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	------

Total per year (kWh/year) = Sum(64)m = 2467.1019 (64)

12Total per year (kWh/year)

2467 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
--	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

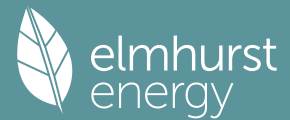
Heat gains from water heating, kWh/month	104.0397	92.3941	99.0321	89.0537	87.6971	80.5056	80.4818	82.8126	82.7740	90.5344	94.1240	103.1542	(65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	(66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.9205	150.4834	135.9205	140.4512	135.9205	140.4512	135.9205	135.9205	140.4512	135.9205	140.4512	135.9205 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.2053	261.8950	255.1170	240.6873	222.4724	205.3530	193.9162	191.2264	198.0045	212.4342	230.6490	247.7685 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779 (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)	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230 (71)
Water heating gains (Table 5)	139.8382	137.4913	133.1076	123.6857	117.8725	111.8133	108.1745	111.3072	114.9639	121.6861	130.7278	138.6482 (72)
Total internal gains	602.2977	617.2034	591.4787	572.1579	543.5991	521.9512	502.3448	502.7878	517.7532	537.3744	569.1616	589.6708 (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
Southwest				7.2000	36.7938		0.6300		0.7000		0.7700		80.9616 (79)
Northwest				3.6000	11.2829		0.6300		0.7000		0.7700		12.4136 (81)
Southwest				1.6000	26.0000		0.6300		0.7000		1.0000		16.5110 (82)
Northwest				3.2000	26.0000		0.6300		0.7000		1.0000		33.0221 (82)
Solar gains	142.9083	266.0523	417.1080	594.3311	728.1553	748.1462	710.9454	608.7107	478.8747	309.0350	175.4618	119.4314	(83)
Total gains	745.2060	883.2557	1008.5867	1166.4890	1271.7544	1270.0973	1213.2902	1111.4985	996.6279	846.4093	744.6235	709.1021	(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	1.3986	1.4030	1.4074	1.4283	1.4322	1.4510	1.4510	1.4546	1.4437	1.4322	1.4242	1.4159
alpha	1.0932	1.0935	1.0938	1.0952	1.0955	1.0967	1.0967	1.0970	1.0962	1.0955	1.0949	1.0944
util living area	0.7212	0.6746	0.6167	0.5296	0.4380	0.3432	0.2711	0.2983	0.4221	0.5729	0.6770	0.7307 (86)
MIT	15.9483	16.4796	17.3138	18.4018	19.3782	20.1460	20.5458	20.4732	19.8455	18.5666	17.0874	15.8494 (87)
Th 2	20.0891	20.0917	20.0943	20.1064	20.1086	20.1192	20.1192	20.1211	20.1151	20.1086	20.1041	20.0993 (88)
util rest of house	0.7091	0.6610	0.6006	0.5096	0.4123	0.3095	0.2281	0.2546	0.3877	0.5498	0.6614	0.7190 (89)
MIT 2	14.5219	15.1382	16.1075	17.3662	18.4775	19.3373	19.7614	19.6949	19.0253	17.5829	15.8667	14.4120 (90)
Living area fraction	14.9002	15.4940	16.4274	17.6409	18.7164	19.5518	19.9694	19.9013	19.2428	17.8438	16.1905	14.7932 (92)
MIT	14.9002	15.4940	16.4274	17.6409	18.7164	19.5518	19.9694	19.9013	19.2428	17.8438	16.1905	14.7932 (93)
Temperature adjustment												0.0000
adjusted MIT	14.9002	15.4940	16.4274	17.6409	18.7164	19.5518	19.9694	19.9013	19.2428	17.8438	16.1905	14.7932 (93)

8. Space heating requirement

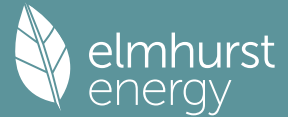
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.6155	0.5715	0.5195	0.4449	0.3676	0.2861	0.2203	0.2429	0.3499	0.4787	0.5726	0.6249 (94)
Ext temp.	458.6609	504.8150	523.9338	518.9957	467.5396	363.3346	267.2740	269.9975	348.7011	405.1872	426.3558	443.1077 (95)
Heat loss rate W	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	1071.6182	1067.6062	997.3303	865.2924	692.6514	482.5012	328.3183	340.3405	503.6505	715.0987	902.4570	1057.7984 (97)
Space heating requirement - total per year (kWh/year)	456.0402	378.1957	352.2070	249.3337	167.4832	0.0000	0.0000	0.0000	0.0000	230.5741	342.7928	457.3298 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	456.0402	378.1957	352.2070	249.3337	167.4832	0.0000	0.0000	0.0000	0.0000	230.5741	342.7928	457.3298 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2633.9565 (98c) / (4) =
Space heating per m2												25.8738 (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)	456.0402	378.1957	352.2070	249.3337	167.4832	0.0000	0.0000	0.0000	0.0000	230.5741	342.7928	457.3298 (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)
Space heating efficiency (main heating system 2)	494.0847	409.7461	381.5894	270.1340	181.4552	0.0000	0.0000	0.0000	0.0000	249.8095	371.3899	495.4820 (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 (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	244.8814	216.4399	229.8210	202.0052	195.7310	176.2965	174.0308	181.0405	183.1188	204.2642	217.2541	242.2185 (64)
Efficiency of water heater (217)m	85.4337	85.2984	85.0140	84.5330	83.7123	79.8000	79.8000	79.8000	79.8000	84.3322	85.0778	79.8000 (216)
Fuel for water heating, kWh/month	286.6334	253.7444	270.3330	238.9662	233.8141	220.9229	218.0837	226.8678	229.4721	242.2139	255.3593	283.4204 (219)
Space cooling fuel requirement												

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2853.6907	1.1300	3224.6705	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2959.8312	1.1300	3344.6092	(278)
Space and water heating			6569.2797	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	227.9259	1.5338	349.6003	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-640.5123	1.4941	-957.0094	
PV Unit electricity exported	-617.4177	0.4603	-284.1829	
Total			-1241.1922	(283)
Total Primary energy kWh/year			5807.7886	(286)
Target Primary Energy Rate (TPER)			57.0500	(287)

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Property Reference	2.02 Gas				Issued on Date	15/12/2023
Assessment Reference	2.02 EDL		Prop Type Ref	2.02 EDL		
Property	1.01, 1.01					
SAP Rating	89 B	DER	10.66	TER	10.93	
Environmental	90 B	% DER < TER				2.47
CO ₂ Emissions (t/year)	1.02	DFEE	29.55	TFEE	32.51	
Compliance Check	See BREL	% DFEE < TFEE				9.09
% DPER < TPER	0.99	DPER	57.03	TPER	57.60	
Assessor Details	Mr. Jonathan Lewis				Assessor ID	AZ32-0001
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	59.4000 (1b)	x 2.8000 (2b)	= 166.3200 (1b) - (3b)
First floor	42.4000 (1c)	x 2.2000 (2c)	= 93.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 259.6000 (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	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

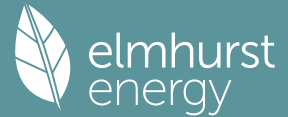
3. Heat losses and heat loss parameter

Element	Gross 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
Door			2.1000	1.0000	2.1000		(26)
Window (Uw = 1.20)			10.8000	1.1450	12.3664		(27)
NW Roof Light			3.2000	1.1450	3.6641		(27a)
SW Roof Light			1.6000	1.1450	1.8321		(27a)
External Wall 1	67.4000	10.8000	56.6000	0.1700	9.6220		(29a)
Corridor	26.0000	2.1000	23.9000	0.1300	3.1070		(29a)
External Roof 1	59.4000	4.8000	54.6000	0.1600	8.7360		(30)
Total net area of external elements Aum(A, m ²)			152.8000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 41.4276		(33)
Party Floor 1			59.4000				(32d)
Party Ceiling 1			52.9000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							5.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

elmhurst
energy

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7. Mean internal temperature (heating season)

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

21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238	1.6238
alpha	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083	1.1083
util living area	0.7059	0.6560	0.5955	0.5089	0.4171	0.3267	0.2569	0.2845	0.4057	0.5572	0.6640	0.7188 (86)
MIT	16.1398	16.6860	17.5130	18.5560	19.4920	20.2066	20.5811	20.5101	19.9147	18.6773	17.2245	16.0099 (87)
Th 2	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056	20.2056 (88)
util rest of house	0.6950	0.6437	0.5810	0.4910	0.3946	0.2972	0.2196	0.2463	0.3753	0.5364	0.6499	0.7082 (89)
MIT 2	14.7987	15.4321	16.3931	17.5963	18.6632	19.4611	19.8620	19.7942	19.1577	17.7607	16.0746	14.6479 (90)
Living area fraction									fLA = Living area /	(4) =		0.2652 (91)
MIT	15.1544	15.7646	16.6902	17.8508	18.8830	19.6588	20.0527	19.9841	19.3585	18.0038	16.3796	15.0091 (92)
Temperature adjustment												0.0000
adjusted MIT	15.1544	15.7646	16.6902	17.8508	18.8830	19.6588	20.0527	19.9841	19.3585	18.0038	16.3796	15.0091 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.6029	0.5569	0.5035	0.4302	0.3533	0.2755	0.2121	0.2350	0.3396	0.4680	0.5628	0.6151 (94)
Useful gains	423.0796	467.6631	485.9945	483.1311	434.0081	337.9069	248.0847	251.0177	323.7007	375.7757	394.6080	409.4870 (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	945.1129	946.0064	887.2780	779.3662	625.4382	440.4843	300.6342	312.0751	457.8667	644.6637	807.9901	941.1746 (97)
Space heating kWh	388.3928	321.4467	298.5549	213.2893	142.4240	0.0000	0.0000	0.0000	0.0000	200.0527	297.6351	395.5756 (98a)
Space heating requirement - total per year (kWh/year)												2257.3711
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	388.3928	321.4467	298.5549	213.2893	142.4240	0.0000	0.0000	0.0000	0.0000	200.0527	297.6351	395.5756 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2257.3711
Space heating per m2										(98c) / (4) =		22.1746 (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 %)

84.2000 (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	388.3928	321.4467	298.5549	213.2893	142.4240	0.0000	0.0000	0.0000	0.0000	200.0527	297.6351	395.5756 (98)
Space heating efficiency (main heating system 1)	84.2000	84.2000	84.2000	84.2000	84.2000	0.0000	0.0000	0.0000	0.0000	84.2000	84.2000	84.2000 (210)
Space heating fuel (main heating system)	461.2741	381.7657	354.5783	253.3127	169.1496	0.0000	0.0000	0.0000	0.0000	237.5923	353.4859	469.8048 (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	222.0741	195.8267	206.9766	179.8562	172.8167	154.0951	151.0749	158.0998	160.9351	181.3720	195.1406	219.4060 (64)
Efficiency of water heater (217)m	88.4619	88.4322	88.3702	88.2738	88.0924	87.2000	87.2000	87.2000	87.2000	88.2377	88.3971	88.4760 (217)
Fuel for water heating, kWh/month	251.0393	221.4429	234.2155	203.7481	196.1767	176.7146	173.2511	181.3071	184.5586	205.5494	220.7545	247.9836 (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	12.0165	10.8536	12.0165	11.6289	12.0165	11.6289	12.0165	12.0165	11.6289	12.0165	11.6289	12.0165 (231)
Lighting	27.5933	22.1364	19.9314	14.6026	11.2794	9.2154	10.2895	13.3747	17.3724	22.7935	25.7452	28.3602 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.0869	-22.1364	-35.6244	-44.6115	-51.9049	-49.8354	-49.1161	-44.3390	-36.5730	-27.0528	-16.2039	-11.8913 (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												2680.9633 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												87.2000
Water heating fuel used												2496.7412 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 3.6790, total flow = 21.0000, SFP = 0.1752)

mechanical ventilation fans (SFP = 0.1752)

55.4849 (230a)

central heating pump

41.0000 (230c)

main heating flue fan

45.0000 (230e)

Total electricity for the above, kWh/year

141.4849 (231)

Electricity for lighting (calculated in Appendix L)

222.6940 (232)

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

PV generation	-403.3755	(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	5138.5079	(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	2680.9633	0.2100	563.0023 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2496.7412	0.2100	524.3157 (264)
Space and water heating			1087.3180 (265)
Pumps, fans and electric keep-hot	141.4849	0.1387	19.6257 (267)
Energy for lighting	222.6940	0.1443	32.1416 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-403.3755	0.1325	-53.4437
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-53.4437 (269)
Total CO2, kg/year			1085.6416 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.6600 (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	2680.9633	1.1300	3029.4885 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2496.7412	1.1300	2821.3176 (278)
Space and water heating			5850.8062 (279)
Pumps, fans and electric keep-hot	141.4849	1.5128	214.0384 (281)
Energy for lighting	222.6940	1.5338	341.5754 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-403.3755	1.4895	-600.8462
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-600.8462 (283)
Total Primary energy kWh/year			5805.5738 (286)
Dwelling Primary energy Rate (DPER)			57.0300 (287)

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

CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

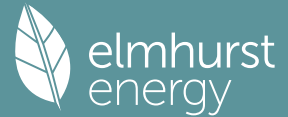
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	59.4000 (1b)	x 2.8000 (2b)	= 166.3200 (1b) - (3b)
First floor	42.4000 (1c)	x 2.2000 (2c)	= 93.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.8000		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	259.6000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1541 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4041 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3435 (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	0.4379	0.4293	0.4208	0.3778	0.3692	0.3263	0.3263	0.3177	0.3435	0.3692	0.3864	0.4036 (22b)
Effective ac	0.5959	0.5922	0.5885	0.5714	0.5682	0.5532	0.5532	0.5505	0.5590	0.5682	0.5747	0.5814 (25)

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3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.20)			10.8000	1.1450	12.3664			(27)
NW Roof Light			3.2000	2.0221	6.4706			(27a)
SW Roof Light			1.6000	2.0221	3.2353			(27a)
External Wall 1	67.4000	10.8000	56.6000	0.1800	10.1880			(29a)
Corridor	26.0000	2.1000	23.9000	0.1800	4.3020			(29a)
External Roof 1	59.4000	4.8000	54.6000	0.1100	6.0060			(30)
Total net area of external elements Aum(A, m ²)			152.8000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.6683		(33)

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

5.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.0000	0.0500	0.4000	
E3 Sill	8.0000	0.0500	0.4000	
E4 Jamb	18.0000	0.0500	0.9000	
E7 Party floor between dwellings (in blocks of flats)	33.6000	0.0700	2.3520	
E16 Corner (normal)	5.0000	0.0900	0.4500	
E14 Flat roof	10.0000	0.0800	0.8000	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250	
E18 Party wall between dwellings	5.0000	0.0600	0.3000	

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

5.3770 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 50.0453 (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	51.0486	50.7297	50.4170	48.9484	48.6736	47.3945	47.3945	47.1577	47.8872	48.6736	49.2295	49.8106	(38)
Heat transfer coeff	101.0939	100.7749	100.4623	98.9937	98.7189	97.4398	97.4398	97.2030	97.9325	98.7189	99.2748	99.8559	(39)
Average = Sum(39)m / 12 =												98.9924	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9931	0.9899	0.9869	0.9724	0.9697	0.9572	0.9572	0.9548	0.9620	0.9697	0.9752	0.9809	(40)
HLP (average)												0.9724	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

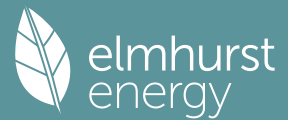
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7556 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	81.2247	80.0184	78.3197	75.1875	72.8422	70.2416	68.8369	70.5238	72.3604	75.1431	78.3398	80.9501	(42b)
Hot water usage for other uses	42.8498	41.2917	39.7335	38.1753	36.6171	35.0590	35.0590	36.6171	38.1753	39.7335	41.2917	42.8498	(42c)
Average daily hot water use (litres/day)												114.2625	(43)
Daily hot water use	124.0745	121.3101	118.0532	113.3628	109.4594	105.3006	103.8959	107.1409	110.5358	114.8766	119.6315	123.7999	(44)
Energy conte	196.5037	172.7439	181.4433	155.1881	147.3533	129.4794	125.6531	132.6628	136.3016	155.8865	170.4369	193.8408	(45)
Energy content (annual)										Total = Sum(45)m =		1897.4935	
Distribution loss (46)m = 0.15 x (45)m	29.4756	25.9116	27.2165	23.2782	22.1030	19.4219	18.8480	19.8994	20.4452	23.3830	25.5655	29.0761	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(59)
Total heat required for water heating calculated for each month	247.4626	218.7713	232.4022	204.5031	198.3122	178.7944	176.6120	183.6217	185.6167	206.8454	219.7520	244.7997	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.4626	218.7713	232.4022	204.5031	198.3122	178.7944	176.6120	183.6217	185.6167	206.8454	219.7520	244.7997	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2497.4935	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month	78.0772	68.9442	73.0696	63.9288	61.7347	55.3807	54.5194	56.8501	57.6491	64.5720	68.9991	77.1918	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	137.7788	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.9205	150.4834	135.9205	140.4512	135.9205	140.4512	135.9205	135.9205	140.4512	135.9205	140.4512	135.9205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.2053	261.8950	255.1170	240.6873	222.4724	205.3530	193.9162	191.2264	198.0045	212.4342	230.6490	247.7685	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	36.7779	(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)	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	-110.2230	(71)
Water heating gains (Table 5)	104.9425	102.5955	98.2119	88.7900	82.9768	76.9176	73.2787	76.4114	80.0681	86.7903	95.8320	103.7524	(72)
Total internal gains	567.4019	582.3076	556.5830	537.2621	508.7033	487.0554	467.4490	467.8920	482.8575	502.4786	534.2659	554.7750	(73)

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6. Solar gains

[Jan]			Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W
Southwest			7.2000		36.7938		0.6300		0.7000		0.7700		80.9616 (79)
Northwest			3.6000		11.2829		0.6300		0.7000		0.7700		12.4136 (81)
Southwest			1.6000		26.0000		0.6300		0.7000		1.0000		16.5110 (82)
Northwest			3.2000		26.0000		0.6300		0.7000		1.0000		33.0221 (82)
Solar gains	142.9083	266.0523	417.1080	594.3311	728.1553	748.1462	710.9454	608.7107	478.8747	309.0350	175.4618	119.4314	(83)
Total gains	710.3103	848.3599	973.6910	1131.5932	1236.8587	1235.2016	1178.3945	1076.6027	961.7322	811.5136	709.7277	674.2064	(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	1.3986	1.4030	1.4074	1.4283	1.4322	1.4510	1.4510	1.4546	1.4437	1.4322	1.4242	1.4159	
alpha	1.0932	1.0935	1.0938	1.0952	1.0955	1.0967	1.0967	1.0970	1.0962	1.0955	1.0949	1.0944	
util living area	0.7313	0.6839	0.6254	0.5376	0.4451	0.3497	0.2770	0.3053	0.4312	0.5837	0.6880	0.7411	(86)
MIT	15.8694	16.4106	17.2562	18.3592	19.3492	20.1283	20.5348	20.4598	19.8184	18.5162	17.0168	15.7673	(87)
Th 2	20.0891	20.0917	20.0943	20.1064	20.1086	20.1192	20.1192	20.1211	20.1151	20.1086	20.1041	20.0993	(88)
util rest of house	0.7195	0.6704	0.6094	0.5175	0.4194	0.3157	0.2334	0.2609	0.3965	0.5607	0.6727	0.7297	(89)
MIT 2	14.4313	15.0596	16.0428	17.3194	18.4472	19.3203	19.7523	19.6835	18.9982	17.5278	15.7867	14.3176	(90)
Living area fraction									fLA = Living area /	(4) =		0.2652	(91)
MIT	14.8127	15.4179	16.3646	17.5952	18.6864	19.5346	19.9599	19.8894	19.2157	17.7899	16.1129	14.7021	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.8127	15.4179	16.3646	17.5952	18.6864	19.5346	19.9599	19.8894	19.2157	17.7899	16.1129	14.7021	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6253	0.5800	0.5270	0.4514	0.3733	0.2912	0.2250	0.2483	0.3571	0.4878	0.5827	0.6352	(94)
Useful gains	444.1689	492.0744	513.1467	510.8043	461.7594	359.7369	265.1071	267.3698	343.4117	395.8186	413.5503	428.2299	(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	1062.7688	1059.9423	991.0207	860.7696	689.6929	480.8238	327.3855	339.1781	500.9974	709.7806	894.7572	1048.6994	(97)
Space heating kWh	460.2384	381.6072	355.5382	251.9750	169.5826	0.0000	0.0000	0.0000	0.0000	233.5877	346.4690	461.6293	(98a)
Space heating requirement - total per year (kWh/year)												2660.6274	
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	460.2384	381.6072	355.5382	251.9750	169.5826	0.0000	0.0000	0.0000	0.0000	233.5877	346.4690	461.6293	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2660.6274	
Space heating per m ²										(98c) / (4) =		26.1358	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	460.2384	381.6072	355.5382	251.9750	169.5826	0.0000	0.0000	0.0000	0.0000	233.5877	346.4690	461.6293	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	498.0935	412.9948	384.7816	272.7002	183.5309	0.0000	0.0000	0.0000	0.0000	252.8005	374.9664	499.5988	(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	247.4626	218.7713	232.4022	204.5031	198.3122	178.7944	176.6120	183.6217	185.6167	206.8454	219.7520	244.7997	(64)
Efficiency of water heater	85.6909	85.5609	85.2894	84.8298	84.0478	80.3000	80.3000	80.3000	80.3000	84.6427	85.3523	85.7187	(216)
Fuel for water heating, kWh/month	288.7851	255.6906	272.4868	241.0745	235.9516	222.6581	219.9402	228.6697	231.1541	244.3749	257.4646	285.5848	(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	28.2416	22.6565	20.3996	14.9456	11.5444	9.4319	10.5312	13.6889	17.7805	23.3290	26.3500	29.0265	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-26.7613	-39.3716	-59.0173	-69.2743	-77.2188	-72.9640	-72.0463	-66.7583	-57.8806	-46.2822	-29.9906	-22.9471	(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	-10.5025	-22.4985	-45.4904	-69.4798	-93.0250	-93.9201	-92.8414	-78.0976	-56.5575	-32.5791	-14.1488	-8.2770	(233b)

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Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													2879.4669	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													80.3000	
Water heating fuel used													2983.8350	(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)													227.9259	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1257.9300	(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													4919.2977	(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	2879.4669	0.2100	604.6880 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2983.8350	0.2100	626.6053 (264)
Space and water heating			1231.2934 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	227.9259	0.1443	32.8967 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-640.5123	0.1337	-85.6448
PV Unit electricity exported	-617.4177	0.1254	-77.4236
Total			-163.0684 (269)
Total CO2, kg/year			1113.0509 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.9300 (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	2879.4669	1.1300	3253.7976 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2983.8350	1.1300	3371.7335 (278)
Space and water heating			6625.5311 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	227.9259	1.5338	349.6003 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-640.5123	1.4941	-957.0094
PV Unit electricity exported	-617.4177	0.4603	-284.1829
Total			-1241.1922 (283)
Total Primary energy kWh/year			5864.0399 (286)
Target Primary Energy Rate (TPER)			57.6000 (287)

JS LEWIS LTD

JS Lewis Ltd
Registered Office: 2 Stanley Hill Cottages, Freshford, Bath,
BA2 7US
Registered Company No. 07066238
VAT Registration No. 121 2714 62