Sustainability Statement for Planning

Corner of Maryland Road and High Road
London
N22 5AR

Job number: 11577

Date: July 2024

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Contents:

Report Details:

Revision	Issue Date	Author	Checked	Description
0	21/12/2023	ROB	CT	First Issue
1	16/07/2024	ROB	PK	Second Issue

1 - Introduction

This Sustainability Statement (SS) has been prepared in support of the planning application for the demolition of the existing building, and the construction of a new building (including lower ground floor) to comprise 6no. flats.

2 - Planning Policies

National Planning Policy Framework 2023

The NPPF was updated in December 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.

Haringey Council

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

3 - Existing and Proposed Development

The site is located on corner of Maryland Road and High Road, London (see Figure 1). The site is currently comprised of an existing building (the latest use being a Church)

Proposals are for the demolition of the existing building, and the construction of a new building (including lower ground floor) to comprise 6no. flats.

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 at corner of Maryland Road and High Road, London, best efforts have been made to reduce the need for energy and reduce heat demand. A preliminary Energy assessment has been carried out on the dwellings to show how the dwellings can be improved beyond building regulations. As the drawings supplied are at a planning stage, assumptions have been made about the construction, heating and ventilation. Therefore the energy strategy which has been used is a guide only.
Maximise use of passive energy	Through the use of passive and active design measures the design team have enabled the development to require less energy through the use of optimised insulation, cross ventilation, improved window u-values, higher air tightness, reduced cold bridging and light coloured materials.
Increased Energy Efficiency	An Energy Statement has been carried out for the proposed dwellings which show the dwellings will go beyond building regulations Part L1 2021. The dwellings will incorporate: - • Low fabric element u-values, External wall u-value 0.17W/m2k, Floor 0.11W/m2k, Roof 0.10W/m2k • High efficiency ASHP heating system • Time and temperature zone control • Mechanical ventilation with heat recovery • Waste Water Heat Recovery • Solar PV panels 2.4kWp for all the dwellings, totalling 14.4kWp for the total development

	This has shown to be an improvement over building regulations Part L1 2021 baseline, by achieving a potential of 96% improvement in CO2 emissions.

Renewable Energy Sources	The feasibility of several renewable technologies has been reviewed and show that Solar panels and ASHP are potentially feasible.
	
	Low carbon technology included in the Be Green assessment:
	
	• Solar PV totalling 14.4kWp to be displayed as follows:
	  ○ 2.4kWp for Flat 1 displayed at 30° angle on South pitch with little or no shading.
	  ○ 2.4kWp for Flat 2 displayed at 30° angle on West pitch with little or no shading.
	  ○ 2.4kWp for Flat 3 displayed at 30° angle on East pitch with little or no shading.
	  ○ 2.4kWp for Flat 4 displayed at 30° angle on West pitch with little or no shading.
	  ○ 2.4kWp for Flat 5 displayed at 30° angle on East pitch with little or no shading.
	  ○ 2.4kWp for Flat 6 displayed at 30° angle on South pitch with little or no shading.
	
	• Low carbon Air Source Heat Pumps

Responsible Travel Provisions	The site is in an urban area and therefore has good access to public transport. There are 2 trains stations, Bowes Park approximately 950m and Bounds Green underground approximately 1400m away, and several bus nodes located along A105 (High Road) and Wolves Lane There will also be short stay cycle storage for 2 cycles and long stay cycle storage for 12 cycles provided for each dwelling to promote healthier travel methods and reduce CO2 emissions from vehicles.

Water	
Issue	Compliance
Water Saving Measures	Initial advice from the design team suggests that water saving measures can be incorporated in order to reduce water usage. It has been identified that there is the opportunity to have low flow rates and dual flush toilets.
Water Consumption Targets	Water efficient fixtures, fittings and appliances will be provided to ensure that internal water use targets are achieved to comply with the local council of Haringey target of 105 L/person/day. In comparison, Building Regulations Approved Document G requires internal water use to be at 125litres/person/day or less.
Reusing Water	A preliminary feasibility study of the potential to include rainwater harvesting has been carried out and stated in the FRA and Suds Report. These are summarised below: • Rainwater reuse would not be a feasible solution, given the proposed site layout. • The British Geology Survey (BGS) Geology Maps indicate that the site is underlain by London Clay. Given the underlying clay, we do not recommend a strategy based on infiltration. • A rainwater butt will be installed and to be designed into the development for the watering of the garden areas. **Further details are provided in a separate Surface Water and Flood Report that has been carried out by Base Energy.**

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 aim to design and choose materials that will influence the construction process and reduce 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. Where feasible the developer use materials and products with Environmental Product Declaration (EPD) certificates. 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 to be installed it will be 100% legally sourced and FSC certified. Setting a specific percentage target for responsible sourced, low-impact materials can be challenging due to various factors such as project scope, budget, and material availability. However, establishing ambitious goals demonstrates a commitment to sustainability. The client will aim to target a minimum 90% for responsibly sourced materials.

	Key considerations when setting targets: • Material availability: Consider the regional availability of sustainable materials. • Cost implications: Assess the financial impact of using low-impact materials. • Life cycle assessment: Evaluate the overall environmental impact of materials beyond sourcing. • Minimising the harmful effects of some materials on human health, ensuring that specified materials are robust and sensitive to the building type and age.

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. Where feasible, the project will prioritize the reuse of demolition materials to minimize waste and reduce the environmental impact of the development. Suitable materials, including bricks, timber and metals, will be assessed for their suitability for reuse in accordance with Building Regulations. By salvaging and reusing materials, the project aims to conserve resources, reduce landfill waste, and contribute to a more sustainable construction process. A Site Waste Management Plan (SWMP) should be prepared and incorporate non-hazardous waste, demolition and excavation waste if applicable. The development will target the diversion of 95% of construction and extraction waste from land fill. The BRE Smartwaste tool can be used as an easy tool by contractors. Note: It is essential to conduct thorough inspections of reclaimed materials to ensure they meet the required standards for safety and performance.
Storage for Recyclables & Waste	Sufficient internal and external space will be provided to facilitate recycling and composting and the good management of waste for the building occupiers. The dwellings will be fitted with internal waste storage facilities in the kitchen for the segregation of recyclable materials, in compliance with BS5096.

Nature Conservation and Biodiversity	
Issue	Compliance
Protecting Species **Promoting the Protection and Planting of Trees**	The existing site is comprised of an existing building (the latest use being a Church) with hardstanding areas and is considered to be of low ecological value. Existing trees (and the space they require) have been considered throughout this development. It has not been necessary to remove any trees on site. However, there are features of ecological significance (Trees) next to the construction zone to the rear of the site. These will have to be adequately protected. Whilst measures to enhance the ecological potential of the site will be investigated where possible, opportunities to enhance the ecological value of the site are limited due to the small scale of the development.
Designing development proposals	The green space has been reduced in compared to the previous site. Efforts will be made to improve the ecological value of the site with planting of native plant species and bird boxes relevant to the native birds in the area. There is also the opportunity of planting not native varieties of plants taking into consideration the affects of climate change. Developers should adhere to the following hierarchy when considering biodiversity on their development by; avoiding adverse impact to the biodiversity interest, minimise impact, seek mitigation, and seek appropriate compensation where the benefits of the proposal clearly outweigh the biodiversity impacts

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 rear garden.

Tackling Increased Temperatures and Drought	
Issue	Compliance
Preventing Developments from Overheating	Overheating within buildings can result from either too much heat entering a building and not being released or too much heat being generated within a building and not being released. Therefore, if the internal environment becomes too hot it is likely occupiers will try to find a way to cool their environment. In order to continue minimising CO_2 emissions the design team have considered the internal comfort and implemented the following measures to reduce over heating, via cross ventilation, as well as mechanical ventilation. The dwellings are orientated where summer over heating should be reduced with less windows facing in a south direction.

Promoting Heat and Drought Resistant Planting	London's water demand already outstrips mains water supply. Therefore it is essential that landscaping does not use excessive amounts of water. have ensured the landscaping of the development does not require excessive amounts of water. Consideration will be given the including plant species which are heat and drought resistant. Advice from an ecologist should ideally be sought before any plant species are selected.

Further details are provided in a separate Overheating Report that has been carried out by Base Energy.

Flooding	
Issue	Compliance
Surface Water Flooding	Surface water flooding is the most likely form of flooding that development may be exposed to. Surface water flooding is likely to increase due to the anticipated increased intensity in rainfall events as well as the continuing urbanisation of London. The site is located within a residential area. As such, it is unlikely that there will be any significant pollution of surface water runoff associated with the current land use.
Flooding Resilience and Resistance	It is understood that the site is at low risk of flooding from all sources. However, should it come to light that there are some localised risks, flood resilient construction techniques could be incorporated into the dwellings in line with best practice guidance The development site is located in a flood zone 1 area, which is low risk.
Flooding and Basement Developments	The proposals include lower ground/basement floor development which can increase velocities of overland flows of surface water therefore more investigative works may be required to assess the impact of any potential standing groundwater and/or through flow. The site is underlain by London Clay and it is therefore unlikely that groundwater would be a problem. However, it is strongly recommended that advice is sought from a structural / geotechnical engineer as to whether measures such as tanking would be required to protect against flooding.

Further details are provided in a separate Surface Water and Flood Report that has been carried out by Base Energy.

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 dwellings, through cross ventilation, and either naturally ventilated or mechanical ventilation. Where there is mechanical ventilation, exhaust flues will be positioned away from intake flues for fresh air. In naturally ventilated buildings/spaces: openable windows/ventilators are over 10m from sources of external pollution.

Noise	
Issue	Compliance
Sources of Noise	The proposed site is located within an existing residential area, with few commercial units in the vicinity. The area is identified having a low potential for noise pollution from residential dwellings.
Mitigation of Noise Emitted by Development	Noise attenuation measures will be incorporated on-site where required, to ensure that any noise generated by equipment or services will not generate a source of noise pollution or negatively impact the surrounding area. The developer will comply with the council's construction noise rules which states what hours of the day the site can work within.

Mitigation of Noise impacts on the Development	For the occupiers of the dwellings, the specification of the partition walls, floors and external walls will be designed to go beyond Document E of the building regulations. The following should be followed, and best efforts will be made here were possible to avoid impacts of external noise to the occupiers. Locate noise sensitive areas/rooms away from the parts of the site most exposed to noises, create setbacks, design the building so its shape and orientation reflect noise and protect the most sensitive uses, position non-residential uses closer to the noise source in mixed use developments, design in lobbies, balconies, winter gardens and dual facades; and carefully locate noise generating equipment for the building such as plant and services away from sensitive uses.

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 80 lumens per circuit watt. Second all external lights will be automatically controlled for the prevention of operation during daylight hours and presence detection in areas of intermitted pedestrian traffic. The ILP Guidance for the reduction of obtrusive light, 2001 will be used to design the lighting strategy. All external lighting (except for safety and security lighting) can be automatically switched off between 23:00 and 07:00. If safety or security lighting is provided and will be used between 23:00 and 07:00, this part of the lighting system complies with the lower levels of lighting recommended during these hours in Table 2 of the ILP's Guidance notes. Illuminated advertisements, where specified, must be designed in compliance with ILE Technical Report 5 – The Brightness of Illuminated Advertisements

Water Pollution	
Issue	Compliance
How Sustainable Drainage Contributes to Water Quality	Surface water runoff will be managed through a combination of SuDS, in line with the London Plan Drainage Hierarchy, and based on a desktop study of underlying ground conditions. Through a combination of SuDS, water quality will be improved.

Connection of New Developments to the Sewer Network	It is proposed that surface water runoff from hardstanding areas will ultimately connect into the public sewer system, via attenuation storage with a controlled outlet. Based on the review of underlying ground conditions, and in line with the London Plan hierarchy, the following are proposed to manage flows from hardstanding areas: - Rainwater recycling (water butt) - Rain planter - Attenuation storage with a controlled outlet into the public sewer system. Storage will be provided for surface water runoff from roof and hardstanding areas (~265m2) in up to the 1 in 100 year plus 40% allowance for climate change. Flows will be restricted to 0.5l/s; this is the existing 1 in 100 year greenfield rate of runoff

5 Conclusion

The proposed development is to be located on the corner of Maryland Road and High Road, London, where the site is currently comprised of an existing building (the latest use being a Church). Proposals are for the demolition of the existing building, and the construction of a new building (including lower ground floor) to comprise 6no. flats.

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

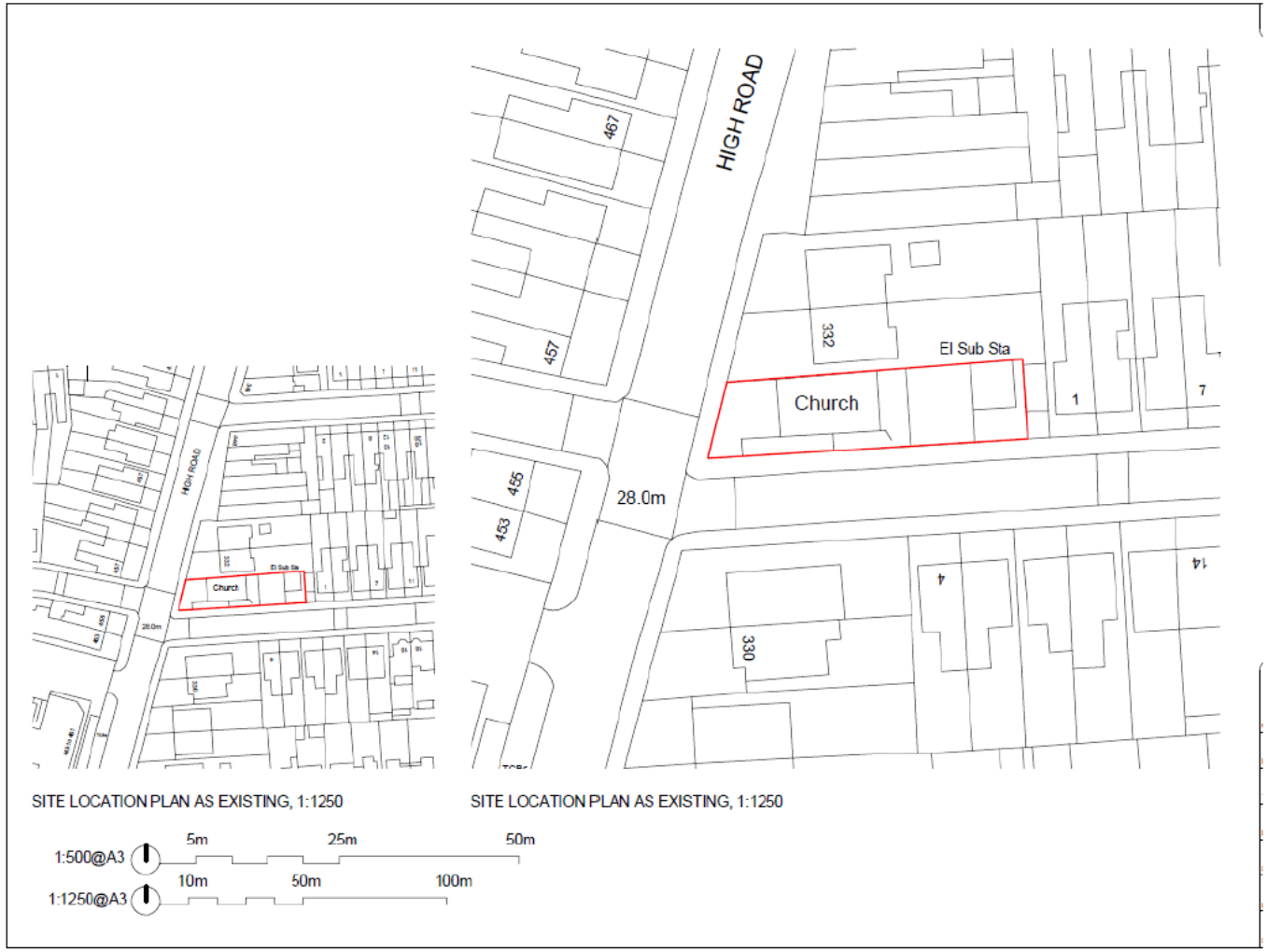
Given the scale and nature of the development, this constrains the development proposals in terms of the layout, positioning and orientation of the proposed dwelling. Subsequently, these constraints will impact on the feasibility of certain sustainability and energy efficient measures that can feasibly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

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

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

- The energy efficiency measures of the building are to go beyond current Part L1 2021, with a potential of 96% saving in CO2
- The development is to take a fabric first approach, which is to be designed to be highly insulated, with low u-values and good air tightness
- The development has also reviewed feasible renewable and low carbon technology and is incorporating an ASHP with solar PV
- Water efficiency is a big driver of sustainability and indoor fittings which will have water efficiency will be installed. These will help to go beyond building regulations and aim for 105L/person/day
- The location lends itself to good transport links
- Short stay cycle storage for 2 cycles and long stay cycle storage for 12 cycles provided for each dwelling to promote healthier travel methods and reduce CO2 emissions from vehicles

Appendix A Site Plan



Appendix B SAP Worksheet Improvement over Part L1 2023

Full SAP Calculation Printout

Property Reference	11577 1	**Issued on Date**	25/07/2024
Assessment Reference	Be Green - V4	**Prop Type Ref**	Flat 1
Property	Corner of, Maryland Road & High Road, London, N22		

SAP Rating	93 A	**DER**	0.86	**TER**	11.06
Environmental	99 A	**% DER < TER**			92.22
CO_2 Emissions (t/year)	0.06	**DFEE**	34.62	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			1.71
% DPER < TPER	71.85	**DPER**	16.41	**TPER**	58.29

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)	
Ground floor	59.6600 (1b)	x	2.5000 (2b)	=	149.1500	(1b) - (3b)
First floor	53.9000 (1c)	x	2.5000 (2c)	=	134.7500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	283.9000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.5000	(17)
Infiltration rate		0.1750	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1487	(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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		80.1000 (23c)

Effective ac	0.2892	0.2854	0.2817	0.2631	0.2594	0.2408	0.2408	0.2371	0.2482	0.2594	0.2668	0.2743	(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	
Door			1.8900	1.4000	2.6460			(26)
Window (Uw = 1.20)			17.3400	1.1450	19.8550			(27)
Heat Loss Floor 1			59.6600	0.1100	6.5626			(28a)
External Wall	91.0000	19.2300	71.7700	0.1700	12.2009			(29a)
Basement Wall	48.7500		48.7500	0.1700	8.2875			(29a)
Corridor Wall	19.2500		19.2500	0.1700	3.2725			(29a)
Ceiling to corridor	5.7600		5.7600	0.0970	0.5587			(30)
Total net area of external elements Aum(A, m2)			224.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.3831			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	11.2210	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	64.6041	(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	27.0902	26.7418	26.3934	24.6514	24.3030	22.5610	22.5610	22.2126	23.2578	24.3030	24.9998	25.6966	(38)
Heat transfer coeff	91.6943	91.3459	90.9975	89.2555	88.9071	87.1651	87.1651	86.8167	87.8619	88.9071	89.6039	90.3007	(39)
Average = Sum(39)m / 12 =												89.1684	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8075	0.8044	0.8013	0.7860	0.7829	0.7676	0.7676	0.7645	0.7737	0.7829	0.7890	0.7952	(40)
HLP (average)												0.7852	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8346 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	89.6832	88.3354	86.3715	82.6138	79.8407	76.7482	74.9905	76.9395	79.0761	82.3965	86.2349	89.3396	(42a)
Hot water usage for baths	30.9766	30.5165	29.8687	28.6742	27.7798	26.7880	26.2523	26.8956	27.5960	28.6573	29.8764	30.8719	(42b)
Hot water usage for other uses	43.6590	42.0714	40.4838	38.8962	37.3086	35.7210	35.7210	37.3086	38.8962	40.4838	42.0714	43.6590	(42c)
Average daily hot water use (litres/day)												151.0951	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.3188	160.9234	156.7240	150.1842	144.9291	139.2572	136.9638	141.1438	145.5684	151.5376	158.1827	163.8705	(44)
Energy conte	260.2408	229.1528	240.8790	205.5947	195.1025	171.2330	165.6458	174.7655	179.5004	205.6351	225.3603	256.5816	(45)
Energy content (annual)										Total = Sum(45)m =		2509.6914	
Distribution loss (46)m = 0.15 x (45)m	39.0361	34.3729	36.1318	30.8392	29.2654	25.6850	24.8469	26.2148	26.9251	30.8453	33.8040	38.4872	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6642	(55)
Total storage loss	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902	(56)
If cylinder contains dedicated solar storage	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902	(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	304.0934	268.7616	284.7316	248.0327	238.9551	213.6710	209.4984	218.6181	221.9384	249.4877	267.7983	300.4342	(62)
WWHRS	-52.0734	-46.0542	-48.2253	-39.9324	-37.2156	-31.8457	-29.8502	-31.7427	-32.9487	-38.8429	-44.0043	-51.1091	(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	252.0200	222.7074	236.5063	208.1003	201.7395	181.8254	179.6482	186.8753	188.9896	210.6448	223.7940	249.3251	(64)
										Total per year (kWh/year) = Sum(64)m =		2542.1758	(64)
12Total per year (kWh/year)												2542	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	121.6122	107.8803	115.1743	102.3106	99.9537	90.8854	90.1593	93.1916	93.6343	103.4558	108.8827	120.3955	(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	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.9197	162.6611	146.9197	151.8170	146.9197	151.8170	146.9197	146.9197	151.8170	146.9197	151.8170	146.9197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5748	279.4448	272.2125	256.8159	237.3804	219.1138	206.9106	204.0406	211.2729	226.6695	246.1050	264.3716	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	(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)	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	(71)
Water heating gains (Table 5)	163.4572	160.5362	154.8042	142.0981	134.3463	126.2297	121.1819	125.2575	130.0476	139.0534	151.2260	161.8218	(72)
Total internal gains	652.4705	668.1609	639.4553	616.2498	584.1652	562.6794	540.5310	541.7367	558.6563	578.1615	614.6668	638.6320	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.1400	19.6403	0.3500	0.0000	0.7700	53.6715	(76)
South	7.2000	46.7521	0.3500	0.0000	0.7700	90.7177	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	144.3892	253.5651	362.1630	466.0754	531.9477	530.8765	510.7830	462.2609	398.7984	284.8320	174.4535	122.5253	(83)
Total gains	796.8598	921.7261	1001.6183	1082.3253	1116.1129	1093.5558	1051.3140	1003.9975	957.4548	862.9935	789.1203	761.1573	(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	34.4017	34.5330	34.6652	35.3417	35.4802	36.1893	36.1893	36.3345	35.9023	35.4802	35.2043	34.9327	
alpha	3.2934	3.3022	3.3110	3.3561	3.3653	3.4126	3.4126	3.4223	3.3935	3.3653	3.3470	3.3288	
util living area													

	0.9406	0.9079	0.8609	0.7696	0.6450	0.4836	0.3573	0.3874	0.5763	0.7968	0.9078	0.9472	(86)
Living	19.7119	19.9370	20.2067	20.5276	20.7435	20.8648	20.8975	20.8938	20.8249	20.5428	20.0935	19.6851	
Non living	18.7183	19.0011	19.3372	19.7360	19.9876	20.1285	20.1580	20.1580	20.0856	19.7635	19.2111	18.6927	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3411	19.9370	20.2067	20.5276	20.7435	20.8648	20.8975	20.8938	20.8249	20.5428	20.0935	19.8690	(87)
Th 2	20.2469	20.2495	20.2522	20.2655	20.2682	20.2815	20.2815	20.2842	20.2762	20.2682	20.2628	20.2575	(88)
util rest of house													
	0.9335	0.8974	0.8452	0.7449	0.6087	0.4357	0.3015	0.3305	0.5278	0.7694	0.8956	0.9408	(89)
MIT 2	19.6375	19.0011	19.3372	19.7360	19.9876	20.1285	20.1580	20.1580	20.0856	19.7635	19.2111	18.9747	(90)
Living area fraction										fLA = Living area / (4) =		0.3104	(91)
MIT	19.8559	19.2916	19.6071	19.9817	20.2222	20.3570	20.3875	20.3864	20.3151	20.0054	19.4850	19.2523	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8559	19.2916	19.6071	19.9817	20.2222	20.3570	20.3875	20.3864	20.3151	20.0054	19.4850	19.2523	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9293	0.8818	0.8301	0.7346	0.6063	0.4409	0.3099	0.3388	0.5305	0.7586	0.8806	0.9305	(94)
Useful gains	740.5478	812.7914	831.4321	795.0747	676.6711	482.1552	325.7667	340.1083	507.9376	654.6862	694.8879	708.2545	(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													
	1426.3859	1314.6158	1192.7150	989.1056	757.6869	501.8134	330.1417	346.0865	546.0716	836.2088	1109.7470	1359.2339	(97)
Space heating kWh													
	510.2636	337.2260	268.7945	139.7022	60.2758	0.0000	0.0000	0.0000	0.0000	135.0528	298.6986	484.3287	(98a)
Space heating requirement - total per year (kWh/year)												2234.3421	
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													
	510.2636	337.2260	268.7945	139.7022	60.2758	0.0000	0.0000	0.0000	0.0000	135.0528	298.6986	484.3287	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2234.3421	
Space heating per m2											(98c) / (4) =	19.6754	(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 %)	354.8982	(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													
	510.2636	337.2260	268.7945	139.7022	60.2758	0.0000	0.0000	0.0000	0.0000	135.0528	298.6986	484.3287	(98)
Space heating efficiency (main heating system 1)													
	354.8982	354.8982	354.8982	354.8982	354.8982	0.0000	0.0000	0.0000	0.0000	354.8982	354.8982	354.8982	(210)
Space heating fuel (main heating system)													
	143.7774	95.0205	75.7385	39.3640	16.9840	0.0000	0.0000	0.0000	0.0000	38.0540	84.1646	136.4698	(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													
	252.0200	222.7074	236.5063	208.1003	201.7395	181.8254	179.6482	186.8753	188.9896	210.6448	223.7940	249.3251	(64)
Efficiency of water heater												190.4310	(216)
(217)m	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	(217)
Fuel for water heating, kWh/month													
	132.3419	116.9491	124.1952	109.2785	105.9383	95.4810	94.3377	98.1328	99.2431	110.6147	117.5197	130.9267	(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	25.1219	22.6907	25.1219	24.3115	25.1219	24.3115	25.1219	25.1219	24.3115	25.1219	24.3115	25.1219	(231)
Lighting	35.6422	28.5935	25.7453	18.8621	14.5696	11.9035	13.2909	17.2760	22.4398	29.4423	33.2550	36.6328	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.9360	-66.1122	-99.0216	-114.6579	-126.0807	-117.3215	-115.9121	-107.8858	-93.4006	-76.3885	-50.0201	-38.4297	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-15.9191	-35.4375	-73.9291	-117.1301	-160.2739	-164.2106	-161.8995	-134.8396	-96.7021	-53.4292	-22.1628	-12.4956	(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	629.5726	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4310	
Water heating fuel used	1334.9588	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8540)		
mechanical ventilation fans (SFP = 0.8540)	295.7897	(230a)
Total electricity for the above, kWh/year	295.7897	(231)
Electricity for lighting (calculated in Appendix L)	287.6532	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2098.5959	(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	449.3784	(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	629.5726	0.1560	98.2267	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1334.9588	0.1409	188.0540	(264)
Space and water heating			286.2807	(265)
Pumps, fans and electric keep-hot	295.7897	0.1387	41.0297	(267)
Energy for lighting	287.6532	0.1443	41.5172	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1050.1668	0.1340	-140.7204	
PV Unit electricity exported	-1048.4291	0.1244	-130.4459	
Total			-271.1663	(269)
Total CO2, kg/year			97.6614	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.8600	(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	629.5726	1.5776	993.1981	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1334.9588	1.5209	2030.3120	(278)
Space and water heating			3023.5101	(279)
Pumps, fans and electric keep-hot	295.7897	1.5128	447.4707	(281)
Energy for lighting	287.6532	1.5338	441.2120	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1050.1668	1.4952	-1570.2161	
PV Unit electricity exported	-1048.4291	0.4566	-478.7537	
Total			-2048.9698	(283)
Total Primary energy kWh/year			1863.2230	(286)
Dwelling Primary energy Rate (DPER)			16.4100	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.6600 (1b)	x	2.5000 (2b)	=	149.1500	(1b) - (3b)
First floor	53.9000 (1c)	x	2.5000 (2c)	=	134.7500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 113.5600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	283.9000	(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) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3909	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3323	(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	0.4236	0.4153	0.4070	0.3655	0.3572	0.3156	0.3156	0.3073	0.3323	0.3572	0.3738	0.3904	(22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5699	0.5762	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			17.3400	1.1450	19.8550			(27)
Heat Loss Floor 1			59.6600	0.1300	7.7558			(28a)
External Wall	91.0000	19.2300	71.7700	0.1800	12.9186			(29a)
Basement Wall	48.7500		48.7500	0.1800	8.7750			(29a)
Corridor Wall	19.2500		19.2500	0.1800	3.4650			(29a)
Ceiling to corridor	5.7600		5.7600	0.1100	0.6336			(30)
Total net area of external elements Aum(A, m2)			224.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2930			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.3000	0.0500	0.7150
E3 Sill	13.4000	0.0500	0.6700
E4 Jamb	27.6000	0.0500	1.3800
E5 Ground floor (normal)	34.2000	0.1600	5.4720
E6 Intermediate floor within a dwelling	29.4000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.7370 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 65.0300 (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	55.2502	54.9238	54.6038	53.1009	52.8197	51.5107	51.5107	51.2683	52.0149	52.8197	53.3885	53.9832	(38)
Heat transfer coeff	120.2802	119.9537	119.6338	118.1308	117.8496	116.5406	116.5406	116.2982	117.0448	117.8496	118.4185	119.0132	(39)
Average = Sum(39)m / 12 =												118.1295	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0592	1.0563	1.0535	1.0403	1.0378	1.0262	1.0262	1.0241	1.0307	1.0378	1.0428	1.0480	(40)
HLP (average)												1.0402	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8346 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.7466	70.6684	69.0972	66.0910	63.8726	61.3986	59.9924	61.5516	63.2609	65.9172	68.9879	71.4717	(42a)
Hot water usage for baths	30.9766	30.5165	29.8687	28.6742	27.7798	26.7880	26.2523	26.8956	27.5960	28.6573	29.8764	30.8719	(42b)
Hot water usage for other uses	43.6590	42.0714	40.4838	38.8962	37.3086	35.7210	35.7210	37.3086	38.8962	40.4838	42.0714	43.6590	(42c)
Average daily hot water use (litres/day)												134.5581	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.3822	143.2563	139.4497	133.6615	128.9610	123.9076	121.9657	125.7559	129.7532	135.0583	140.9357	146.0026	(44)
Energy conte	231.8336	203.9951	214.3290	182.9759	173.6063	152.3589	147.5069	155.7120	159.9986	183.2729	200.7888	228.6047	(45)
Energy content (annual)										Total = Sum(45)m =		2234.9826	
Distribution loss (46)m = 0.15 x (45)m	34.7750	30.5993	32.1494	27.4464	26.0409	22.8538	22.1260	23.3568	23.9998	27.4909	30.1183	34.2907	(46)

Water storage loss:
Store volume 170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5003 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8102 (55)
Total storage loss

	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	280.2113	247.6911	262.7067	229.7930	221.9840	199.1760	195.8846	204.0897	206.8157	231.6506	247.6059	276.9824	(62)
WWHRS	-32.7995	-29.0082	-30.3757	-25.1523	-23.4410	-20.0586	-18.8018	-19.9938	-20.7534	-24.4660	-27.7170	-32.1921	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.4118	218.6829	232.3310	204.6407	198.5430	179.1173	177.0828	184.0959	186.0623	207.1845	219.8889	244.7903	(64)
										Total per year (kWh/year) = Sum(64)m =		2499.8315	(64)
12Total per year (kWh/year)												2500	(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

	115.7868	102.7852	109.9666	98.2932	96.4262	88.1130	87.7482	90.4764	90.6532	99.6404	104.2160	114.7132	(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	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.9197	162.6611	146.9197	151.8170	146.9197	151.8170	146.9197	146.9197	151.8170	146.9197	151.8170	146.9197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5748	279.4448	272.2125	256.8159	237.3804	219.1138	206.9106	204.0406	211.2729	226.6695	246.1050	264.3716	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	(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)	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	(71)
Water heating gains (Table 5)	155.6275	152.9541	147.8045	136.5183	129.6052	122.3792	117.9411	121.6081	125.9073	133.9253	144.7444	154.1845	(72)
Total internal gains	647.6408	663.5788	635.4556	613.6700	582.4241	558.8289	537.2903	538.0872	554.5160	576.0333	611.1852	633.9946	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.1400	19.6403	0.6300	0.7000	0.7700	60.8635	(76)
South	7.2000	46.7521	0.6300	0.7000	0.7700	102.8739	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	163.7374	287.5429	410.6929	528.5295	603.2287	602.0139	579.2279	524.2038	452.2374	322.9995	197.8303	138.9437	(83)
Total gains	811.3782	951.1217	1046.1484	1142.1996	1185.6528	1160.8428	1116.5182	1062.2910	1006.7534	899.0328	809.0155	772.9383	(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	26.2258	26.2972	26.3675	26.7030	26.7667	27.0673	27.0673	27.1238	26.9507	26.7667	26.6381	26.5050	
alpha	2.7484	2.7531	2.7578	2.7802	2.7844	2.8045	2.8045	2.8083	2.7967	2.7844	2.7759	2.7670	
util living area	0.9489	0.9224	0.8843	0.8116	0.7062	0.5609	0.4297	0.4643	0.6511	0.8372	0.9240	0.9545	(86)
MIT	18.7033	19.0438	19.4959	20.0622	20.5167	20.8223	20.9381	20.9216	20.7150	20.1163	19.3243	18.6515	(87)
Th 2	20.0343	20.0367	20.0390	20.0499	20.0520	20.0615	20.0615	20.0633	20.0578	20.0520	20.0478	20.0435	(88)
util rest of house	0.9419	0.9119	0.8685	0.7854	0.6641	0.4972	0.3477	0.3820	0.5913	0.8088	0.9121	0.9482	(89)
MIT 2	17.3499	17.7781	18.3436	19.0438	19.5799	19.9187	20.0251	20.0145	19.8125	19.1248	18.1443	17.2901	(90)
Living area fraction									fLA = Living area / (4) =			0.3104	(91)
MIT	17.7700	18.1710	18.7013	19.3599	19.8707	20.1992	20.3085	20.2961	20.0927	19.4325	18.5106	17.7127	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7700	18.1710	18.7013	19.3599	19.8707	20.1992	20.3085	20.2961	20.0927	19.4325	18.5106	17.7127	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9193	0.8860	0.8417	0.7637	0.6553	0.5070	0.3701	0.4033	0.5937	0.7871	0.8871	0.9270	(94)
Useful gains	745.9382	842.7072	880.5010	872.2582	776.9663	588.5852	413.1787	428.4032	597.6821	707.6017	717.6844	716.4984	(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	1620.1762	1591.9091	1459.6896	1235.6405	962.9124	652.5314	432.1888	453.1094	701.4124	1040.9115	1351.2274	1608.1857	(97)
Space heating kWh	650.4331	503.4637	430.9163	261.6353	138.3439	0.0000	0.0000	0.0000	0.0000	247.9825	456.1509	663.4154	(98a)
Space heating requirement - total per year (kWh/year)												3352.3410	
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	650.4331	503.4637	430.9163	261.6353	138.3439	0.0000	0.0000	0.0000	0.0000	247.9825	456.1509	663.4154	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3352.3410	
Space heating per m2										(98c) / (4) =		29.5204	(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	650.4331	503.4637	430.9163	261.6353	138.3439	0.0000	0.0000	0.0000	0.0000	247.9825	456.1509	663.4154	(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)	704.6946	545.4644	466.8649	283.4618	149.8850	0.0000	0.0000	0.0000	0.0000	268.6701	494.2047	718.7599	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.4118	218.6829	232.3310	204.6407	198.5430	179.1173	177.0828	184.0959	186.0623	207.1845	219.8889	244.7903	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1234	85.8674	85.4251	84.6119	83.2655	79.8000	79.8000	79.8000	79.8000	84.4639	85.6578	86.1803	(217)
Fuel for water heating, kWh/month	287.2758	254.6752	271.9704	241.8582	238.4455	224.4578	221.9083	230.6966	233.1608	245.2936	256.7063	284.0445	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	30.5270	24.4899	22.0504	16.1551	12.4787	10.1952	11.3835	14.7966	19.2194	25.2169	28.4824	31.3754	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-29.6106	-43.4327	-64.9074	-75.9429	-84.4306	-79.6887	-78.6785	-73.0085	-63.4610	-50.9440	-33.1360	-25.4044	(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	-11.9580	-25.5846	-51.6730	-78.8402	-105.4799	-106.4739	-105.2572	-88.5812	-64.1971	-37.0274	-16.1024	-9.4268	(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	3632.0055	(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	2990.4930	(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)	246.3704	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1403.2469	(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	5551.6220	(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	3632.0055	0.2100	762.7211	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2990.4930	0.2100	628.0035	(264)
Space and water heating			1390.7247	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	246.3704	0.1443	35.5589	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-702.6452	0.1338	-93.9992	
PV Unit electricity exported	-700.6017	0.1254	-87.8749	
Total			-181.8741	(269)
Total CO2, kg/year			1256.3387	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.0600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3632.0055	1.1300	4104.1662	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2990.4930	1.1300	3379.2571	(278)
Space and water heating			7483.4233	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	246.3704	1.5338	377.8912	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-702.6452	1.4944	-1050.0185	
PV Unit electricity exported	-700.6017	0.4604	-322.5449	
Total			-1372.5634	(283)
Total Primary energy kWh/year			6618.8519	(286)
Target Primary Energy Rate (TPER)			58.2900	(287)