Sustainability Statement for Planning

Client: Newview Properties Limited

Site: Land Adjacent to No. 63 Netherhall Gardens,
London,
NW3 5RE

Proposals: The demolition of a garage and the construction of a new build two storey dwelling plus heated basement.

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Contents:

Assessor	Checked	Date	Job
CT	PK	28/05/2024	12134 Rev1

Report Details:

1 - Introduction

This Sustainability Statement (SS) has been prepared in support of the planning application for the proposed redevelopment on Land adjacent to No.63 Netherhall Gardens. The development is comprising the demolition of a garage and the construction of a new build two storey dwelling plus heated basement falling under the requirements of Camden council.

2 - Planning Policies

National Planning Policy Framework 2023

The NPPF was updated in 2023 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 2021 is the latest strategy for Greater London which sets out the below policies.

Chapter 8 Green Infrastructure and Natural Environment G1- G7

Chapter 9 Sustainable Infrastructure SI1 - SI17.

Chapter 10 Transport T1 – T9

Only some of the above policies will be relevant to the proposed development, as they can vary depending on the size and type of project, therefore we would taylor the guidance to the site.

The proposed development will use the above policies as a guide to implement the sustainable design principles within the development.

Camden Council

The Local Plan sets out to promote Sustainable Development. Furthermore, Local Plan Policy CC1, CC2 and CC3, 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.

3 - Existing and Proposed Development

The site is located on land adjacent to No.63 Netherhall Gardens (see Figure 1). The site is currently a basement level garage/storage building.

Proposal are for the construction of a new build two storey dwelling plus heated basement with rear external amenity space and front garden landscaping with bin and bike storage.

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.

Figure 1: Site Location

4 – Sustainability Statement

Energy	
Issue	Compliance
Energy Demand	Throughout the new development of land adjacent to No.63 Netherhall Gardens, best efforts have been made to reduce the need for energy and reduce heat demand. A preliminary Energy assessment has been carried out to show how the dwellings can be improved beyond part L 2013 and achieve current Part L 2021 building regulations. As the drawings supplied are at a planning stage, assumptions have been made about the construction, heating and ventilation. Therefore energy strategy which have been used, which should be used as a guide to design the dwellings.
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 dwelling which show how the developmennt will go current building regulations Part L 2021. The dwellings will incorporate • Low fabric element u-values, External wall u-value 0.18W/m2k, Floor 0.11W/m2k, Roof 0.11W/m2k • High efficiency Internal Air source heat pump (no external condensing unit) with a 332% efficiency • Time and temperature zone control • Mechanical ventilation with heat recovery system within the ASHP with an SFP 0.81

	This has shown to be an improvement over building regulations Part L1 2021 baseline, by achieving a potential of 89% improvement in CO2 emissions over Part L 2021.
Renewable Energy Sources	The feasibility of several renewable technologies has been reviewed and shows that Solar panels, 4.8kWp approximately 12 panels and ASHP are feasible. These have been incorporated in the design of the dwelling. As requested by the council Solar PV has been added to reduce the CO2 emissions be 65% through renewable technologies alone.
Responsible Travel Provisions	As stated in the Transport Statement carried out by TTP Consulting Ltd. The site has a PTAL of 5 which indicates the site has 'very good' levels of public transport accessibility. The site is in an urban area and therefore has excellent access to public transport. The closest underground stations are Hampstead Underground (approximately 640m away) and Finchley Road Underground (approximately 800m away). With the closes over ground station Finchley Road and Froanal Station located approximately 640m away. The development also several bus stops along Fitzjohn's Avenue providing access to bus routes 46 and 603. With the development being car free there will be cycle storage for 2 cycles provided for the occupiers to promote healthier travel methods and reduce CO2 emissions from vehicles.

Water	
Issue	Compliance
Water Saving Measures	Initial advice from the design team suggests the 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 Camden 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	As stated in the SUDs report competed by Amber Planning. Whilst no uplift in impervious surface will arise from development proposals, a detrimental impact on the rate and volume of runoff generated may arise from climate change impacts over time. This would be further compounded by the presence of the basement which could reduce the infiltration capacity of the underlying soils. Full surface water management is therefore proposed, in line with best practise for new development. The surface water attenuation requirements have been assessed using the WinDes Micro Drainage software package with a total storage of 9.0m3 proposed to improve existing rates and volumes of runoff, accounting for climate change at 40%. Sustainable Drainage (SuDS) measures including permeable paviours and storm cells are proposed to promote the interception and infiltration of runoff at source (paviours) with residual runoff discharged via gravity to the Thames Water sewer network at controlled (greenfield) rates via an existing connection. This is considered to improve existing rates and volumes of runoff currently discharged to the sewer. The above measures will be supplemented with water re-use measures including water butts for use in watering gardens. This to reduce over reliance on potable supply for non-potable uses.

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 materials with low embodied carbon. 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 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 dwelling/s will be fitted with internal waste storage facilities in the kitchen for the segregation of recyclable materials, in compliance with BS5096.

Nature Conservation and Biodiversity	
Issue	Compliance
Protecting Species **Promoting the Protection and Planting of Trees**	The existing area is generally hard standing land with the majority of the site being concrete and the existing basement garage. As stated in the Arboricultural Report, Tree Constraints Plan and Impact Assessment carried out by Central London Trees Survey: Existing trees (and the space they require) have been considered throughout this development. Two category C trees will be removed with mitigation planting of 2 Japanese Acer trees proposed. *Protection measures will be put in place to safeguard the retained trees during construction phases. Hand digging within the RPA's is proposed and in the event of any significant roots, the consultant will be informed and appropriate action taken to safeguard the trees.*

Designing development proposals	The green space will increase compared to the previous site, with new gardens to the front and rear of the development which are currently hard standing concrete areas. Efforts will be made to improve the ecological value of the site with planting of native plant species and bird boxes could be installed for local species of birds. In accordance with London Plan Policy 7.19 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

Increased Green Cover and Trees	
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 gardens.

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, lightly colours external walls. 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. Consideration will be given 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	As stated in the SUDs report completed by Amber Planning: - Whilst no uplift in impervious surface will arise from development proposals, a detrimental impact on the rate and volume of runoff generated may arise from climate change impacts over time. This would be further compounded by the presence of the basement which could reduce the infiltration capacity of the underlying soils. Full surface water management is therefore proposed, in line with best practise for new development. The surface water attenuation requirements have been assessed using the WinDes Micro Drainage software package with a total storage of 9.0m3 proposed to improve existing rates and volumes of runoff, accounting for climate change at 40%. Sustainable Drainage (SuDS) measures including permeable paviours and storm cells are proposed to promote the interception and infiltration of runoff at source (paviours) with residual runoff discharged via gravity to the Thames Water sewer network at controlled (greenfield) rates via an existing connection. This is considered to improve existing rates and volumes of runoff currently discharged to the sewer. The above measures will be supplemented with water re-use measures including water butts for use in watering gardens. This to reduce over reliance on potable supply for non-potable uses.
Flooding Resilience and Resistance	As stated in the SUDs report completed by Amber Planning: - *The application area is located c.870m south west of Hampstead Ponds at the nearest point but is not within the catchment of the Hampstead Heath Pond Chain. Review of Environment Agency Flood Maps indicates the Netherhall Gardens area to be situated entirely within Flood Zone 1: Low Risk.*

Flooding and Basement Developments	As stated in the Suds report completed by Amber Planning *The NPPF and its PPG require that existing runoff rates be maintained, taking account of climate change and that, wherever possible, a degree of betterment is provided. Whilst no uplift in impervious surface will arise from development proposals, a detrimental impact on the rate and volume of runoff generated may arise from climate change impacts over time. This would be further compounded by the presence of the basement which could reduce the infiltration capacity of the underlying soils. Full surface water management is therefore proposed, in line with best practise for new development.*

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.

Air Pollution	
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 dwelling/s, 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 built up 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.

Light Pollution	
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 60 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

Water Pollution	
Issue	Compliance
How Sustainable Drainage Contributes to Water Quality	There are no activities on site which lead to pollutants accumulating on hardstanding areas, therefore traditional drainage systems will be sufficient. Where applicable, the design team will incorporate the drainage hierarchy set out in London Plan Policy 5.3. Further details is required by a drainage engineer.
Connection of New Developments to the Sewer Network	The site is in close proximity to the main sewer network therefore connection should not be a problem.

5 Conclusion

The proposed development is to be located on land adjacent to No.63 Netherhall Gardens (see Figure 1). The site is currently a basement level garage/storage building.

Proposals are for the construction of a new build two storey dwelling plus heated basement with rear external amenity space and front garden landscaping with bin and bike storage.

Camden Council Local Plan sets out Policy CC1, CC2 and CC3, 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 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).

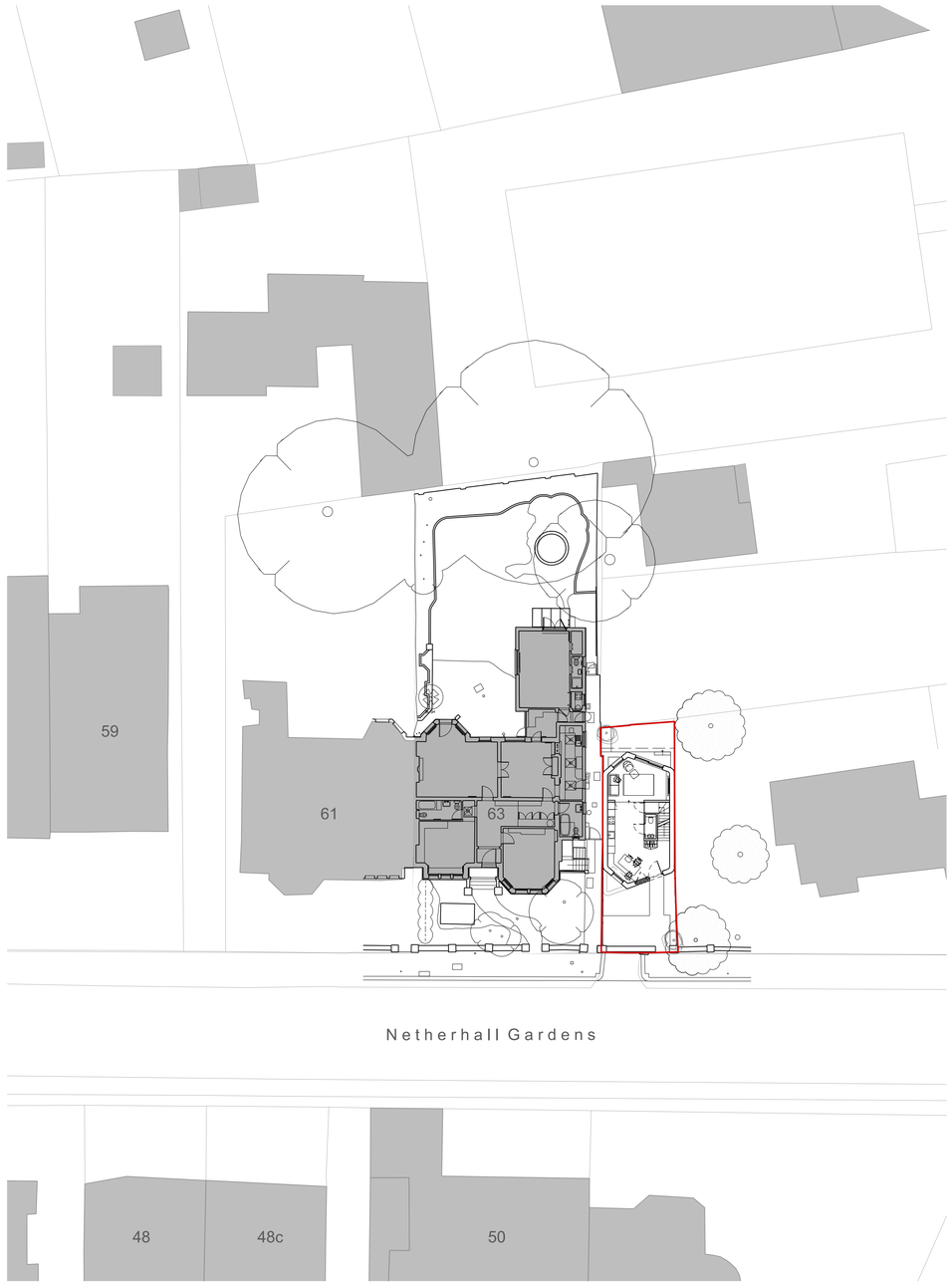
The above sustainability statement sets out what the requirements are of the planning policies and what can be achieved for the proposed development.

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

- The energy efficiency measures of the building are to go beyond Part L1 2021, with a potentially a 89% improvement
- 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, high heating efficiency and controls. The heating system is to incorporate a heat recovery system for ventilation also
- The development is proposing the use of low carbon Internal ASHP for space and water heating as well as renewable technology to include 4.8kWp worth of 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 Part G minimum standard of 125L/person/day and will aim to achieve a 105L/person/day
- Materials to be used in the proposed development are to consist of low embodied carbon. All timber used on site is to be sustainably sourced. Where possible recycled aggregates will be used.
- The contractor to be used for this development will need to monitor, record construction site impacts (energy, water and transport), having policies in place for reducing air and surface water pollution

- The contractor will need to have a site waste management plan in place from the beginning of construction and use this throughout the construction period. Any demolition waste will be recycled
- The location lends itself to excellent transport links and has proposals for two bicycles storage

Appendix A Site Plan



SITE LAYOUT PLAN
Scale: 1:500 @ A3

ISSUED

REV	DATE	BY	CK	
00	05.05.23	DN	CS	Pre-Application Issue
01	05.09.23	DN	CS	Post Pre-App Issue
02	12.10.23	DN	CS	Updated Pre-App Issue
03	28.03.24	AA	DN	Planning Issue

0 25m 50m
1:1250

NOTES

DRAWING KEY

Site Boundary *Approximate*

Building/s

SMITH & NEWTON ARCHITECTS
RIBA CHARTERED PRACTICE
A 9 Shepherd's Lane, Homerton, London E9 6JJ
T +44 (0)20 8520 3867
E Info@smith-newton.com **W** www.smith-newton.com

Project
NETHERHALL

Site Address
Land Adjacent to No.63
Netherhall Gardens
London, NW3 5RE

Drawing Title
Site Layout Plan
Proposed

Status
Planning

Scale(s) at A3
As Noted

DRAWING
0736-03-0150

REVISION
03

Appendix B SAP Worksheet Baseline

Full SAP Calculation Printout

Property Reference	S12134 01	**Issued on Date**	06/06/2024
Assessment Reference	Be Lean New	**Prop Type Ref**	
Property	63, Netherhall Gardens, London, NW3 5RE		

SAP Rating	83 B	**DER**	13.96	**TER**	11.88
Environmental	86 B	**% DER < TER**			-17.51
CO_2 Emissions (t/year)	1.66	**DFEE**	42.48	**TFEE**	46.38
Compliance Check	See BREL	**% DFEE < TFEE**			8.40
% DPER < TPER	-27.86	**DPER**	79.71	**TPER**	62.34

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	45.5500 (1a)	x	2.5000 (2a)	=	113.8750	(1a) - (3a)
Ground floor	44.4300 (1b)	x	2.7500 (2b)	=	122.1825	(1b) - (3b)
First floor	44.4300 (1c)	x	2.9800 (2c)	=	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	368.4589	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Mechanical extract ventilation - centralised

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)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
Door			2.7600	1.0000	2.7600			(26)
W10			1.0000	1.3258	1.3258			(27a)
RL11			3.7200	1.3258	4.9318			(27a)
Rl12			1.1800	1.3258	1.5644			(27a)
W13			1.1800	1.3258	1.5644			(27a)
Heat Loss Floor 1			45.5500	0.1100	5.0105			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143			(30)
Total net area of external elements Aum(A, m2)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.6684			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area) 12.3364 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 91.0048 (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	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	(38)
Heat transfer coeff	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	(39)

Average = Sum(39)m / 12 = 151.8005

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	(40)
HLP (average)												1.1294	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9056 (42)

Hot water usage for mixer showers

117.1474	115.3869	112.8215	107.9131	104.2908	100.2512	97.9552	100.5011	103.2920	107.6292	112.6431	116.6985	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

44.3861	42.7721	41.1580	39.5440	37.9300	36.3159	36.3159	37.9300	39.5440	41.1580	42.7721	44.3861	(42c)

Average daily hot water use (litres/day) 148.3570 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	161.5335	158.1590	153.9795	147.4571	142.2207	136.5672	134.2711	138.4311	142.8360	148.7873	155.4152	161.0846	(44)
Energy conte	255.8296	225.2162	236.6608	201.8614	191.4565	167.9253	162.3893	171.4066	176.1311	201.9029	221.4174	252.2196	(45)

Energy content (annual) Total = Sum(45)m = 2464.4166

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

38.3744	33.7824	35.4991	30.2792	28.7185	25.1888	24.3584	25.7110	26.4197	30.2854	33.2126	37.8329	(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 19.7718	17.7993	19.5782	18.6723	19.1217	18.3295	18.8281	18.9192	18.4124	19.2272	18.8698	19.7354	(61)

Total heat required for water heating calculated for each month

275.6014	243.0155	256.2390	220.5337	210.5781	186.2548	181.2173	190.3258	194.5435	221.1301	240.2872	271.9550	(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

275.6014	243.0155	256.2390	220.5337	210.5781	186.2548	181.2173	190.3258	194.5435	221.1301	240.2872	271.9550	(64)

Total per year (kWh/year) = Sum(64)m = 2691.6815 (64)

12Total per year (kWh/year) 2692 (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

90.0063	79.3342	83.5843	71.7870	68.4397	60.4175	58.7014	61.7225	63.1667	71.9395	78.3387	88.7969	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)

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

153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643	(67)

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

302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)

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

37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(69)
Pumps, fans 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)

-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)

Water heating gains (Table 5)

120.9762	118.0569	112.3444	99.7041	91.9888	83.9132	78.8998	82.9603	87.7315	96.6929	108.8038	119.3506	(72)

Total internal gains

646.6853	663.3202	633.2751	608.8747	574.7643	548.7849	525.2985	526.2152	544.0141	567.7356	606.2416	631.6923	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.4500	0.0000	0.7700	37.4342	(74)
Southeast	2.4400	36.7938	0.4500	0.0000	0.7700	31.1077	(77)
South	3.5100	46.7521	0.4500	0.0000	0.7700	56.8606	(78)
Northwest	3.7600	11.2829	0.4500	0.0000	0.7700	14.6999	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

Solar gains 211.7890	390.8888	614.3439	893.6144	1121.1582	1165.7714	1102.0003	924.2927	709.8597	453.5051	259.1748	177.6811	(83)
Total gains 858.4742	1054.2090	1247.6189	1502.4892	1695.9225	1714.5562	1627.2988	1450.5079	1253.8738	1021.2406	865.4164	809.3733	(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	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	
alpha	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	
util living area	0.9936	0.9842	0.9598	0.8822	0.7298	0.5439	0.4050	0.4702	0.7315	0.9392	0.9869	0.9950	(86)
MIT	19.7273	19.9241	20.2115	20.5628	20.8036	20.9000	20.9215	20.9162	20.8348	20.4856	20.0314	19.6825	(87)
Th 2	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	(88)
util rest of house	0.9918	0.9801	0.9493	0.8532	0.6739	0.4654	0.3135	0.3708	0.6542	0.9175	0.9827	0.9936	(89)
MIT 2	18.4846	18.7345	19.0953	19.5183	19.7803	19.8676	19.8819	19.8796	19.8184	19.4387	18.8730	18.4275	(90)
Living area fraction										fLA = Living area / (4) =		0.2912	(91)
MIT	18.8465	19.0809	19.4204	19.8225	20.0783	20.1682	20.1847	20.1814	20.1144	19.7436	19.2103	18.7929	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6965	18.9309	19.2704	19.6725	19.9283	20.0182	20.0347	20.0314	19.9644	19.5936	19.0603	18.6429	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9888	0.9745	0.9401	0.8432	0.6711	0.4687	0.3187	0.3763	0.6531	0.9072	0.9776	0.9911	(94)
Useful gains	848.8451	1027.2988	1172.8714	1266.9569	1138.0645	803.6377	518.6587	545.7800	818.9154	926.4871	846.0204	802.1575	(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	2185.3965	2129.9026	1938.5475	1635.2713	1249.0570	822.4838	521.3822	551.2537	890.2158	1365.2297	1815.5820	2192.4425	(97)
Space heating kWh	994.3943	740.9497	569.6630	265.1864	82.5785	0.0000	0.0000	0.0000	0.0000	326.4245	698.0843	1034.3720	(98a)
Space heating requirement - total per year (kWh/year)												4711.6527	
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	994.3943	740.9497	569.6630	265.1864	82.5785	0.0000	0.0000	0.0000	0.0000	326.4245	698.0843	1034.3720	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4711.6527	
Space heating per m2										(98c) / (4) =		35.0543	(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 %)	88.5000	(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	994.3943	740.9497	569.6630	265.1864	82.5785	0.0000	0.0000	0.0000	0.0000	326.4245	698.0843	1034.3720	(98)
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000	(210)
Space heating fuel (main heating system)	1123.6094	837.2313	643.6870	299.6456	93.3090	0.0000	0.0000	0.0000	0.0000	368.8412	788.7959	1168.7820	(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	275.6014	243.0155	256.2390	220.5337	210.5781	186.2548	181.2173	190.3258	194.5435	221.1301	240.2872	271.9550	(64)
Efficiency of water heater												87.0000	(216)
(217)m	88.1701	88.1247	88.0291	87.8126	87.4174	87.0000	87.0000	87.0000	87.0000	87.8880	88.1110	88.1835	(217)
Fuel for water heating, kWh/month	312.5792	275.7631	291.0844	251.1413	240.8882	214.0860	208.2958	218.7653	223.6132	251.6043	272.7097	308.3968	(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	47.5060	42.9086	47.5060	45.9735	47.5060	45.9735	47.5060	47.5060	45.9735	47.5060	45.9735	47.5060	(231)
Lighting	30.9564	24.8344	22.3606	16.3824	12.6542	10.3386	11.5436	15.0048	19.4897	25.5716	28.8830	31.8168	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	5323.9013	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	87.0000	
Water heating fuel used	3068.9272	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 1.0530)		
mechanical ventilation fans (SFP = 1.0530)	473.3444	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	559.3444	(231)
Electricity for lighting (calculated in Appendix L)	249.8361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)

Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	9202.0091	(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	5323.9013	0.2100	1118.0193	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.9272	0.2100	644.4747	(264)
Space and water heating			1762.4940	(265)
Pumps, fans and electric keep-hot	559.3444	0.1387	77.5880	(267)
Energy for lighting	249.8361	0.1443	36.0591	(268)
Total CO2, kg/year			1876.1410	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.9600	(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	5323.9013	1.1300	6016.0085	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.9272	1.1300	3467.8878	(278)
Space and water heating			9483.8963	(279)
Pumps, fans and electric keep-hot	559.3444	1.5128	846.1762	(281)
Energy for lighting	249.8361	1.5338	383.2070	(282)
Total Primary energy kWh/year			10713.2795	(286)
Dwelling Primary energy Rate (DPER)			79.7100	(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	45.5500 (1a)	x	2.5000 (2a)	=	113.8750	(1a) - (3a)
Ground floor	44.4300 (1b)	x	2.7500 (2b)	=	122.1825	(1b) - (3b)
First floor	44.4300 (1c)	x	2.9800 (2c)	=	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	368.4589	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1086	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3586	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3317	(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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759	(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			2.7600	1.0000	2.7600			(26)
TER Opening Type (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
W10			1.0000	1.5918	1.5918			(27a)
RL11			3.7200	1.5918	5.9213			(27a)

R112			1.1800	1.5918	1.8783	(27a)
W13			1.1800	1.5918	1.8783	(27a)
Heat Loss Floor 1			45.5500	0.1300	5.9215	(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066	(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128	(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259	(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143	(30)
Total net area of external elements Aum(A, m2)			308.4100			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.4627	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.6700	0.0500	0.5835
E3 Sill	10.4700	0.0500	0.5235
E4 Jamb	33.3400	0.0500	1.6670
E5 Ground floor (normal)	27.5200	0.1600	4.4032
E6 Intermediate floor within a dwelling	53.2800	0.0000	0.0000
E16 Corner (normal)	32.9200	0.0900	2.9628
R1 Head of roof window	5.0600	0.0800	0.4048
R2 Sill of roof window	5.0600	0.0600	0.3036
R3 Jamb of roof window	7.2000	0.0800	0.5760
E14 Flat roof	53.2800	0.0800	4.2624

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.6868 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 97.1495 (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	71.6675	71.2453	70.8315	68.8879	68.5243	66.8314	66.8314	66.5179	67.4835	68.5243	69.2599	70.0290	(38)
Heat transfer coeff	168.8170	168.3948	167.9810	166.0374	165.6737	163.9809	163.9809	163.6674	164.6330	165.6737	166.4094	167.1785	(39)

Average = Sum(39)m / 12 = 166.0356

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2560	1.2528	1.2498	1.2353	1.2326	1.2200	1.2200	1.2177	1.2249	1.2326	1.2381	1.2438	(40)
HLP (average)												1.2353	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9056 (42)

Hot water usage for mixer showers

93.7179	92.3095	90.2572	86.3305	83.4326	80.2010	78.3641	80.4009	82.6336	86.1034	90.1145	93.3588	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

44.3861	42.7721	41.1580	39.5440	37.9300	36.3159	36.3159	37.9300	39.5440	41.1580	42.7721	44.3861	(42c)

Average daily hot water use (litres/day) 126.7558 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	138.1040	135.0816	131.4152	125.8745	121.3626	116.5169	114.6801	118.3309	122.1776	127.2614	132.8866	137.7449	(44)
Energy conte	218.7230	192.3544	201.9803	172.3158	163.3774	143.2711	138.6956	146.5183	150.6572	172.6926	189.3213	215.6753	(45)
Energy content (annual)										Total = Sum(45)m =		2105.5823	
Distribution loss (46)m = 0.15 x (45)m	32.8085	28.8532	30.2970	25.8474	24.5066	21.4907	20.8043	21.9778	22.5986	25.9039	28.3982	32.3513	(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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	269.6819	238.3818	252.9392	221.6309	214.3363	192.5862	189.6545	197.4773	199.9723	223.6515	238.6363	266.6342	(62)
WWHRS	-42.8439	-37.8915	-39.6778	-32.8548	-30.6195	-26.2013	-24.5595	-26.1166	-27.1089	-31.9584	-36.2050	-42.0505	(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	226.8380	200.4903	213.2614	188.7761	183.7168	166.3849	165.0950	171.3606	172.8634	191.6931	202.4314	224.5837	(64)
										Total per year (kWh/year) = Sum(64)m =		2307.4947	(64)
12Total per year (kWh/year)												2307	(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	85.4651	75.4647	79.8982	69.6238	67.0627	59.9664	58.8560	61.4571	62.4223	70.1600	75.2781	84.4518	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(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)	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Water heating gains (Table 5)	114.8725	112.2986	107.3900	96.6997	90.1380	83.2867	79.1075	82.6036	86.6976	94.3011	104.5529	113.5104	(72)
Total internal gains	640.5816	657.5619	628.3206	605.8703	572.9135	548.1583	525.5062	525.8585	542.9802	565.3437	601.9907	625.8521	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.6300	0.7000	0.7700	33.0170	(74)
Southeast	2.4400	36.7938	0.6300	0.7000	0.7700	27.4370	(77)
South	3.5100	46.7521	0.6300	0.7000	0.7700	50.1510	(78)
Northwest	3.7600	11.2829	0.6300	0.7000	0.7700	12.9653	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	195.2569	361.6753	571.0857	833.7064	1047.7188	1089.9208	1030.1081	863.0475	660.9765	420.3790	239.1933	163.6431	(83)
Total gains	835.8384	1019.2373	1199.4064	1439.5767	1620.6322	1638.0791	1555.6143	1388.9060	1203.9568	985.7228	841.1840	789.4951	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.2326	44.3435	44.4528	44.9731	45.0719	45.5371	45.5371	45.6244	45.3568	45.0719	44.8726	44.6662	
alpha	3.9488	3.9562	3.9635	3.9982	4.0048	4.0358	4.0358	4.0416	4.0238	4.0048	3.9915	3.9777	
util living area	0.9942	0.9869	0.9684	0.9078	0.7795	0.5980	0.4524	0.5202	0.7770	0.9513	0.9887	0.9954	(86)
MIT	19.1587	19.4197	19.8185	20.3469	20.7417	20.9347	20.9834	20.9716	20.8131	20.2692	19.6229	19.1219	(87)
Th 2	19.8755	19.8780	19.8804	19.8919	19.8940	19.9040	19.9040	19.9059	19.9002	19.8940	19.8897	19.8851	(88)
util rest of house	0.9926	0.9833	0.9595	0.8822	0.7239	0.5108	0.3451	0.4062	0.6993	0.9324	0.9850	0.9941	(89)
MIT 2	17.7368	18.0705	18.5753	19.2294	19.6738	19.8644	19.8980	19.8944	19.7650	19.1528	18.3392	17.6960	(90)
Living area fraction										fLA = Living area / (4) =		0.2912	(91)
MIT	18.1508	18.4634	18.9373	19.5548	19.9848	20.1761	20.2141	20.2081	20.0702	19.4779	18.7130	18.1113	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1508	18.4634	18.9373	19.5548	19.9848	20.1761	20.2141	20.2081	20.0702	19.4779	18.7130	18.1113	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9889	0.9768	0.9496	0.8730	0.7289	0.5334	0.3761	0.4389	0.7127	0.9232	0.9793	0.9910	(94)
Useful gains	826.5385	995.6175	1138.9349	1256.6837	1181.2602	873.8118	585.1153	609.5457	858.0594	910.0541	823.7357	782.3682	(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	2338.2552	2284.0010	2089.2319	1769.0954	1372.5695	914.3742	592.6389	623.2622	982.8905	1470.8334	1932.5162	2325.6634	(97)
Space heating kWh	1124.7172	865.7937	707.0210	368.9364	142.3342	0.0000	0.0000	0.0000	0.0000	417.2198	798.3220	1148.2116	(98a)
Space heating requirement - total per year (kWh/year)												5572.5559	
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	1124.7172	865.7937	707.0210	368.9364	142.3342	0.0000	0.0000	0.0000	0.0000	417.2198	798.3220	1148.2116	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5572.5559	
Space heating per m2											(98c) / (4) =	41.4594	(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	1124.7172	865.7937	707.0210	368.9364	142.3342	0.0000	0.0000	0.0000	0.0000	417.2198	798.3220	1148.2116	(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)	1217.2264	937.0062	765.1742	399.2819	154.0413	0.0000	0.0000	0.0000	0.0000	451.5366	863.9848	1242.6533	(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	226.8380	200.4903	213.2614	188.7761	183.7168	166.3849	165.0950	171.3606	172.8634	191.6931	202.4314	224.5837	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3303	87.1451	86.7471	85.7900	83.8406	80.3000	80.3000	80.3000	80.3000	86.0004	87.0149	87.3692	(217)
Fuel for water heating, kWh/month	259.7473	230.0648	245.8428	220.0444	219.1263	207.2041	205.5977	213.4005	215.2720	222.8979	232.6398	257.0513	(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	31.8245	25.5308	22.9877	16.8417	13.0090	10.6285	11.8673	15.4256	20.0363	26.2887	29.6930	32.7090	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.0699	-62.8997	-91.4990	-104.1143	-113.2528	-105.9806	-104.5869	-98.2037	-87.1761	-72.3942	-48.6892	-38.0045	(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	-22.6242	-47.8344	-95.5471	-144.2257	-191.4468	-192.7059	-190.5264	-161.0569	-117.6434	-68.7505	-30.3107	-17.8799	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	6030.9047	(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	2728.8889	(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)	256.8421	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2251.4229	(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	6851.2128	(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	6030.9047	0.2100	1266.4900	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2728.8889	0.2100	573.0667	(264)
Space and water heating			1839.5567	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	256.8421	0.1443	37.0702	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-970.8709	0.1344	-130.4379	
PV Unit electricity exported	-1280.5520	0.1257	-161.0135	
Total			-291.4515	(269)
Total CO2, kg/year			1597.1047	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.8800	(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	6030.9047	1.1300	6814.9223	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2728.8889	1.1300	3083.6445	(278)
Space and water heating			9898.5668	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	256.8421	1.5338	393.9529	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-970.8709	1.4965	-1452.9349	
PV Unit electricity exported	-1280.5520	0.4615	-591.0197	
Total			-2043.9545	(283)
Total Primary energy kWh/year			8378.6660	(286)
Target Primary Energy Rate (TPER)			62.3400	(287)

Appendix C SAP Worksheet Be Greem Part L1 2021

Full SAP Calculation Printout

Property Reference	S12134 01	**Issued on Date**	06/06/2024
Assessment Reference	Be Green PV New	**Prop Type Ref**	
Property	63, Netherhall Gardens, London, NW3 5RE		

SAP Rating	91 B	**DER**	1.30	**TER**	11.61
Environmental	99 A	**% DER < TER**			88.80
CO_2 Emissions (t/year)	0.11	**DFEE**	42.48	**TFEE**	46.38
Compliance Check	See BREL	**% DFEE < TFEE**			8.40
% DPER < TPER	65.12	**DPER**	21.24	**TPER**	60.88

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	45.5500 (1a)	x	2.5000 (2a)	=	113.8750	(1a) - (3a)
Ground floor	44.4300 (1b)	x	2.7500 (2b)	=	122.1825	(1b) - (3b)
First floor	44.4300 (1c)	x	2.9800 (2c)	=	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	368.4589	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Mechanical extract ventilation - centralised

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)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
Door			2.7600	1.0000	2.7600			(26)
W10			1.0000	1.3258	1.3258			(27a)
RL11			3.7200	1.3258	4.9318			(27a)
Rl12			1.1800	1.3258	1.5644			(27a)
W13			1.1800	1.3258	1.5644			(27a)
Heat Loss Floor 1			45.5500	0.1100	5.0105			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143			(30)
Total net area of external elements Aum(A, m2)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.6684			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (User defined value 0.040 * total exposed area)	12.3364	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	91.0048	(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	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	(38)
Heat transfer coeff	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	151.8005	(39)
Average = Sum(39)m / 12 =												151.8005	
HLP	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	1.1294	(40)
HLP (average)												1.1294	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9056	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
117.1474	115.3869	112.8215	107.9131	104.2908	100.2512	97.9552	100.5011	103.2920	107.6292	112.6431	116.6985	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

44.3861	42.7721	41.1580	39.5440	37.9300	36.3159	36.3159	37.9300	39.5440	41.1580	42.7721	44.3861	(42c)

Average daily hot water use (litres/day)	148.3570	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	161.5335	158.1590	153.9795	147.4571	142.2207	136.5672	134.2711	138.4311	142.8360	148.7873	155.4152	161.0846	(44)
Energy conte	255.8296	225.2162	236.6608	201.8614	191.4565	167.9253	162.3893	171.4066	176.1311	201.9029	221.4174	252.2196	(45)
Energy content (annual)											Total = Sum(45)m =	2464.4166	
Distribution loss (46)m = 0.15 x (45)m	38.3744	33.7824	35.4991	30.2792	28.7185	25.1888	24.3584	25.7110	26.4197	30.2854	33.2126	37.8329	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.9440	248.8034	262.7752	227.1334	217.5709	193.1973	188.5037	197.5210	201.4031	228.0173	246.6894	278.3340	(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	281.9440	248.8034	262.7752	227.1334	217.5709	193.1973	188.5037	197.5210	201.4031	228.0173	246.6894	278.3340	(64)
										Total per year (kWh/year) = Sum(64)m =		2771.8926	(64)
12Total per year (kWh/year)												2772	(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	85.0633	74.8844	78.6897	67.1189	63.6593	55.8352	53.9944	56.9927	58.5636	67.1327	73.6213	83.8630	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Water heating gains (Table 5)	114.3324	111.4351	105.7657	93.2207	85.5635	77.5488	72.5732	76.6031	81.3383	90.2322	102.2518	112.7191	(72)
Total internal gains	637.0415	653.6984	623.6964	599.3913	565.3390	542.4204	518.9718	519.8580	537.6209	558.2748	596.6896	622.0608	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.4500	0.0000	0.7700	37.4342	(74)
Southeast	2.4400	36.7938	0.4500	0.0000	0.7700	31.1077	(77)
South	3.5100	46.7521	0.4500	0.0000	0.7700	56.8606	(78)
Northwest	3.7600	11.2829	0.4500	0.0000	0.7700	14.6999	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

Solar gains	211.7890	390.8888	614.3439	893.6144	1121.1582	1165.7714	1102.0003	924.2927	709.8597	453.5051	259.1748	177.6811	(83)
Total gains	848.8305	1044.5872	1238.0402	1493.0057	1686.4972	1708.1918	1620.9722	1444.1507	1247.4806	1011.7799	855.8644	799.7418	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	49.1910	
alpha	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	4.2794	
util living area	0.9938	0.9848	0.9608	0.8841	0.7325	0.5456	0.4065	0.4721	0.7339	0.9409	0.9874	0.9952	(86)
Living	19.7206	19.9177	20.2059	20.5589	20.8018	20.8996	20.9214	20.9160	20.8336	20.4805	20.0250	19.6757	
Non living	18.4762	18.7265	19.0884	19.5140	19.7787	19.8673	19.8819	19.8795	19.8174	19.4328	18.8649	18.4189	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	(88)
util rest of house	0.9922	0.9807	0.9505	0.8554	0.6767	0.4670	0.3147	0.3724	0.6567	0.9196	0.9834	0.9939	(89)
MIT 2	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	19.9769	(90)
Living area fraction										fLA = Living area / (4) =		0.2912	(91)
MIT	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	20.2748	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9820	0.9538	0.8645	0.6938	0.4906	0.3418	0.4021	0.6808	0.9266	0.9847	0.9943	(94)
Useful gains	842.6291	1025.8203	1180.8386	1290.6532	1170.1062	838.0002	554.0184	580.6707	849.2930	937.5054	842.7622	795.1872	(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	2424.9872	2333.9069	2091.0261	1726.7050	1301.6636	861.4422	557.8412	588.2013	937.3424	1468.6441	1999.9458	2440.1673	(97)
Space heating kWh	1177.2744	879.0342	677.1796	313.9573	97.8787	0.0000	0.0000	0.0000	0.0000	395.1672	833.1722	1223.8652	(98a)
Space heating requirement - total per year (kWh/year)												5597.5288	
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	1177.2744	879.0342	677.1796	313.9573	97.8787	0.0000	0.0000	0.0000	0.0000	395.1672	833.1722	1223.8652	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5597.5288	
Space heating per m2											(98c) / (4) =	41.6452	(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 %) 332.2552 (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	1177.2744	879.0342	677.1796	313.9573	97.8787	0.0000	0.0000	0.0000	0.0000	395.1672	833.1722	1223.8652	(98)
Space heating efficiency (main heating system 1)	332.2552	332.2552	332.2552	332.2552	332.2552	0.0000	0.0000	0.0000	0.0000	332.2552	332.2552	332.2552	(210)
Space heating fuel (main heating system)	354.3283	264.5660	203.8131	94.4928	29.4589	0.0000	0.0000	0.0000	0.0000	118.9348	250.7627	368.3509	(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	281.9440	248.8034	262.7752	227.1334	217.5709	193.1973	188.5037	197.5210	201.4031	228.0173	246.6894	278.3340	(64)
Efficiency of water heater												220.6850	(216)
(217)m	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	(217)
Fuel for water heating, kWh/month	127.7586	112.7414	119.0725	102.9220	98.5889	87.5444	85.4175	89.5036	91.2627	103.3225	111.7835	126.1228	(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	18.1146	16.3616	18.1146	17.5303	18.1146	17.5303	18.1146	18.1146	17.5303	18.1146	17.5303	18.1146	(231)
Lighting	30.9564	24.8344	22.3606	16.3824	12.6542	10.3386	11.5436	15.0048	19.4897	25.5716	28.8830	31.8168	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.4198	-69.5002	-114.1620	-139.7281	-154.0209	-142.2115	-139.1852	-126.5002	-103.8860	-81.9184	-49.6958	-36.4535	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.3271	-31.1106	-79.2824	-154.6571	-242.4984	-261.6928	-253.3933	-194.1226	-120.2427	-52.5084	-17.8796	-9.2425	(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 1684.7075 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 220.6850

Water heating fuel used 1256.0403 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(MEVCentralised, Database: in-use factor = 1.3000, SFP = 1.0530)

mechanical ventilation fans (SFP = 1.0530) 213.2852 (230a)

Total electricity for the above, kWh/year	213.2852	(231)
Electricity for lighting (calculated in Appendix L)	249.8361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2629.6391	(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	774.2301	(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	1684.7075	0.1560	262.7520	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1256.0403	0.1413	177.4472	(264)
Space and water heating			440.1993	(265)
Pumps, fans and electric keep-hot	213.2852	0.1387	29.5853	(267)
Energy for lighting	249.8361	0.1443	36.0591	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1200.6817	0.1332	-159.9201	
PV Unit electricity exported	-1428.9574	0.1201	-171.5667	
Total			-331.4867	(269)
Total CO2, kg/year			174.3569	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.3000	(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	1684.7075	1.5774	2657.4470	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1256.0403	1.5224	1912.1994	(278)
Space and water heating			4569.6463	(279)
Pumps, fans and electric keep-hot	213.2852	1.5128	322.6578	(281)
Energy for lighting	249.8361	1.5338	383.2070	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1200.6817	1.4922	-1791.6479	
PV Unit electricity exported	-1428.9574	0.4404	-629.2935	
Total			-2420.9414	(283)
Total Primary energy kWh/year			2854.5698	(286)
Dwelling Primary energy Rate (DPER)			21.2400	(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	45.5500 (1a)	x	2.5000 (2a)	=	113.8750	(1a) - (3a)
Ground floor	44.4300 (1b)	x	2.7500 (2b)	=	122.1825	(1b) - (3b)
First floor	44.4300 (1c)	x	2.9800 (2c)	=	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 134.4100						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	368.4589	(5)

2. Ventilation rate

		m3 per hour		
Number of open chimneys	0 * 80	=	0.0000	(6a)
Number of open flues	0 * 20	=	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10	=	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20	=	0.0000	(6d)
Number of flues attached to other heater	0 * 35	=	0.0000	(6e)
Number of blocked chimneys	0 * 20	=	0.0000	(6f)
Number of intermittent extract fans	4 * 10	=	40.0000	(7a)
Number of passive vents	0 * 10	=	0.0000	(7b)
Number of flueless gas fires	0 * 40	=	0.0000	(7c)
	Air changes per hour			
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5)	=	0.1086	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3586	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3317	(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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.7600	1.0000	2.7600			(26)
TER Opening Type (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
W10			1.0000	1.5918	1.5918			(27a)
RL11			3.7200	1.5918	5.9213			(27a)
Rl12			1.1800	1.5918	1.8783			(27a)
W13			1.1800	1.5918	1.8783			(27a)
Heat Loss Floor 1			45.5500	0.1300	5.9215			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1100	5.0259			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1100	0.0143			(30)
Total net area of external elements Aum(A, m2)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4627			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 200.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.6700	0.0500	0.5835
E3 Sill	10.4700	0.0500	0.5235
E4 Jamb	33.3400	0.0500	1.6670
E5 Ground floor (normal)	27.5200	0.1600	4.4032
E6 Intermediate floor within a dwelling	53.2800	0.0000	0.0000
E16 Corner (normal)	32.9200	0.0900	2.9628
R1 Head of roof window	5.0600	0.0800	0.4048
R2 Sill of roof window	5.0600	0.0600	0.3036
R3 Jamb of roof window	7.2000	0.0800	0.5760
E14 Flat roof	53.2800	0.0800	4.2624

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.6868 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 97.1495 (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	71.6675	71.2453	70.8315	68.8879	68.5243	66.8314	66.8314	66.5179	67.4835	68.5243	69.2599	70.0290	(38)
Heat transfer coeff	168.8170	168.3948	167.9810	166.0374	165.6737	163.9809	163.9809	163.6674	164.6330	165.6737	166.4094	167.1785	(39)
Average = Sum(39)m / 12 =												166.0356	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2560	1.2528	1.2498	1.2353	1.2326	1.2200	1.2200	1.2177	1.2249	1.2326	1.2381	1.2438	(40)
HLP (average)												1.2353	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9056 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
93.7179	92.3095	90.2572	86.3305	83.4326	80.2010	78.3641	80.4009	82.6336	86.1034	90.1145	93.3588	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

44.3861	42.7721	41.1580	39.5440	37.9300	36.3159	36.3159	37.9300	39.5440	41.1580	42.7721	44.3861	(42c)

Average daily hot water use (litres/day) 126.7558 (43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
138.1040	135.0816	131.4152	125.8745	121.3626	116.5169	114.6801	118.3309	122.1776	127.2614	132.8866	137.7449	(44)
Energy conte 218.7230	192.3544	201.9803	172.3158	163.3774	143.2711	138.6956	146.5183	150.6572	172.6926	189.3213	215.6753	(45)

Energy content (annual) Total = Sum(45)m = 2105.5823

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

32.8085	28.8532	30.2970	25.8474	24.5066	21.4907	20.8043	21.9778	22.5986	25.9039	28.3982	32.3513	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss

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

If cylinder contains dedicated solar storage

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

265.3179	234.4401	248.5752	217.4077	209.9723	188.3630	185.2905	193.1132	195.7491	219.2875	234.4131	262.2702	(62)
WWHRS -42.8439	-37.8915	-39.6778	-32.8548	-30.6195	-26.2013	-24.5595	-26.1166	-27.1089	-31.9584	-36.2050	-42.0505	(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

222.4740	196.5486	208.8974	184.5529	179.3528	162.1617	160.7310	166.9966	168.6402	187.3291	198.2081	220.2197	(64)

Total per year (kWh/year) = Sum(64)m = 2256.1121 (64)

12Total per year (kWh/year) 2256 (64)

Electric shower(s)

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

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

Heat gains from water heating, kWh/month

110.0013	97.6264	104.4344	93.3685	91.5989	83.7111	83.3922	85.9933	86.1670	94.6962	99.0228	108.9880	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	153.1643	169.5748	153.1643	158.2698	153.1643	158.2698	153.1643	153.1643	158.2698	153.1643	158.2698	153.1643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(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)													
	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Water heating gains (Table 5)													
	147.8512	145.2774	140.3688	129.6785	123.1168	116.2655	112.0863	115.5824	119.6764	127.2798	137.5317	146.4892	(72)
Total internal gains													
	673.5603	690.5407	661.2994	638.8490	605.8922	581.1371	558.4850	558.8373	575.9590	598.3225	634.9695	658.8308	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.6300	0.7000	0.7700	33.0170	(74)
Southeast	2.4400	36.7938	0.6300	0.7000	0.7700	27.4370	(77)
South	3.5100	46.7521	0.6300	0.7000	0.7700	50.1510	(78)
Northwest	3.7600	11.2829	0.6300	0.7000	0.7700	12.9653	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	195.2569	361.6753	571.0857	833.7064	1047.7188	1089.9208	1030.1081	863.0475	660.9765	420.3790	239.1933	163.6431	(83)
Total gains	868.8172	1052.2160	1232.3851	1472.5554	1653.6110	1671.0579	1588.5931	1421.8848	1236.9355	1018.7015	874.1627	822.4739	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.2326	44.3435	44.4528	44.9731	45.0719	45.5371	45.5371	45.6244	45.3568	45.0719	44.8726	44.6662	
alpha	3.9488	3.9562	3.9635	3.9982	4.0048	4.0358	4.0358	4.0416	4.0238	4.0048	3.9915	3.9777	
util living area													
	0.9934	0.9854	0.9656	0.9022	0.7710	0.5885	0.4437	0.5096	0.7655	0.9463	0.9871	0.9946	(86)
MIT	19.1884	19.4484	19.8449	20.3670	20.7525	20.9383	20.9845	20.9736	20.8237	20.2936	19.6519	19.1518	(87)
Th 2	19.8755	19.8780	19.8804	19.8919	19.8940	19.9040	19.9040	19.9059	19.9002	19.8940	19.8897	19.8851	(88)
util rest of house													
	0.9915	0.9814	0.9560	0.8755	0.7146	0.5019	0.3381	0.3973	0.6866	0.9259	0.9829	0.9932	(89)
MIT 2	17.7745	18.1067	18.6079	19.2524	19.6841	19.8668	19.8984	19.8953	19.7738	19.1816	18.3758	17.7342	(90)
Living area fraction									fLA = Living area / (4) =			0.2912	(91)
MIT	18.1863	18.4974	18.9681	19.5769	19.9952	20.1789	20.2147	20.2093	20.0795	19.5054	18.7474	18.1470	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1863	18.4974	18.9681	19.5769	19.9952	20.1789	20.2147	20.2093	20.0795	19.5054	18.7474	18.1470	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9874	0.9745	0.9458	0.8666	0.7203	0.5246	0.3687	0.4295	0.7009	0.9167	0.9767	0.9897	(94)
Useful gains	857.8824	1025.4097	1165.5871	1276.0670	1191.0621	876.5928	585.7406	610.7568	866.9275	933.8736	853.7889	813.9910	(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													
	2344.2366	2289.7326	2094.4015	1772.7712	1374.2980	914.8260	592.7418	623.4597	984.4261	1475.3940	1938.2368	2331.6409	(97)
Space heating kWh													
	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316	(98a)
Space heating requirement - total per year (kWh/year)												5453.2902	
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													
	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5453.2902	
Space heating per m2											(98c) / (4) =	40.5721	(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													
	1105.8475	849.6250	691.0379	357.6270	136.3275	0.0000	0.0000	0.0000	0.0000	402.8912	780.8025	1129.1316	(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)													
	1198.1013	920.5038	748.6868	387.4616	147.7004	0.0000	0.0000	0.0000	0.0000	436.5018	845.9399	1223.3278	(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

	222.4740	196.5486	208.8974	184.5529	179.3528	162.1617	160.7310	166.9966	168.6402	187.3291	198.2081	220.2197 (64)
Efficiency of water heater												79.8000 (216)
(217)m	87.1537	86.9575	86.5346	85.5170	83.4526	79.8000	79.8000	79.8000	79.8000	85.7312	86.8176	87.1950 (217)
Fuel for water heating, kWh/month												
	255.2662	226.0284	241.4034	215.8084	214.9157	203.2101	201.4172	209.2690	211.3285	218.5075	228.3040	252.5599 (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	31.8245	25.5308	22.9877	16.8417	13.0090	10.6285	11.8673	15.4256	20.0363	26.2887	29.6930	32.7090 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-44.0699	-62.8997	-91.4990	-104.1143	-113.2528	-105.9806	-104.5869	-98.2037	-87.1761	-72.3942	-48.6892	-38.0045 (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	-22.6242	-47.8344	-95.5471	-144.2257	-191.4468	-192.7059	-190.5264	-161.0569	-117.6434	-68.7505	-30.3107	-17.8799 (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	5908.2234 (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	2678.0183 (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)	256.8421 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2251.4229 (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	6677.6610 (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	5908.2234	0.2100	1240.7269	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2678.0183	0.2100	562.3839	(264)
Space and water heating			1803.1108	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	256.8421	0.1443	37.0702	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-970.8709	0.1344	-130.4379	
PV Unit electricity exported	-1280.5520	0.1257	-161.0135	
Total			-291.4515	(269)
Total CO2, kg/year			1560.6588	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6100	(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	5908.2234	1.1300	6676.2925	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2678.0183	1.1300	3026.1607	(278)
Space and water heating			9702.4532	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	256.8421	1.5338	393.9529	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-970.8709	1.4965	-1452.9349	
PV Unit electricity exported	-1280.5520	0.4615	-591.0197	
Total			-2043.9545	(283)
Total Primary energy kWh/year			8182.5524	(286)
Target Primary Energy Rate (TPER)			60.8800	(287)