

Sustainability Statement for Planning

Collins Court,
Cascade Avenue,
London

Job number: S10559

Date: January 2023

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Report Details:

Revision	Issue Date	Author	Checked	Description
0	10/01/2023	CT	PK	First Issue
1	21/12/2023	CT	PK	Second Issue

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1 - Introduction

This Sustainability Statement (SS) has been prepared in support of the planning application for the proposed construction of eight dwellings consisting of two runs of four terrace houses and the conversion of an existing tennis pavilion into a bungalow, which will create a ninth dwelling.

2 - Planning Policies

National Planning Policy Framework 2021

The NPPF was updated in July 2021 to place greater emphasis on beauty, place-making, the environment, and sustainable development. The strengthened environmental objectives aim to protect and enhance the natural, built, and historic environment, and encourage effective land use, greater biodiversity, prudent use of natural resources, minimisation of waste and pollution, and adaptation to climate change alongside a move to a low carbon economy.

The London Plan has recently been updated for energy assessments. However, the below guidance has been used which refers to sustainability measure.

The London Plan 2021 (previously London Plan 2016).

All planning applications across the area are to take into account the requirements of The London Plan.

Within the Plan, Policy 5.3 Sustainable Design and Construction SPG sets out the following:

Strategic

A - The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.

Planning Decisions

B - Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

C - Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:

a minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)

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- b** avoiding internal overheating and contributing to the urban heat island effect
 - c** efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
 - d** minimising pollution (including noise, air and urban runoff)
 - e** minimising the generation of waste and maximising reuse or recycling
 - f** avoiding impacts from natural hazards (including flooding)
 - g** ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
 - h** securing sustainable procurement of materials, using local supplies where feasible, and
 - i** promoting and protecting biodiversity and green infrastructure.

LDF Preparation

D - Within LDFs boroughs should consider the need to develop more detailed policies and proposals based on the sustainable design principles outlined above and those which are outlined in the Mayor's supplementary planning guidance that are specific to their local circumstances".

Haringey Council

The Core strategy sets out to promote Sustainable Development. Furthermore, Sustainable Design and Construction Policy UD2, requires a sustainability statement to be provided for all planning applications in line with the key principals of the Sustainable Design and Construction.

3 - Existing and Proposed Development

The site is located on land to The Chine and Cascade Avenue in London (see Figure 1). The site is currently overgrown tennis courts and a derelict pavilion.

Proposals are for the construction of nine dwellings consisting of two runs of four terrace houses and the conversion of an existing tennis pavilion into a bungalow.

Given the scale and nature of the development, this constrains the development proposals in terms of the layout, positioning and orientation of the proposed dwellings. Subsequently, these constraints will impact on the feasibility of certain sustainability and energy efficient measures that can feasibly be incorporated into the new dwellings.



4 – Sustainability Statement

Energy	
Issue	Compliance
Energy Demand	Throughout the new development of Collins Court, best efforts have been made to reduce the need for energy and reduce heat demand. A preliminary Energy assessment has been carried out on a sample dwelling to show how the dwellings can be improved beyond building regulations. As the drawings supplied are at a planning stage, assumptions have been made about the construction, heating and ventilation. Therefore the energy strategy which has been used is a guide only.
Maximise use of passive energy	Through the use of passive and active design measures the design team have enabled the development to require less energy through the use of optimised insulation, cross ventilation, improved window u-values, higher air tightness, reduced cold bridging and light coloured materials.
Increased Energy Efficiency	An Energy Statement has been carried out for the proposed dwellings which show the dwellings will go beyond building regulations Part L1 2021. The dwellings will incorporate: - • Low fabric element u-values, External wall u-value 0.17W/m²k, Floor 0.10W/m²k, Roof 0.10W/m²k • Air Source Heat Pump (winter efficiency 380% and Summer 176%) • Triple Glazed windows with a u-value 1.0 W/m²k • Time and temperature zone control, • Mechanical Ventilations with Heat recovery system with an 88% efficiency and SFP 1.09 • Solar PV panels 3.2kWp for all the dwellings, totalling 28.8kWp for the total development • 5kW batteries for all plots

	This has shown to be an improvement over building regulations Part L1 2021 baseline, by achieving a potential of 82% improvement in CO2 emissions.
Renewable Energy Sources	The feasibility of several renewable technologies has been reviewed and shown that an ASHP and Solar PV with battery storage would be feasible for this development. Consultation should be gained from an M&E consultant or ASHP/PV specialist to ensure feasibility for the development.
Responsible Travel Provisions	The site is in an urban area and therefore has good access to public transport. There are 2 underground stations, Highgate approximately 1200m and East Finchley approximately 1800m away, Hornsey main station is approximately 2000m away and several bus nodes located along B550 (Muswell Hill Road) and Muswell Hill. There will also be cycle storage for 2 cycles provided for each dwelling to promote healthier travel methods and reduce CO2 emissions from vehicles.

<u>Water</u>	
Issue	Compliance
Water Saving Measures	Initial advice from the design team suggests that water saving measures can be incorporated in order to reduce water usage. It has been identified that there is the opportunity to have low flow rates and dual flush toilets.
Water Consumption Targets	Water efficient fixtures, fittings and appliances will be provided to ensure that internal water use targets are achieved to comply with the local council of Haringey target of 105 L/person/day. In comparison, Building Regulations Approved Document G requires internal water use to be at 125litres/person/day or less.
Reusing Water	In order to provide a simple level of rainwater harvesting, each dwelling should have a water butt; this will afford the opportunity to reduce the impact on potable water supply by enabling future occupants of the dwelling to reuse collected water, for example washing the bins. If this supply is used frequently it may also ensure that some additional storage is available during an extreme rainfall event.
Metering	A water meter could be provided. During detailed design, consideration will be given to the provision of digital meters with connectivity to a central building management / billing system, rather than standard analogue meters.

Materials and Waste

Issue	Compliance
Design Stage Choosing materials that minimise the use of resources are sustainably sourced, do not cause harm to health and are robust.	The contractor and developer will need to design and choose materials that will influence the construction process and the embodied carbon of the development. Ensuring that materials are responsibly sourced, sourcing materials from local sources, minimising the harmful effects of some materials on human health, ensuring that specified materials are robust and sensitive to the building type and age. The developer will aim to use the BRE green guide document to compare the environmental impact of different construction materials and where possible priorities the use of the highest rated products from D to A+. It is intended that insulation materials will have an Ozone Depletion Potential (ODP) of zero, and a Global Warming Potential (GWP) of less than five. Where specified by the developer (e.g. low VOC paint), finishes and other materials will not contain or emit toxic substances. Where timber is installed it will be 100% legally sourced.
Construction Stage Management of materials resulting from demolition through the waste hierarchy	The Contractor will need to reduce waste during the construction phase of the development via the hierarchy of, Reduce, Reuse (prioritising on-site reuse of demolition materials, followed by offsite reuse), Recycle (prioritising on-site recycling, then off-site recycling), Resource recovery (for energy generation processes – fuels, heat and power); and Disposal. A Site Waste Management Plan (SWMP) will be prepared and incorporate non-hazardous waste, demolition and excavation waste if applicable. The development will target the diversion of 95% of construction and extraction waste from land fill. The BRE Smartwaste tool can be used as an easy tool by contractors.

Storage for Recyclables & Waste	Sufficient internal and external space will be provided to facilitate recycling and composting and the good management of waste for the building occupiers. The dwellings will be fitted with internal waste storage facilities in the kitchen for the segregation of recyclable materials, in compliance with BS5096.
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<u>Nature Conservation and Biodiversity</u>	
Issue	Compliance
Protecting Species Promoting the Protection and Planting of Trees	The existing site is a building with hardstanding areas and is considered to be of low ecological value. Existing trees (and the space they require) have been considered throughout this development. It has not been necessary to remove any trees on site. However, there are features of ecological significance (Trees) next to the construction zone to the rear of the site. These will have to be adequately protected. Located at the base of the south facing wall of the tennis pavilion there are 3 colonies of Jersey Cudweed which is a protected species under Schedule 8 of the wildlife and Countryside act 1981. On the Mitigation and Enhancement plan it has stated that the most suitable option for maintaining the colony on the development would be through the incorporation of a biodiverse/brown roof. With the Jersey Cudweed being relocated to surroundings that mimic those in which it was found, such as close to wall edge south facing in a sheltered location. The project has had a biodiversity net gain report carried out and is targeting to achieve a gain in biodiversity.

Designing development proposals	The green space has been reduced in compared to the previous site, however there will be new gardens to the dwellings. Efforts will be made to improve the ecological value of the site with planting of native plant species and bird boxes relevant to the native birds in the area. There is also the opportunity of planting not native varieties of plants taking into consideration the affects of climate change. Developers should adhere to the following hierarchy when considering biodiversity on their development by; avoiding adverse impact to the biodiversity interest, minimise impact, seek mitigation, and seek appropriate compensation where the benefits of the proposal clearly outweigh the biodiversity impacts
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<u>Increased Green Cover and Trees</u>	
Issue	Compliance
Promoting Urban Greening	To help the city to adapt to future climates. Green infrastructure is a network of mainly vegetated spaces and other environmental features which can promote urban cooling, reduced runoff, reduced energy demand, improved air quality, improved biodiversity, enhanced aesthetic and an increased health and well-being. The development will look to encompass ecological features such as native plant species and trees in the rear garden.

Tackling Increased Temperatures and Drought

Issue	Compliance
Preventing Developments from Overheating	Overheating within buildings can result from either too much heat entering a building and not being released or too much heat being generated within a building and not being released. Therefore, if the internal environment becomes too hot it is likely occupiers will try to find a way to cool their environment. In order to continue minimising CO ₂ emissions the design team have considered the internal comfort and implemented the following measures to reduce over heating, via cross ventilation, as well as mechanical ventilation. The dwellings are orientated where summer over heating should be reduced with less windows facing in a south direction.
Promoting Heat and Drought Resistant Planting	London's water demand already outstrips mains water supply. Therefore it is essential that landscaping does not use excessive amounts of water. have ensured the landscaping of the development does not require excessive amounts of water. Consideration will be given the including plant species which are heat and drought resistant. Advice from an ecologist should ideally be sought before any plant species are selected.

Flooding

Issue	Compliance
Surface Water Flooding	The proposals will result in a decrease in hardstanding areas of ~1ha and will therefore provide significant betterment in terms of surface water management when compared with the existing situation.

Flooding Resilience and Resistance	It is understood that the site is at low risk of flooding from all sources. However, should it come to light that there are some localised risks, flood resilient construction techniques could be incorporated into the dwellings in line with best practice guidance The development site is located in a flood zone 1 area, which is low risk.
Flooding and Basement Developments	The proposals include lower ground floor development, and it is important to note that the site slopes which can increase velocities of overland flows of surface water. The site is underlain by London Clay and it is therefore unlikely that groundwater would be a problem. However, it is strongly recommended that advice is sought from a structural / geotechnical engineer as to whether measures such as tanking would be required to protect against flooding.

Land Contamination

Issue	Compliance
Responsible Person/Organisation	The current site is not identified as being contaminated as a result of previous uses.
Bioremediation	Bioremediation is not required.

<u>Air Pollution</u>	
Issue	Compliance
Assessment Requirements	An air quality test should not be needed for the proposed development being located on a residential road.
Construction and Demolition	To recognise and encourage construction-sites which are managed in an environmentally and socially considerate, responsible and accountable manner. For the proposed development, the contractor will comply with 'The Control of Dust and Emissions during Construction Demolition SPG'. Control measures will be implemented by the contractor on site to prevent air and dust pollution. An example of this could be using dust sheets on materials and skips, damping down in waste areas.
Design and Occupation	Ventilation pathways will need to be designed to reduce the build-up of air pollutants in the dwellings, through cross ventilation, and either naturally ventilated or mechanical ventilation. Where there is mechanical ventilation, exhaust flues will be positioned away from intake flues for fresh air. In naturally ventilated buildings/spaces: openable windows/ventilators are over 10m from sources of external pollution.

Noise	
Issue	Compliance
Sources of Noise	The proposed site is located within an existing residential area, with few commercial units in the vicinity. The area is identified having a low potential for noise pollution from residential dwellings.
Mitigation of Noise Emitted by Development	Noise attenuation measures will be incorporated on-site where required, to ensure that any noise generated by equipment or services will not generate a source of noise pollution or negatively impact the surrounding area. The developer will comply with the council's construction noise rules which states what hours of the day the site can work within.
Mitigation of Noise impacts on the Development	For the occupiers of the dwellings, the specification of the partition walls, floors and external walls will be designed to go beyond Document E of the building regulations. The following should be followed, and best efforts will be made here were possible to avoid impacts of external noise to the occupiers. Locate noise sensitive areas/rooms away from the parts of the site most exposed to noises, create setbacks, design the building so its shape and orientation reflect noise and protect the most sensitive uses, position non-residential uses closer to the noise source in mixed use developments, design in lobbies, balconies, winter gardens and dual facades; and carefully locate noise generating equipment for the building such as plant and services away from sensitive uses.

<u>Light Pollution</u>	
Issue	Compliance
Type of Light Pollution	Light pollution comprises any adverse effect of lighting for building occupiers, and for this development includes; Glare, 'Light Trespass' and 'Sky Glow' and Poor Artificial Lighting
Potential Effects	Light pollution can have a detrimental impact on the quality of life of residents; by significantly changing the character of the locality, altering wildlife and ecological patterns and wasting energy
Lighting Design to Minimise Impacts	To minimise obtrusive light where applicable, lights will be designed to be used only in appropriate areas, and that upward lighting is minimised, this will help to reduce light pollution and effect to neighbours. Where there is external lighting, it will have to be designed to the following standards. First to be energy efficient going beyond Part L of the building regulations, with the aim to achieve no less than 80 lumens per circuit watt. Second all external lights will be automatically controlled for the prevention of operation during daylight hours and presence detection in areas of intermitted pedestrian traffic. The ILP Guidance for the reduction of obtrusive light, 2001 will be used to design the lighting strategy. All external lighting (except for safety and security lighting) can be automatically switched off between 23:00 and 07:00. If safety or security lighting is provided and will be used between 23:00 and 07:00, this part of the lighting system complies with the lower levels of lighting recommended during these hours in Table 2 of the ILP's Guidance notes. Illuminated advertisements, where specified, must be designed in compliance with ILE Technical Report 5 – The Brightness of Illuminated Advertisements

<u>Water Pollution</u>	
Issue	Compliance
How Sustainable Drainage Contributes to Water Quality	Surface water runoff will be managed through a combination of SuDS, in line with the London Plan Drainage Hierarchy, and based on a desktop study of underlying ground conditions. Through a combination of SuDS, water quality will be improved.
Connection of New Developments to the Sewer Network	It is proposed that surface water runoff from hardstanding areas will ultimately connect into the public sewer system, via attenuation storage with a controlled outlet.

5 Conclusion

The proposed development is to be located on land off Cascade Avenue and The Chine, where the existing site is currently an overgrown tennis court with a disused pavilion. Proposals are for the construction of eight dwellings consisting of two runs of four terrace houses and the conversion of an existing tennis pavilion into a bungalow, which will create a ninth dwelling.

Haringey Council Local Plan sets out Policy UD2: Sustainable Design and Construction, requires a sustainability statement to be provided for all planning applications in line with the key principals of the Sustainable Design and Construction of the London Plan Policy 5.3 to promote Sustainable Development.

Given the scale and nature of the development, this constrains the development proposals in terms of the layout, positioning and orientation of the proposed dwelling. Subsequently, these constraints will impact on the feasibility of certain sustainability and energy efficient measures that can feasibly be incorporated into the development (as discussed in Section 4 of this report).

The above sustainability statement sets out what the requirements are of the planning policies and what can be achieved for the proposed development.

The main features of the site to meet the building environmental standards are:

- The energy efficiency measures of the building are to go beyond current Part L1 2021, with a potentially a 82% saving in CO₂.
- The development is to take a fabric first approach, which is to be designed to be highly insulated, with low u-values, good air tightness and Mechanical ventilation with heat recovery
- The development has also reviewed feasible renewable and low carbon technology and is incorporating an ASHP with solar PV.
- Water efficiency is a big driver of sustainability and indoor fittings which will have water efficiency will be installed. These will help to go beyond building regulations and aim for 105L/person/day
- The location lends itself to good transport links
- 2 Cycle storage per dwelling

Appendix A Site Plan



Adjacent Properties and Boundaries are shown for illustrative purposes only and have not been surveyed unless otherwise stated.

All areas shown are approximate and should be verified before forming the basis of a decision.

Do not scale other than for Planning Application purposes.

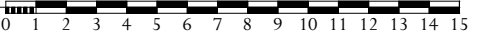
All dimensions must be checked by the contractor before commencing work on site.

No deviation from this drawing will be permitted without the prior written consent of the Architect.

The copyright of this drawing remains with the Architect and may not be reproduced in any form without prior written consent.

Ground Floor Slabs, Foundations, Sub-Structures, etc. All work below ground level is shown provisionally. Inspection of ground condition is essential prior to work commencing.

Reassessment is essential when the ground conditions are apparent, and redesign may be necessary in the light of soil conditions found. The responsibility for establishing the soil and sub-soil conditions rests with the contractor.



Rev	Date	Description	Initials
PROJECT		The Grove Cascade Avenue	
TITLE:		Site Layout	
SCALE:		1:250 @A3	
DATE:		August 2022	
DRAWING No:		SK_6299 - 01	
DRAWN BY:		MB/SDR/CL	

ADAM ARCHITECTURE

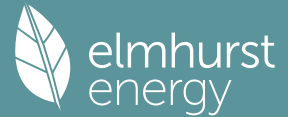
OLD HYDE HOUSE, 75 HYDE STREET
WINCHESTER, HANTS, SO23 7DW, TEL. 01962 843843

WEST WING, SOMERSET HOUSE, STRAND
LONDON, WC2R 1LA, TEL. 020 7841 0140

www.adamarchitecture.com contact@adamarchitecture.com

Appendix B SAP Worksheet Improvement over Part L1 2023

Full SAP Calculation Printout



Property Reference	S10559 02 03				Issued on Date	21/12/2023
Assessment Reference	Be Green	Prop Type Ref				
Property	Mid Terrace, The Grove, The Chine					
SAP Rating	90 B	DER	1.90	TER	10.63	
Environmental	98 A	% DER < TER				82.13
CO ₂ Emissions (t/year)	0.37	DFEE	40.72	TFEE	42.08	
Compliance Check	See BREL	% DFEE < TFEE				3.23
% DPER < TPER	63.46	DPER	20.58	TPER	56.33	
Assessor Details	Mr. Peter Kinsella				Assessor ID	L770-0002
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)
Basement floor	41.4500 (1a)	x 2.6500 (2a)	= 109.8425 (1a) - (3a)
Ground floor	61.9500 (1b)	x 3.0000 (2b)	= 185.8500 (1b) - (3b)
First floor	76.5400 (1c)	x 3.0000 (2c)	= 229.6200 (1c) - (3c)
Second floor	58.3300 (1d)	x 3.0500 (2d)	= 177.9065 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	238.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 703.2190 (5)

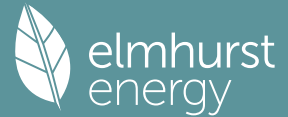
2. Ventilation rate

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) =	
Pressure test	0.0000 / (5) =	
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	4.0000 (17)	
Number of sides sheltered	0.2000 (18)	
Shelter factor	2 (19)	
Infiltration rate adjusted to include shelter factor	(20) = 1 - [0.075 x (19)] =	
	(21) = (18) x (20) =	
Wind speed	Jan 5.1000	Feb 5.0000
Wind factor	Mar 4.9000	Apr 4.4000
Adj infilt rate	May 4.3000	Jun 3.8000
	Jul 3.8000	Aug 3.7000
	Sep 4.0000	Oct 4.3000
	Nov 4.5000	Dec 4.7000 (22)
Balanced mechanical ventilation with heat recovery	0.2167	
If mechanical ventilation	0.2125	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.2083	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.1870	
Effective ac	0.1827	0.1615
	0.1615	0.1573
	0.1700	0.1827
	0.1913	0.1998 (22b)
	0.5000 (23a)	0.5000 (23b)
	70.4000 (23c)	0.3478 (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
Triple glazed windows (Uw = 1.00)			26.9300	0.9615	25.8942		(27)
Front door			2.2000	1.0000	2.2000		(26)
RL21			0.4500	1.3258	0.5966		(27a)
Heat Loss Floor 1			41.4500	0.1000	4.1450		(28)
Heat Loss Floor 2			22.4900	0.1000	2.2490		(28a)
Exposed floor			15.8000	0.1000	1.5800		(28b)
External Wall 1	157.7600	26.0800	131.6800	0.1700	22.3856		(29a)
Basement wall	23.8500		23.8500	0.1700	4.0545		(29a)
Dormer wall	5.3800	3.0500	2.3300	0.1700	0.3961		(29a)
External Roof 1	38.7800		38.7800	0.1000	3.8780		(30)
Pitched roof	58.5200	0.4500	58.0700	0.1000	5.8070		(30)
Bay window roof	1.2000		1.2000	0.1000	0.1200		(30)

Full SAP Calculation Printout



Total net area of external elements Aum(A, m2)	365.2300	(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	73.3060 (33)
Party Wall 1	172.0700 0.0000 0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.089 * total exposed area)	32.5055	(36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	105.8115 (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	84.6447	83.6584	82.6722	77.7409	76.7546	71.8233	71.8233	70.8370	73.7958	76.7546	78.7271	80.6997
Average = Sum(39)m / 12 =	190.4562	189.4699	188.4837	183.5524	182.5661	177.6348	177.6348	176.6485	179.6073	182.5661	184.5386	186.5111
												183.3058
HLP	0.7993	0.7952	0.7911	0.7704	0.7662	0.7455	0.7455	0.7414	0.7538	0.7662	0.7745	0.7828
HLP (average)												0.7693
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0517
Hot water usage for mixer showers												(42)
Hot water usage for baths	103.6565	102.0987	99.8288	95.4856	92.2805	88.7062	86.6745	88.9273	91.3967	95.2345	99.6709	103.2593
Hot water usage for other uses	32.5419	32.0586	31.3780	30.1232	29.1835	28.1416	27.5789	28.2547	28.9905	30.1054	31.3861	32.4319
Average daily hot water use (litres/day)	45.8823	44.2138	42.5454	40.8769	39.2085	37.5400	37.5400	39.2085	40.8769	42.5454	44.2138	45.8823
												167.4504
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	182.0806	178.3712	173.7522	166.4857	160.6725	154.3878	151.7934	156.3904	161.2642	167.8852	175.2708	181.5735
Energy content (annual)	288.3712	253.9981	267.0506	227.9106	216.2961	189.8378	183.5810	193.6440	198.8549	227.8187	249.7054	284.3002
Distribution loss (46)m = 0.15 x (45)m	43.2557	38.0997	40.0576	34.1866	32.4444	28.4757	27.5371	29.0466	29.8282	34.1728	37.4558	42.6450
Water storage loss:												200.0000
Store volume												1.8900
a) If manufacturer declared loss factor is known (kWh/day):												0.5400
Temperature factor from Table 2b												1.0206
Enter (49) or (54) in (55)												(55)
Total storage loss	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386
If cylinder contains dedicated solar storage	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	343.2722	303.5861	321.9516	281.0406	271.1971	242.9678	238.4820	248.5450	251.9849	282.7197	302.8354	339.2012
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
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	343.2722	303.5861	321.9516	281.0406	271.1971	242.9678	238.4820	248.5450	251.9849	282.7197	302.8354	339.2012
12Total per year (kWh/year)												3427.7837
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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000
Heat gains from water heating, kWh/month	139.8042	124.1248	132.7151	118.2843	115.8392	105.6251	104.9615	108.3074	108.6232	119.6705	125.5311	138.4506

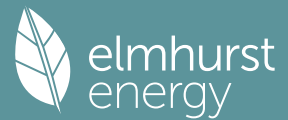
5. Internal gains (see Table 5 and 5a)

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	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	235.9462	261.2261	235.9462	243.8110	235.9462	243.8110	235.9462	235.9462	243.8110	235.9462	243.8110	235.9462
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	406.1044	410.3185	399.6991	377.0917	348.5540	321.7325	303.8141	299.6000	310.2193	332.8267	361.3645	388.1860
Pumps, fans	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water heating gains (Table 5)	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672
Total internal gains	187.9089	184.7095	178.3806	164.2837	155.6979	146.7015	141.0772	145.5745	150.8656	160.8475	174.3487	186.0895
	898.7347	925.0293	882.8011	853.9617	808.9732	781.0202	749.6127	749.8958	773.6712	798.3956	848.2995	878.9969

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
East				15.3000	19.6403		0.5700		0.7000		0.7700		83.0893 (76)
Southwest				1.0000	36.7938		0.5700		0.7000		0.7700		10.1738 (79)
West				9.6300	19.6403		0.5700		0.7000		0.7700		52.2974 (80)
Northwest				1.0000	11.2829		0.5700		0.7000		0.7700		3.1198 (81)
West				0.4500	25.5349		0.6300		0.7000		1.0000		4.5607 (82)
Solar gains	153.2408	297.6216	486.7433	707.5110	866.8690	887.7430	844.9948	725.6496	565.0680	352.0850	190.6402	126.3206	83
Total gains	1051.9755	1222.6509	1369.5443	1561.4727	1675.8422	1668.7632	1594.6075	1475.5454	1338.7391	1150.4805	1038.9397	1005.3175	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	86.8784	87.3306	87.7876	90.1461	90.6331	93.1492	93.1492	93.6692	92.1261	90.6331	89.6643	88.7160
alpha	6.7919	6.8220	6.8525	7.0097	7.0422	7.2099	7.2099	7.2446	7.1417	7.0422	6.9776	6.9144
util living area	0.9996	0.9988	0.9956	0.9733	0.8813	0.6670	0.4887	0.5474	0.8408	0.9882	0.9989	0.9997 (86)
Living	20.1868	20.2946	20.4602	20.7015	20.8757	20.9482	20.9560	20.9553	20.9151	20.6795	20.4023	20.1854
Non living	19.2761	19.4172	19.6320	19.9505	20.1553	20.2403	20.2451	20.2486	20.2076	19.9293	19.5704	19.2863
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5840	20.2946	20.4602	20.7015	20.8757	20.9482	20.9560	20.9553	20.9151	20.6795	20.4023	20.2994 (87)
Th 2	20.2539	20.2575	20.2611	20.2791	20.2827	20.3008	20.3008	20.3044	20.2936	20.2827	20.2755	20.2683 (88)
util rest of house	0.9995	0.9984	0.9940	0.9636	0.8443	0.6002	0.4119	0.4664	0.7829	0.9825	0.9985	0.9997 (89)
MIT 2	19.8641	19.4172	19.6320	19.9505	20.1553	20.2403	20.2451	20.2486	20.2076	19.9293	19.5704	19.4633 (90)
Living area fraction									FLA = Living area / (4) =			0.1016 (91)
MIT	19.9373	19.5063	19.7161	20.0268	20.2285	20.3122	20.3174	20.3204	20.2795	20.0056	19.6549	19.5482 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9373	19.5063	19.7161	20.0268	20.2285	20.3122	20.3174	20.3204	20.2795	20.0056	19.6549	19.5482 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9994	0.9979	0.9925	0.9594	0.8412	0.6013	0.4137	0.4683	0.7816	0.9795	0.9979	0.9995 (94)
Useful gains	1051.3957	1220.0537	1359.2244	1498.1019	1409.7039	1003.4894	659.6625	691.0042	1046.3406	1126.9153	1036.8089	1004.8473 (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	2978.2126	2767.4616	2491.0233	2042.3564	1557.0167	1014.6874	660.3344	692.5395	1109.8888	1717.1346	2316.8719	2862.6124 (97)
Space heating kWh	1433.5518	1039.8581	842.0584	391.8633	109.6007	0.0000	0.0000	0.0000	0.0000	439.1232	921.6454	1382.1772 (98a)
Space heating requirement - total per year (kWh/year)												6559.8781
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	1433.5518	1039.8581	842.0584	391.8633	109.6007	0.0000	0.0000	0.0000	0.0000	439.1232	921.6454	1382.1772 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6559.8781
Space heating per m2										(98c) / (4) =		27.5313 (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 %)												381.0748 (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	1433.5518	1039.8581	842.0584	391.8633	109.6007	0.0000	0.0000	0.0000	0.0000	439.1232	921.6454	1382.1772 (98)
Space heating efficiency (main heating system 1)	381.0748	381.0748	381.0748	381.0748	381.0748	0.0000	0.0000	0.0000	0.0000	381.0748	381.0748	381.0748 (210)
Space heating fuel (main heating system)	376.1864	272.8751	220.9693	102.8311	28.7610	0.0000	0.0000	0.0000	0.0000	115.2328	241.8542	362.7050 (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	343.2722	303.5861	321.9516	281.0406	271.1971	242.9678	238.4820	248.5450	251.9849	282.7197	302.8354	339.2012 (64)
Efficiency of water heater (217)m	175.4909	175.4909	175.4909	175.4909	175.4909	175.4909	175.4909	175.4909	175.4909	175.4909	175.4909	175.4909 (216)
Fuel for water heating, kWh/month	195.6069	172.9925	183.4577	160.1454	154.5363	138.4504	135.8942	141.6284	143.5886	161.1022	172.5647	193.2870 (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	87.3652	78.9105	87.3652	84.5470	87.3652	84.5470	87.3652	87.3652	84.5470	87.3652	84.5470	87.3652 (231)
Lighting	66.4460	53.3054	47.9956	35.1637	27.1614	22.1911	24.7776	32.2068	41.8335	54.8878	61.9956	68.2927 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-48.4382	-88.6254	-167.1819	-235.0019	-287.4853	-279.2203	-273.7743	-238.3592	-180.3262	-116.3714	-58.8649	-39.2618 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.0825	-4.2719	-15.6635	-41.4781	-78.2055	-89.4197	-86.2027	-60.6693	-31.6418	-9.3348	-1.9607	-0.7356 (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												1721.4148 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.4909
Water heating fuel used												1953.2543 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

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(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.1990)	
mechanical ventilation fans (SFP = 1.1990)	1028.6547 (230a)
Total electricity for the above, kWh/year	1028.6547 (231)
Electricity for lighting (calculated in Appendix L)	536.2572 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2433.5770 (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	2806.0040 (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	1721.4148	0.1560	268.6005 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1953.2543	0.1410	275.4828 (264)
Space and water heating			544.0833 (265)
Pumps, fans and electric keep-hot	1028.6547	0.1387	142.6871 (267)
Energy for lighting	536.2572	0.1443	77.3985 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2012.9108	0.1306	-262.9138
PV Unit electricity exported	-420.6662	0.1153	-48.4961
Total			-311.4099 (269)
Total CO2, kg/year			452.7590 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.9000 (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	1721.4148	1.5777	2715.8173 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1953.2543	1.5215	2971.9035 (278)
Space and water heating			5687.7207 (279)
Pumps, fans and electric keep-hot	1028.6547	1.5128	1556.1488 (281)
Energy for lighting	536.2572	1.5338	822.5291 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2012.9108	1.4825	-2984.1454
PV Unit electricity exported	-420.6662	0.4225	-177.7242
Total			-3161.8696 (283)
Total Primary energy kWh/year			4904.5291 (286)
Dwelling Primary energy Rate (DPER)			20.5800 (287)

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

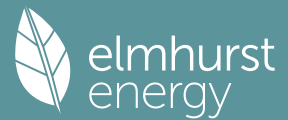
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	41.4500 (1a)	x 2.6500 (2a)	= 109.8425 (1a) - (3a)
Ground floor	61.9500 (1b)	x 3.0000 (2b)	= 185.8500 (1b) - (3b)
First floor	76.5400 (1c)	x 3.0000 (2c)	= 229.6200 (1c) - (3c)
Second floor	58.3300 (1d)	x 3.0500 (2d)	= 177.9065 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	238.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	703.2190 (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) = 0.0569 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3069 (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) = 0.2608 (21)

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	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													
Effective ac	0.3326	0.3261	0.3195	0.2869	0.2804	0.2478	0.2478	0.2413	0.2608	0.2804	0.2935	0.3065	(22b)
	0.5553	0.5532	0.5511	0.5412	0.5393	0.5307	0.5307	0.5291	0.5340	0.5393	0.5431	0.5470	(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			2.2000	1.0000	2.2000			(26)
TER Opening Type (Uw = 1.20)			26.9300	1.1450	30.8359			(27)
RL21			0.4500	1.4151	0.6368			(27a)
Heat Loss Floor 1			41.4500	0.1300	5.3885			(28)
Heat Loss Floor 2			22.4900	0.1300	2.9237			(28a)
Exposed floor			15.8000	0.1300	2.0540			(28b)
External Wall 1	157.7600	26.0800	131.6800	0.1800	23.7024			(29a)
Basement wall	23.8500		23.8500	0.1800	4.2930			(29a)
Dormer wall	5.3800	3.0500	2.3300	0.1800	0.4194			(29a)
External Roof 1	38.7800		38.7800	0.1100	4.2658			(30)
Pitched roof	58.5200	0.4500	58.0700	0.1100	6.3877			(30)
Bay window roof	1.2000		1.2000	0.1100	0.1320			(30)
Total net area of external elements Aum(A, m2)			365.2300					(31)
Fabric heat loss, W/K = Sum (A x U)								(32)
Party Wall 1			172.0700	0.0000	0.0000			(32)

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

250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	18.1100	0.0500	0.9055	
E2 Other lintels (including other steel lintels)	17.1100	0.0500	0.8555	
E3 Sill	51.1200	0.0500	2.5560	
E4 Jamb	22.6100	0.1600	3.6176	
E5 Ground floor (normal)	5.4900	0.3200	1.7568	
E20 Exposed floor (normal)	12.4900	0.3200	3.9968	
E21 Exposed floor (inverted)	9.0000	0.0700	0.6300	
E22 Basement floor	38.1700	0.0000	0.0000	
E6 Intermediate floor within a dwelling	18.6000	0.0400	0.7440	
E11 Eaves (insulation at rafter level)	5.4400	0.0800	0.4352	
E13 Gable (insulation at rafter level)	22.7800	0.0800	1.8224	
E14 Flat roof	41.7200	0.0900	3.7548	
E16 Corner (normal)	18.3500	-0.0900	-1.6515	
E17 Corner (inverted - internal area greater than external area)	24.3500	0.0600	1.4610	
E18 Party wall between dwellings	19.2800	0.0800	1.5424	
P1 Party wall - Ground floor	51.7200	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	12.7800	0.1200	1.5336	
P4 Party wall - Roof (insulation at ceiling level)	15.2500	0.0800	1.2200	
P5 Party wall - Roof (insulation at rafter level)	0.5500	0.0800	0.0440	
R1 Head of roof window	0.5500	0.0600	0.0330	
R2 Sill of roof window	1.6400	0.0800	0.1312	
R3 Jamb of roof window	10.7100	0.0800	0.8568	
R4 Ridge (vaulted ceiling)	21.6500	0.0400	0.8660	
R5 Ridge (inverted)				

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

27.1111 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 110.3503 (37)

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

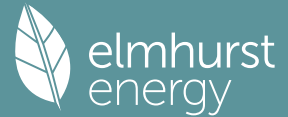
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	128.8655	128.3671	127.8786	125.5841	125.1548	123.1564	123.1564	122.7863	123.9262	125.1548	126.0233	126.9312	(38)
Heat transfer coeff	239.2157	238.7174	238.2289	235.9344	235.5051	233.5067	233.5067	233.1366	234.2764	235.5051	236.3735	237.2815	(39)
Average = Sum(39)m / 12 =												235.9323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0040	1.0019	0.9998	0.9902	0.9884	0.9800	0.9800	0.9785	0.9832	0.9884	0.9920	0.9959	(40)
HLP (average)												0.9902	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0517 (42)
Hot water usage for mixer showers	75.3865	74.2536	72.6027	69.4441	67.1131	64.5136	63.0360	64.6744	66.4704	69.2614	72.4879	75.0977	(42a)
Hot water usage for baths	32.5419	32.0586	31.3780	30.1232	29.1835	28.1416	27.5789	28.2547	28.9905	30.1054	31.3861	32.4319	(42b)
Hot water usage for other uses	45.8823	44.2138	42.5454	40.8769	39.2085	37.5400	37.5400	39.2085	40.8769	42.5454	44.2138	45.8823	(42c)
Average daily hot water use (litres/day)												141.3865	(43)
Daily hot water use	153.8107	150.5260	146.5261	140.4442	135.5051	130.1952	128.1549	132.1375	136.3378	141.9122	148.0879	153.4118	(44)
Energy conte	243.5985	214.3471	225.2052	192.2611	182.4159	160.0902	154.9922	163.6139	168.1181	192.5735	210.9783	240.2059	(45)
Energy content (annual)										Total = Sum(45)m =		2348.4000	
Distribution loss (46)m = 0.15 x (45)m	36.5398	32.1521	33.7808	28.8392	27.3624	24.0135	23.2488	24.5421	25.2177	28.8860	31.6467	36.0309	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	294.5246	260.3448	276.1313	241.5444	233.3420	209.3735	205.9183	214.5399	217.4014	243.4996	260.2616	291.1319	(62)
WWHRS	-34.4636	-30.4799	-31.9168	-26.4283	-24.6303	-21.0763	-19.7557	-21.0082	-21.8063	-25.7073	-29.1232	-33.8254	(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)

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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	260.0610	229.8650	244.2145	215.1160	208.7117	188.2972	186.1626	193.5318	195.5951	217.7923	231.1384	257.3066 (64)
	Total per year (kWh/year) = Sum(64)m =											2627.7923 (64)
12Total per year (kWh/year)												2628 (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	121.7374	108.0686	115.6216	103.3534	101.3941	92.6566	92.2758	95.1425	95.3259	104.7716	109.5769	120.6093 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	152.5840	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	229.3724	253.9480	229.3724	237.0182	229.3724	237.0182	229.3724	229.3724	237.0182	229.3724	237.0182	229.3724	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	406.1044	410.3185	399.6991	377.0917	348.5540	321.7325	303.8141	299.6000	310.2193	332.8267	361.3645	388.1860	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	38.2584	(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)	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	-122.0672	(71)
Water heating gains (Table 5)	163.6255	160.8164	155.4054	143.5464	136.2825	128.6898	124.0266	127.8797	132.3971	140.8220	152.1902	162.1093	(72)
Total internal gains	870.8776	896.8581	856.2521	829.4316	785.9840	756.2156	725.9883	725.6273	748.4098	774.7964	822.3481	851.4429	(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
East						15.3000	19.6403		0.6300	0.7000	0.7700		91.8355 (76)
Southwest						1.0000	36.7938		0.6300	0.7000	0.7700		11.2447 (79)
West						9.6300	19.6403		0.6300	0.7000	0.7700		57.8023 (80)
Northwest						1.0000	11.2829		0.6300	0.7000	0.7700		3.4482 (81)
West						0.4500	25.5349		0.6300	0.7000	1.0000		4.5607 (82)
Solar gains	168.8914	327.9927	536.3553	779.5411	955.0531	978.0209	930.9376	799.4998	622.6353	387.9981	210.1057	139.2247	(83)
Total gains	1039.7689	1224.8508	1392.6075	1608.9726	1741.0372	1734.2365	1656.9259	1525.1271	1371.0452	1162.7944	1032.4538	990.6677	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	69.1699	69.3143	69.4564	70.1319	70.2597	70.8611	70.8611	70.9735	70.6282	70.2597	70.0016	69.7338
alpha	5.6113	5.6210	5.6304	5.6755	5.6840	5.7241	5.7241	5.7316	5.7085	5.6840	5.6668	5.6489
util living area	0.9996	0.9989	0.9964	0.9828	0.9291	0.7813	0.6042	0.6726	0.9113	0.9923	0.9990	0.9997 (86)
MIT	19.6340	19.7887	20.0440	20.4099	20.7345	20.9353	20.9878	20.9783	20.8297	20.3995	19.9558	19.6132 (87)
Th 2	20.0800	20.0818	20.0835	20.0915	20.0930	20.1000	20.1000	20.1013	20.0973	20.0930	20.0900	20.0868 (88)
util rest of house	0.9995	0.9985	0.9950	0.9756	0.8987	0.7009	0.4888	0.5562	0.8612	0.9882	0.9986	0.9996 (89)
MIT 2	18.4576	18.6572	18.9853	19.4549	19.8480	20.0590	20.0957	20.0926	19.9637	19.4467	18.8777	18.4359 (90)
Living area fraction	fLA = Living area / (4) =											0.1016 (91)
MIT	18.5771	18.7721	19.0928	19.5519	19.9381	20.1480	20.1863	20.1826	20.0517	19.5435	18.9873	18.5555 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5771	18.7721	19.0928	19.5519	19.9381	20.1480	20.1863	20.1826	20.0517	19.5435	18.9873	18.5555 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9976	0.9928	0.9698	0.8923	0.7056	0.5003	0.5674	0.8580	0.9844	0.9978	0.9993	(94)
Useful gains	1038.8544	1221.9656	1382.6316	1560.4289	1553.5686	1223.6738	829.0086	865.3454	1176.3734	1144.6608	1030.2071	990.0116	(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	3415.3147	3311.5180	2999.9802	2513.1468	1940.1046	1295.5058	837.4278	881.8622	1394.3508	2106.2404	2809.8327	3406.3017	(97)
Space heating kWh	1768.0865	1404.1792	1203.3074	685.9569	287.5828	0.0000	0.0000	0.0000	0.0000	715.4152	1281.3304	1797.7199	(98a)
Space heating requirement - total per year (kWh/year)												9143.5782	
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	1768.0865	1404.1792	1203.3074	685.9569	287.5828	0.0000	0.0000	0.0000	0.0000	715.4152	1281.3304	1797.7199	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9143.5782	
Space heating per m2											(98c) / (4) =	38.3749	(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												

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Space heating efficiency (main heating system 1)	1768.0865	1404.1792	1203.3074	685.9569	287.5828	0.0000	0.0000	0.0000	0.0000	715.4152	1281.3304	1797.7199 (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)	1915.5866	1521.3209	1303.6916	743.1819	311.5740	0.0000	0.0000	0.0000	0.0000	775.0977	1388.2236	1947.6922 (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 (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 (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 requirement	260.0610	229.8650	244.2145	215.1160	208.7117	188.2972	186.1626	193.5318	195.5951	217.7923	231.1384	257.3066 (64)
Efficiency of water heater (217)m	87.5341	87.4132	87.1419	86.4718	84.7790	79.8000	79.8000	79.8000	79.8000	86.5226	87.2954	79.8000 (216)
Fuel for water heating, kWh/month	297.0968	262.9638	280.2493	248.7702	246.1833	235.9615	233.2865	242.5210	245.1066	251.7172	264.7772	87.5635 (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	293.8514 (219)
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	0.0000 (221)
Lighting	47.6591	38.2339	34.4254	25.2215	19.4818	15.9168	17.7720	23.1007	30.0055	39.3688	44.4670	7.3041 (231)
Electricity generated by PVs (Appendix M) (negative quantity)	-43.1511	-63.2413	-94.3975	-110.2592	-122.3481	-115.3169	-113.8016	-105.7012	-92.0515	-74.0619	-48.2539	48.9837 (232)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity generated by PVs (Appendix M) (negative quantity)	-17.5399	-37.5255	-75.8124	-115.7275	-154.9252	-156.4845	-154.7484	-130.2231	-94.3319	-54.3782	-23.6351	0.0000 (235c)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Annual totals kWh/year												0.0000 (235d)
Space heating fuel - main system 1												9906.3685 (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												3102.4848 (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)												384.6359 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2048.7701 (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												11430.7192 (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	9906.3685	0.2100	2080.3374 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3102.4848	0.2100	651.5218 (264)
Space and water heating			2731.8592 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	384.6359	0.1443	55.5148 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1019.6077	0.1338	-136.4445
PV Unit electricity exported	-1029.1624	0.1254	-129.0611
Total			-265.5056 (269)
Total CO2, kg/year			2533.7977 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.6300 (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	9906.3685	1.1300	11194.1964 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3102.4848	1.1300	3505.8079 (278)
Space and water heating			14700.0043 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	384.6359	1.5338	589.9674 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1019.6077	1.4945	-1523.8396
PV Unit electricity exported	-1029.1624	0.4603	-473.7170
Total			-1997.5566 (283)
Total Primary energy kWh/year			13422.5159 (286)
Target Primary Energy Rate (TPER)			56.3300 (287)