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	02/05/2024	12134 Rev0

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 dwellings which show the dwelling will go beyond building regulations Part L1a 2013 and achieve 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 294% 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 L1a 2013 baseline, by achieving a potential of 53% improvement in CO2 emissions over Part L 2013, which equates to a saving of 1,773Kg/year CO2. This is also a 67% CO2 reduction over Part L 2021.
Renewable Energy Sources	The feasibility of several renewable technologies has been reviewed and shows that Solar panels, 1.6kWp approximately 4 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 26% 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).

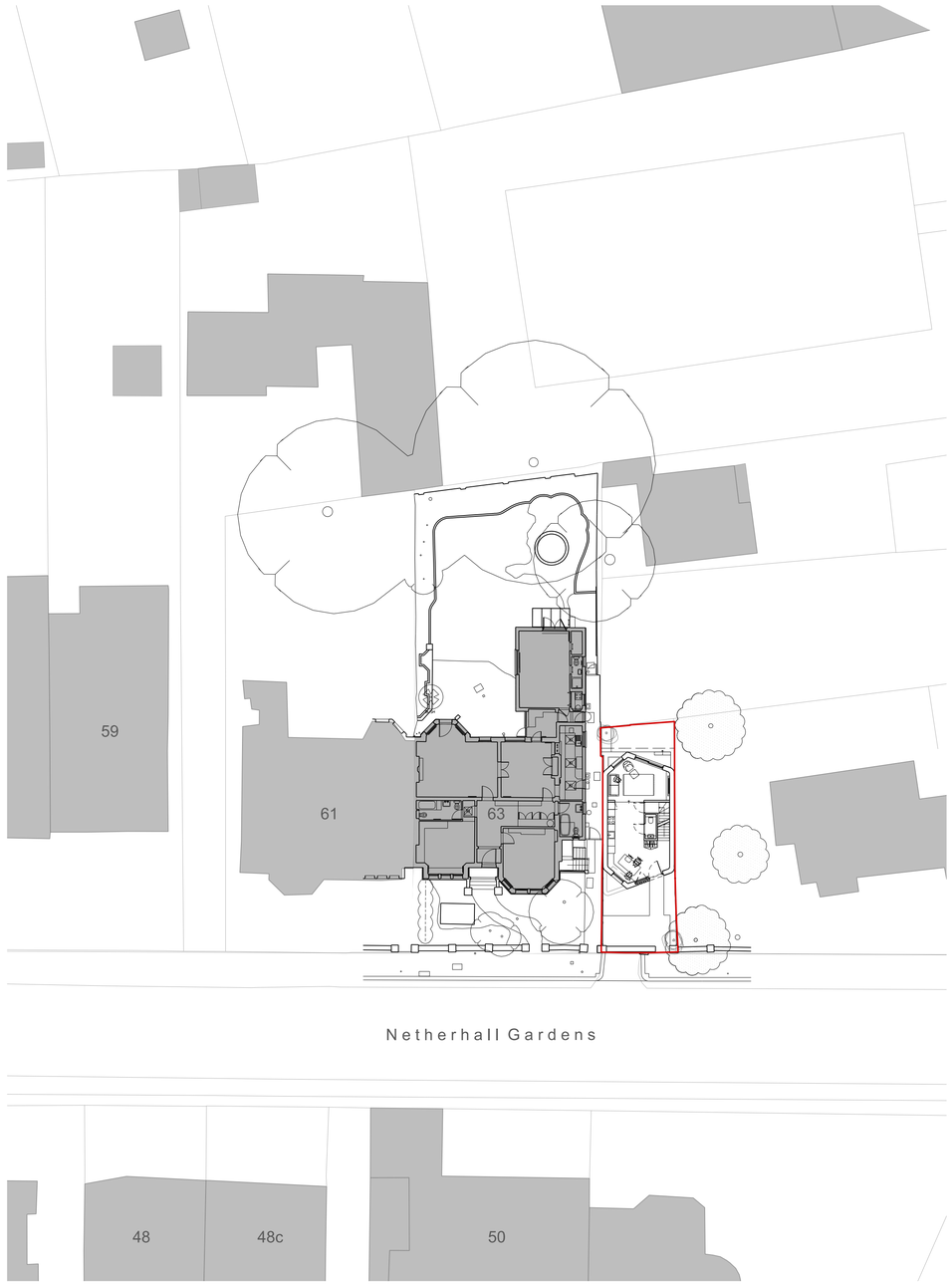
The above sustainability statement sets out what the requirements are of the planning policies and what can be achieved for the proposed development.

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 L1a 2013, with a potentially a 53% improvement
- The energy efficiency measures of the building are to go beyond Part L1 2021, with a potentially a 67% 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 1.6kWp 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
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	S12134 01	**Issued on Date**	02/05/2024
Assessment Reference	Be Lean	**Prop Type Ref**	
Property	63, Netherhall Gardens, London, NW3 5RE		

SAP Rating	82 B	**DER**	17.86	**TER**	25.06
Environmental	83 B	**% DER<TER**	28.73		
CO_2 Emissions (t/year)	2.05	**DFEE**	49.26	**TFEE**	60.11
General Requirements Compliance	Fail	**% DFEE<TFEE**	18.05		

Assessor Details	Mr. Peter Kinsella, Base Energy Services Ltd, Tel: 0151 933 0328, peter@baseenergy.co.uk	**Assessor ID**	L770-0002
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 134 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 25.06 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.86 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.3 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using user-specified y-value of 0.050

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3 Air permeability
Air permeability at 50 pascals: 4.00 (design value)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Air-to-water heat pump

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

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6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

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8 Mechanical ventilation
Continuous extract system
Specific fan power: 0.81
Maximum 0.7 Fail

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9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 10.16 m², No overhang
Windows facing South East: 2.44 m², No overhang
Windows facing South: 3.51 m², No overhang
Windows facing North West: 3.76 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: None

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10 Key features
Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 1.00 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	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

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Measured/design AP50				4.0000	
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross 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)
Roof light (Uw = 1.60)			7.0800	1.5038	10.6466			(27a)
Heat Loss Floor 1			45.5500	0.1000	4.5550			(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	0.1000	4.5690			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1000	0.0130			(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) =		79.0149			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							15.4205	(36)
Total fabric heat loss					(33) + (36) =		94.4354	(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	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	(39)
Average = Sum(39)m / 12 =												155.2311	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	(40)
HLP (average)												1.1549	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9056	(42)
Average daily hot water use (litres/day)	103.2077	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)
Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												1.2120	(55)
Total storage loss													
	37.5720	33.9360	37.5720	36.3600	37.5720	36.3600	37.5720	37.5720	36.3600	37.5720	36.3600	37.5720	(56)
If cylinder contains dedicated solar storage													
	37.5720	33.9360	37.5720	36.3600	37.5720	36.3600	37.5720	37.5720	36.3600	37.5720	36.3600	37.5720	(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)
Total heat required for water heating calculated for each month													
	229.1939	202.1955	212.7814	191.3431	187.9436	168.5576	162.4742	177.4675	176.8981	198.3825	209.0165	223.8816	(62)
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	(63)
											Solar input (sum of months) = Sum(63)m =	0.0000	(63)
Output from w/h													
	229.1939	202.1955	212.7814	191.3431	187.9436	168.5576	162.4742	177.4675	176.8981	198.3825	209.0165	223.8816	(64)
											Total per year (kWh/year) = Sum(64)m =	2340.1354	(64)
Heat gains from water heating, kWh/month													
	74.5894	65.7690	69.1323	62.0562	60.8737	54.4800	52.4052	57.3904	57.2533	64.3446	67.9326	72.8231	(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													
	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244	(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	3.0000	3.0000	3.0000	3.0000	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)													
	100.2546	97.8706	92.9198	86.1892	81.8195	75.6667	70.4370	77.1377	79.5184	86.4847	94.3509	97.8805	(72)
Total internal gains													
	499.8714	497.6042	480.2409	451.8943	422.4970	394.6112	376.7665	383.3503	398.1436	426.7259	459.6197	484.8823	(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	711.6604	888.4930	1094.5847	1345.5087	1543.6552	1560.3826	1478.7668	1307.6430	1108.0033	880.2310	718.7945	662.5633	(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	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	
alpha	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	
util living area													
	0.9989	0.9964	0.9859	0.9383	0.8045	0.6109	0.4566	0.5338	0.8191	0.9776	0.9973	0.9992	(86)
MIT	19.9607	20.1008	20.3324	20.6234	20.8401	20.9247	20.9418	20.9374	20.8602	20.5511	20.1914	19.9270	(87)
Th 2	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	(88)
util rest of house													
	0.9985	0.9951	0.9809	0.9169	0.7478	0.5220	0.3511	0.4189	0.7419	0.9663	0.9961	0.9989	(89)
MIT 2	18.5581	18.7626	19.0984	19.5068	19.7792	19.8639	19.8755	19.8736	19.8101	19.4154	18.8956	18.5088	(90)
Living area fraction											fLA = Living area / (4) =	0.2912	(91)
MIT	18.9665	19.1523	19.4577	19.8320	20.0882	20.1728	20.1860	20.1834	20.1159	19.7461	19.2729	18.9218	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9665	19.1523	19.4577	19.8320	20.0882	20.1728	20.1860	20.1834	20.1159	19.7461	19.2729	18.9218	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9938	0.9778	0.9139	0.7556	0.5411	0.3747	0.4446	0.7552	0.9633	0.9951	0.9986	(94)
Useful gains	710.2137	882.9597	1070.2722	1229.6219	1166.4134	844.3864	554.0476	581.3790	836.7764	847.8869	715.2663	661.6093	(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													
	2276.7014	2212.3972	2011.4441	1696.9833	1302.1061	865.0693	556.6565	587.2988	933.8531	1419.7569	1889.6152	2285.2811	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh

1165.4668	893.3820	700.2319	336.5002	100.9554	0.0000	0.0000	0.0000	0.0000	425.4713	845.5312	1208.0118	(98)

Space heating 5675.5506 (98)
Space heating per m2 (98) / (4) = 42.2257 (99)

8c. Space cooling requirement

Not applicable

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 %) 249.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2271.1287 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1165.4668	893.3820	700.2319	336.5002	100.9554	0.0000	0.0000	0.0000	0.0000	425.4713	845.5312	1208.0118	(98)
Space heating efficiency (main heating system 1)													
	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)													
	466.3733	357.4958	280.2048	134.6539	40.3983	0.0000	0.0000	0.0000	0.0000	170.2566	338.3478	483.3981	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	229.1939	202.1955	212.7814	191.3431	187.9436	168.5576	162.4742	177.4675	176.8981	198.3825	209.0165	223.8816	(64)
Efficiency of water heater												175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)
Fuel for water heating, kWh/month													
	130.8931	115.4743	121.5199	109.2765	107.3350	96.2636	92.7894	101.3521	101.0269	113.2967	119.3698	127.8593	(219)
Water heating fuel used												1336.4565	(219)
Annual totals kWh/year													
Space heating fuel - main system												2271.1287	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 1.1340)
mechanical ventilation fans (SFP = 1.1340) 509.7555 (230a)
central heating pump 30.0000 (230c)
Total electricity for the above, kWh/year 539.7555 (231)
Electricity for lighting (calculated in Appendix L) 478.0997 (232)
Total delivered energy for all uses 4625.4405 (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	2271.1287	0.5190	1178.7158	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1336.4565	0.5190	693.6209	(264)
Space and water heating			1872.3367	(265)
Pumps and fans	539.7555	0.5190	280.1331	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Total CO2, kg/year			2400.6036	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.8600	ZC1
Total Floor Area	TFA	134.4100	
Assumed number of occupants	N	2.9056	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.3568	ZC2
CO2 emissions from cooking, equation (L16)		1.4042	ZC3
Total CO2 emissions		32.6209	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.6209	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	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

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1086	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
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 = 1.40)			19.8700	1.3258	26.3428			(27)
TER Room Window (Uw = 1.70)			7.0800	1.5918	11.2697			(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	0.1300	5.9397			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1300	0.0169			(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) =		85.9700			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4244	(36)
Total fabric heat loss (33) + (36) =	97.3944	(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	169.0619	168.6397	168.2259	166.2823	165.9186	164.2258	164.2258	163.9123	164.8778	165.9186	166.6543	167.4234	(39)
Average = Sum(39)m / 12 =												166.2805	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2578	1.2547	1.2516	1.2371	1.2344	1.2218	1.2218	1.2195	1.2267	1.2344	1.2399	1.2456	(40)
HLP (average)												1.2371	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9056 (42)
Average daily hot water use (litres/day)	103.2077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)
Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)
Energy content (annual)										Total = Sum(45)m =		1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:
Store volume 180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8381 (55)
Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	217.6021	191.7255	201.1897	180.1253	176.3518	157.3398	150.8825	165.8758	165.6803	186.7907	197.7987	212.2898 (62)
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 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	217.6021	191.7255	201.1897	180.1253	176.3518	157.3398	150.8825	165.8758	165.6803	186.7907	197.7987	212.2898 (64)

Total per year (kWh/year) = Sum(64)m = 2203.6521 (64)

Heat gains from water heating, kWh/month

	95.3737	84.5419	89.9165	82.1700	81.6579	74.5938	73.1894	78.1747	77.3670	85.1289	88.0464	93.6073 (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

	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244 (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	3.0000	3.0000	3.0000	3.0000	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)

	128.1904	125.8063	120.8555	114.1250	109.7553	103.6025	98.3728	105.0735	107.4542	114.4205	122.2867	125.8163 (72)

Total internal gains

	527.8072	525.5400	508.1767	479.8300	450.4328	422.5470	404.7023	411.2860	426.0794	454.6617	487.5554	512.8180 (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)

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	723.0640	887.2153	1079.2624	1313.5364	1498.1515	1512.4679	1434.8104	1274.3336	1087.0559	875.0407	726.7487	676.4611 (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	55.2107	55.3489	55.4851	56.1336	56.2567	56.8366	56.8366	56.9453	56.6118	56.2567	56.0083	55.7510	
alpha	4.6807	4.6899	4.6990	4.7422	4.7504	4.7891	4.7891	4.7964	4.7741	4.7504	4.7339	4.7167	
util living area	0.9987	0.9964	0.9878	0.9497	0.8381	0.6527	0.4941	0.5712	0.8451	0.9800	0.9972	0.9991	(86)
MIT	19.5601	19.7445	20.0580	20.4741	20.8022	20.9559	20.9906	20.9820	20.8491	20.4027	19.9057	19.5325	(87)
Th 2	19.8740	19.8765	19.8790	19.8904	19.8926	19.9026	19.9026	19.9044	19.8987	19.8926	19.8882	19.8837	(88)
util rest of house	0.9983	0.9952	0.9833	0.9309	0.7837	0.5577	0.3758	0.4453	0.7699	0.9695	0.9959	0.9988	(89)
MIT 2	17.9558	18.2269	18.6838	19.2812	19.7058	19.8749	19.8993	19.8974	19.7784	19.1936	18.4711	17.9220	(90)
Living area fraction									fLA = Living area / (4) =			0.2912	(91)
MIT	18.4230	18.6688	19.0839	19.6286	20.0251	20.1897	20.2171	20.2132	20.0902	19.5457	18.8888	18.3910	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4230	18.6688	19.0839	19.6286	20.0251	20.1897	20.2171	20.2132	20.0902	19.5457	18.8888	18.3910	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9932	0.9789	0.9254	0.7909	0.5838	0.4104	0.4821	0.7849	0.9650	0.9943	0.9981	(94)
Useful gains	721.1818	881.1731	1056.4549	1215.5230	1184.9577	883.0152	588.8907	614.4120	853.2699	844.3878	722.6024	675.1679	(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	2387.6624	2321.9667	2116.9440	1783.9692	1381.2858	917.9746	594.0211	625.0344	987.6476	1484.2590	1964.6608	2375.9040	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1239.8615	968.2133	789.0039	409.2813	146.0681	0.0000	0.0000	0.0000	0.0000	476.0642	894.2820	1265.3477	(98)
Space heating												6188.1220	(98)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating per m2 (98) / (4) = 46.0391 (99)

8c. Space cooling requirement

Not applicable

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 %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6618.3123	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1239.8615	968.2133	789.0039	409.2813	146.0681	0.0000	0.0000	0.0000	0.0000	476.0642	894.2820	1265.3477	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	1326.0551	1035.5222	843.8545	437.7340	156.2225	0.0000	0.0000	0.0000	0.0000	509.1596	956.4514	1353.3130	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6021	191.7255	201.1897	180.1253	176.3518	157.3398	150.8825	165.8758	165.6803	186.7907	197.7987	212.2898	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.7238	88.5378	88.0998	86.9376	84.3163	79.8000	79.8000	79.8000	79.8000	87.2050	88.3543	88.7896	(217)
Fuel for water heating, kWh/month													
	245.2579	216.5466	228.3656	207.1893	209.1552	197.1676	189.0758	207.8644	207.6194	214.1973	223.8700	239.0932	(219)
Water heating fuel used												2585.4023	(219)
Annual totals kWh/year													
Space heating fuel - main system												6618.3123	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												478.0997	(232)
Total delivered energy for all uses												9756.8144	(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	6618.3123	0.2160	1429.5555	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.4023	0.2160	558.4469	(264)
Space and water heating			1988.0024	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Total CO2, kg/m2/year			2275.0611	(272)
Emissions per m2 for space and water heating			14.7906	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.8461	(272b)
Emissions per m2 for pumps and fans			0.2896	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7906 * 1.55) + 1.8461 + 0.2896, rounded to 2 d.p.			25.0600	(273)

Appendix C SAP Worksheet Improvement over Part L1a 2013

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	S12134 01	**Issued on Date**	02/05/2024
Assessment Reference	Be Green with PV	**Prop Type Ref**	
Property	63, Netherhall Gardens, London, NW3 5RE		

SAP Rating	89 B	**DER**	11.77	**TER**	25.00
Environmental	90 B	**% DER<TER**	52.92		
CO_2 Emissions (t/year)	1.20	**DFEE**	49.26	**TFEE**	60.11
General Requirements Compliance	Fail	**% DFEE<TFEE**	18.05		

Assessor Details	Mr. Peter Kinsella, Base Energy Services Ltd, Tel: 0151 933 0328, peter@baseenergy.co.uk	**Assessor ID**	L770-0002
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 134 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 25.00 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.77 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.3 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using user-specified y-value of 0.050

---
3 Air permeability
Air permeability at 50 pascals: 4.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
NIBE F730

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system
Specific fan power: 0.81
Maximum 0.7 Fail

---
9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 10.16 m², No overhang
Windows facing South East: 2.44 m², No overhang
Windows facing South: 3.51 m², No overhang
Windows facing North West: 3.76 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: None

---
10 Key features
Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 1.60 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	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

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross 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)
Roof light (Uw = 1.60)			7.0800	1.5038	10.6466			(27a)
Heat Loss Floor 1			45.5500	0.1000	4.5550			(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	0.1000	4.5690			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1000	0.0130			(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) =	79.0149			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	15.4205	(36)
Total fabric heat loss (33) + (36) =	94.4354	(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	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	(39)
Average = Sum(39)m / 12 =												155.2311	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	(40)
HLP (average)												1.1549	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9056 (42)
Average daily hot water use (litres/day)	103.2077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)
Energy content (annual)										Total = Sum(45)m =		1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0908	(55)
Total storage loss													
	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(56)
If cylinder contains dedicated solar storage													
	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(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)
Total heat required for water heating calculated for each month													
	202.1743	177.7907	185.7618	165.1951	160.9240	142.4096	135.4546	150.4479	150.7501	171.3629	182.8685	196.8620	(62)
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.1743	177.7907	185.7618	165.1951	160.9240	142.4096	135.4546	150.4479	150.7501	171.3629	182.8685	196.8620	(64)
								Total per year (kWh/year) = Sum(64)m =				2022.0014	(64)
Heat gains from water heating, kWh/month													
	55.9795	48.9601	50.5224	44.0466	42.2638	36.4704	33.7952	38.7805	39.2437	45.7347	49.9230	54.2132	(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													
	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244	(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)													
	75.2413	72.8572	67.9064	61.1759	56.8062	50.6534	45.4237	52.1244	54.5051	61.4714	69.3375	72.8672	(72)
Total internal gains													
	471.8581	469.5909	452.2276	423.8809	394.4837	366.5979	348.7532	355.3369	370.1302	398.7126	431.6063	456.8689	(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	683.6470	860.4796	1066.5714	1317.4954	1515.6419	1532.3693	1450.7535	1279.6296	1079.9899	852.2177	690.7811	634.5500	(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	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	
alpha	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	
util living area													
	0.9991	0.9969	0.9874	0.9427	0.8127	0.6202	0.4650	0.5443	0.8301	0.9803	0.9977	0.9994	(86)
Tweekday	18.5368	18.7416	19.0789	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	18.4874	
Tweekend	20.3187	20.4094	20.5596	20.7496	20.8932	20.9504	20.9621	20.9590	20.9059	20.7013	20.4679	20.2969	
24 / 16	9	8	5	0	0	0	0	0	0	0	0	9	
24 / 9	22	20	14	0	0	0	0	0	0	0	0	22	
16 / 9	0	0	8	9	0	0	0	0	0	0	22	0	
MIT	21.0000	21.0000	20.8295	20.6665	20.8352	20.9238	20.9416	20.9368	20.8530	20.5390	20.4679	21.0000	(87)
Th 2	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	(88)
util rest of house													
	0.9987	0.9958	0.9828	0.9224	0.7568	0.5307	0.3578	0.4277	0.7546	0.9702	0.9968	0.9991	(89)
Tweekday	18.5368	18.7416	19.0789	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	18.4874	
Tweekend	18.5368	18.7416	19.0789	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	18.4874	
MIT 2	19.9562	19.9562	19.6166	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	19.9562	(90)
Living area fraction									fLA = Living area / (4) =			0.2912	(91)
MIT	20.2602	20.2602	19.9698	19.8345	20.0828	20.1718	20.1858	20.1830	20.1100	19.7297	19.3385	20.2602	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2602	20.2602	19.9698	19.8345	20.0828	20.1718	20.1858	20.1830	20.1100	19.7297	19.3385	20.2602	(93)

8. Space heating requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9961	0.9829	0.9195	0.7643	0.5500	0.3817	0.4538	0.7672	0.9672	0.9960	0.9992	(94)
Useful gains	682.8635	857.1356	1048.3117	1211.4634	1158.3624	842.7314	553.7955	580.7522	828.6171	824.3070	688.0051	634.0505	(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	2477.5176	2384.3789	2090.9349	1697.3681	1301.2742	864.9209	556.6336	587.2362	932.9344	1417.2087	1899.7965	2493.0407	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1335.2226	1026.3075	775.7116	349.8514	106.3264	0.0000	0.0000	0.0000	0.0000	441.1188	872.4898	1383.0887	(98)
Space heating												6290.1169	(98)
Space heating per m2											(98) / (4) =	46.7980	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0340	(201)
Fraction of space heat from main system(s)	0.9660	(202)
Efficiency of main space heating system 1 (in %)	276.6842	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	2196.0967	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1335.2226	1026.3075	775.7116	349.8514	106.3264	0.0000	0.0000	0.0000	0.0000	441.1188	872.4898	1383.0887	(98)
Space heating efficiency (main heating system 1)	276.6842	276.6842	276.6842	276.6842	276.6842	0.0000	0.0000	0.0000	0.0000	276.6842	276.6842	276.6842	(210)
Space heating fuel (main heating system)	466.1723	358.3193	270.8277	122.1452	37.1222	0.0000	0.0000	0.0000	0.0000	154.0098	304.6163	482.8840	(211)
Water heating requirement	45.3976	34.8945	26.3742	11.8949	3.6151	0.0000	0.0000	0.0000	0.0000	14.9980	29.6647	47.0250	(215)
Water heating													
Water heating requirement	202.1743	177.7907	185.7618	165.1951	160.9240	142.4096	135.4546	150.4479	150.7501	171.3629	182.8685	196.8620	(64)
Efficiency of water heater												207.1950	(216)
(217)m	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	(217)
Fuel for water heating, kWh/month	97.5768	85.8084	89.6556	79.7293	77.6679	68.7321	65.3754	72.6118	72.7576	82.7061	88.2591	95.0129	(219)
Water heating fuel used												975.8929	(219)
Annual totals kWh/year													
Space heating fuel - main system												2196.0967	(211)
Space heating fuel - secondary												213.8640	(215)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 1.1340)													
mechanical ventilation fans (SFP = 1.1340)												238.2225	(230a)
Total electricity for the above, kWh/year												238.2225	(231)
Electricity for lighting (calculated in Appendix L)												478.0997	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.60 * 1029 * 0.80) =												-1053.8872	(233)
Total delivered energy for all uses												3048.2886	(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	2196.0967	0.5190	1139.7742	(261)
Space heating - secondary	213.8640	0.5190	110.9954	(263)
Water heating (other fuel)	975.8929	0.5190	506.4884	(264)
Space and water heating			1757.2580	(265)
Pumps and fans	238.2225	0.5190	123.6375	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Energy saving/generation technologies				
PV Unit	-1053.8872	0.5190	-546.9675	(269)
Total CO2, kg/year			1582.0618	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.7700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.7700	ZC1
Total Floor Area	TFA	134.4100	
Assumed number of occupants	N	2.9056	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.3568	ZC2
CO2 emissions from cooking, equation (L16)		1.4042	ZC3
Total CO2 emissions		26.5309	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.5309	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	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

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1086	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
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 = 1.40)			19.8700	1.3258	26.3428			(27)
TER Room Window (Uw = 1.70)			7.0800	1.5918	11.2697			(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	0.1300	5.9397			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1300	0.0169			(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) =		85.9700			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4244	(36)
Total fabric heat loss (33) + (36) =	97.3944	(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	169.0619	168.6397	168.2259	166.2823	165.9186	164.2258	164.2258	163.9123	164.8778	165.9186	166.6543	167.4234	(39)
Average = Sum(39)m / 12 =												166.2805	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2578	1.2547	1.2516	1.2371	1.2344	1.2218	1.2218	1.2195	1.2267	1.2344	1.2399	1.2456	(40)
HLP (average)												1.2371	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9056 (42)
Average daily hot water use (litres/day)	103.2077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)
Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)
Energy content (annual)										Total = Sum(45)m =		1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)
Total heat required for water heating calculated for each month													
	214.9544	189.3340	198.5419	177.5629	173.7041	154.7774	148.2347	163.2280	163.1180	184.1430	195.2363	209.6421	(62)
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	214.9544	189.3340	198.5419	177.5629	173.7041	154.7774	148.2347	163.2280	163.1180	184.1430	195.2363	209.6421	(64)
								Total per year (kWh/year) = Sum(64)m =				2172.4768	(64)
Heat gains from water heating, kWh/month													
	93.2554	82.6286	87.7983	80.1201	79.5397	72.5439	71.0712	76.0564	75.3172	83.0107	85.9965	91.4891	(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													
	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244	(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	3.0000	3.0000	3.0000	3.0000	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)													
	125.3433	122.9593	118.0085	111.2779	106.9082	100.7554	95.5257	102.2264	104.6072	111.5735	119.4396	122.9692	(72)
Total internal gains													
	524.9601	522.6929	505.3296	476.9830	447.5857	419.6999	401.8552	408.4390	423.2323	451.8147	484.7084	509.9710	(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	0.6300	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)

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	720.2170	884.3682	1076.4153	1310.6894	1495.3045	1509.6208	1431.9633	1271.4865	1084.2088	872.1937	723.9016	673.6140	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2107	55.3489	55.4851	56.1336	56.2567	56.8366	56.8366	56.9453	56.6118	56.2567	56.0083	55.7510	
alpha	4.6807	4.6899	4.6990	4.7422	4.7504	4.7891	4.7891	4.7964	4.7741	4.7504	4.7339	4.7167	
util living area													
	0.9988	0.9965	0.9879	0.9501	0.8388	0.6537	0.4950	0.5723	0.8461	0.9803	0.9972	0.9991	(86)
MIT	19.5582	19.7426	20.0561	20.4726	20.8013	20.9557	20.9905	20.9819	20.8482	20.4009	19.9037	19.5305	(87)
Th 2	19.8740	19.8765	19.8790	19.8904	19.8926	19.9026	19.9026	19.9044	19.8987	19.8926	19.8882	19.8837	(88)
util rest of house													
	0.9983	0.9953	0.9835	0.9314	0.7845	0.5586	0.3765	0.4462	0.7711	0.9699	0.9960	0.9988	(89)
MIT 2	17.9530	18.2241	18.6811	19.2791	19.7049	19.8747	19.8993	19.8973	19.7775	19.1912	18.4683	17.9192	(90)
Living area fraction										fLA = Living area / (4) =		0.2912	(91)
MIT	18.4204	18.6663	19.0815	19.6267	20.0242	20.1895	20.2171	20.2131	20.0893	19.5434	18.8863	18.3884	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4204	18.6663	19.0815	19.6267	20.0242	20.1895	20.2171	20.2131	20.0893	19.5434	18.8863	18.3884	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9933	0.9791	0.9258	0.7918	0.5847	0.4112	0.4831	0.7861	0.9653	0.9944	0.9981	(94)
Useful gains	718.3720	878.4197	1053.8781	1213.5004	1183.9144	882.7490	588.8423	614.3051	852.2638	841.9699	719.8350	672.3485	(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													
	2387.2277	2321.5393	2116.5406	1783.6552	1381.1338	917.9391	594.0144	625.0200	987.5037	1483.8838	1964.2357	2375.4715	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1241.6286	969.7763	790.6209	410.5114	146.7312	0.0000	0.0000	0.0000	0.0000	477.5840	895.9686	1267.1235	(98)
Space heating												6199.9446	(98)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating per m2 (98) / (4) = 46.1271 (99)

8c. Space cooling requirement

Not applicable

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 %)	93.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	6630.9568 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1241.6286	969.7763	790.6209	410.5114	146.7312	0.0000	0.0000	0.0000	0.0000	477.5840	895.9686	1267.1235	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1327.9451	1037.1939	845.5839	439.0497	156.9318	0.0000	0.0000	0.0000	0.0000	510.7850	958.2552	1355.2123	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	214.9544	189.3340	198.5419	177.5629	173.7041	154.7774	148.2347	163.2280	163.1180	184.1430	195.2363	209.6421	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.7440	88.5603	88.1282	86.9786	84.3677	79.8000	79.8000	79.8000	79.8000	87.2447	88.3797	88.8095	(217)
Fuel for water heating, kWh/month	242.2186	213.7909	225.2877	204.1455	205.8894	193.9566	185.7578	204.5464	204.4085	211.0650	220.9062	236.0581	(219)
Water heating fuel used												2548.0306	(219)
Annual totals kWh/year													
Space heating fuel - main system												6630.9568	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												478.0997	(232)
Total delivered energy for all uses												9732.0872	(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	6630.9568	0.2160	1432.2867	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2548.0306	0.2160	550.3746	(264)
Space and water heating			1982.6613	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Total CO2, kg/m2/year			2269.7201	(272)
Emissions per m2 for space and water heating			14.7508	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.8461	(272b)
Emissions per m2 for pumps and fans			0.2896	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7508 * 1.55) + 1.8461 + 0.2896, rounded to 2 d.p.			25.0000	(273)

Appendix D SAP Worksheet SAP 10 Compliance

Full SAP Calculation Printout

Property Reference	S12134 01	**Issued on Date**	02/05/2024
Assessment Reference	001	**Prop Type Ref**	
Property	63, Netherhall Gardens, London, NW3 5RE		

SAP Rating	82 B	**DER**	3.69	**TER**	11.37
Environmental	96 A	**% DER < TER**			67.55
CO_2 Emissions (t/year)	0.43	**DFEE**	45.08	**TFEE**	45.12
Compliance Check	See BREL	**% DFEE < TFEE**			0.09
% DPER < TPER	32.33	**DPER**	40.31	**TPER**	59.58

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	1.5038	1.5038			(27a)
RL11			3.7200	1.5038	5.5940			(27a)
Rl12			1.1800	1.5038	1.7744			(27a)
W13			1.1800	1.5038	1.7744			(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) =		79.9286			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	15.4205	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	95.3491	(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	156.1448	156.1448	156.1448	156.1448	156.1448	156.1448	156.1448	156.1448	156.1448	156.1448	156.1448	156.1448	(39)
Average = Sum(39)m / 12 =												156.1448	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1617	1.1617	1.1617	1.1617	1.1617	1.1617	1.1617	1.1617	1.1617	1.1617	1.1617	1.1617	(40)
HLP (average)												1.1617	
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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
128.8621	126.9256	124.1036	118.7044	114.7199	110.2764	107.7507	110.5513	113.6212	118.3922	123.9074	128.3684	(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)	159.1576	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	173.2482	169.6976	165.2617	158.2484	152.6498	146.5923	144.0666	148.4812	153.1652	159.5502	166.6795	172.7545	(44)
Energy conte	274.3828	241.6472	254.0010	216.6341	205.4960	180.2523	174.2361	183.8508	188.8680	216.5081	237.4655	270.4918	(45)
Energy content (annual)											Total = Sum(45)m =	2643.8338	

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

41.1574	36.2471	38.1002	32.4951	30.8244	27.0378	26.1354	27.5776	28.3302	32.4762	35.6198	40.5738	(46)

Water storage loss:		
Store volume	180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	2.0200	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	1.0908	(55)

Total storage loss

33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(56)

If cylinder contains dedicated solar storage

33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(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

308.1976	272.1896	287.8158	249.3581	239.3108	212.9763	208.0509	217.6656	221.5920	250.3229	270.1895	304.3066	(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

308.1976	272.1896	287.8158	249.3581	239.3108	212.9763	208.0509	217.6656	221.5920	250.3229	270.1895	304.3066	(64)
										Total per year (kWh/year) = Sum(64)m =	3041.9758	(64)
12Total per year (kWh/year)											3042	(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

91.2323	80.3477	84.4553	72.0308	68.3274	59.9339	57.9335	61.1304	62.7986	71.9890	78.9573	89.9385	(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	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)	122.6241	119.5650	113.5152	100.0428	91.8379	83.2415	77.8676	82.1645	87.2203	96.7593	109.6629	120.8851	(72)
Total internal gains	645.3331	661.8283	631.4459	606.2134	571.6134	548.1131	524.2663	525.4194	543.5029	564.8020	604.1007	630.2267	(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	0.4000	0.0000	0.7700	33.2749	(74)
Southeast	2.4400	36.7938	0.4000	0.0000	0.7700	27.6513	(77)
South	3.5100	46.7521	0.4000	0.0000	0.7700	50.5427	(78)
Northwest	3.7600	11.2829	0.4000	0.0000	0.7700	13.0665	(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	196.2220	363.3808	573.6112	837.2039	1052.0062	1094.3490	1034.3052	866.6231	663.8303	422.3129	240.3598	164.4626	(83)
Total gains	841.5552	1025.2091	1205.0570	1443.4173	1623.6195	1642.4622	1558.5715	1392.0425	1207.3333	987.1149	844.4605	794.6893	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7780	59.7780	59.7780	59.7780	59.7780	59.7780	59.7780	59.7780	59.7780	59.7780	59.7780	59.7780	
alpha	4.9852	4.9852	4.9852	4.9852	4.9852	4.9852	4.9852	4.9852	4.9852	4.9852	4.9852	4.9852	
util living area	0.9976	0.9932	0.9794	0.9229	0.7833	0.5873	0.4366	0.5066	0.7822	0.9655	0.9945	0.9982	(86)
Living	19.8825	20.0451	20.2909	20.6053	20.8302	20.9172	20.9340	20.9301	20.8585	20.5374	20.1436	19.8456	
Non living	18.6418	18.8492	19.1598	19.5419	19.7852	19.8600	19.8699	19.8684	19.8188	19.4703	18.9759	18.5945	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	0	0	0	0	0	0	0	30	31	
16 / 9	0	0	0	30	0	0	0	0	0	10	0	0	
MIT	21.0000	21.0000	21.0000	20.7765	20.8302	20.9172	20.9340	20.9301	20.8585	20.6021	21.0000	21.0000	(87)
Th 2	19.9508	19.9508	19.9508	19.9508	19.9508	19.9508	19.9508	19.9508	19.9508	19.9508	19.9508	19.9508	(88)
util rest of house	0.9968	0.9909	0.9723	0.8977	0.7245	0.4999	0.3347	0.3958	0.7002	0.9491	0.9922	0.9976	(89)
MIT 2	19.9508	19.9508	19.9508	19.7703	19.7852	19.8600	19.8699	19.8684	19.8188	19.5569	19.9508	19.9508	(90)
Living area fraction										fLA = Living area / (4) =		0.2912	(91)
MIT	20.2563	20.2563	20.2563	20.0633	20.0895	20.1679	20.1797	20.1776	20.1215	19.8613	20.2563	20.2563	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2563	20.2563	20.2563	20.0633	20.0895	20.1679	20.1797	20.1776	20.1215	19.8613	20.2563	20.2563	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9917	0.9746	0.9008	0.7329	0.5186	0.3572	0.4203	0.7149	0.9473	0.9930	0.9978	(94)
Useful gains	839.0615	1016.6646	1174.4419	1300.2265	1189.9757	851.8394	556.7937	585.1176	863.1743	935.1312	838.5165	792.9209	(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	2491.4933	2397.8064	2147.9746	1743.0898	1309.9789	869.3938	558.9577	589.8478	940.2310	1446.0971	2054.2877	2507.1078	(97)
Space heating kWh	1229.4092	928.1273	724.3084	318.8616	89.2824	0.0000	0.0000	0.0000	0.0000	380.1586	875.3552	1275.3550	(98a)
Space heating requirement - total per year (kWh/year)												5820.8578	
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	1229.4092	928.1273	724.3084	318.8616	89.2824	0.0000	0.0000	0.0000	0.0000	380.1586	875.3552	1275.3550	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5820.8578	
Space heating per m2											(98c) / (4) =	43.3067	(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 %) 275.5791 (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	1229.4092	928.1273	724.3084	318.8616	89.2824	0.0000	0.0000	0.0000	0.0000	380.1586	875.3552	1275.3550	(98)
Space heating efficiency (main heating system 1)	275.5791	275.5791	275.5791	275.5791	275.5791	0.0000	0.0000	0.0000	0.0000	275.5791	275.5791	275.5791	(210)
Space heating fuel (main heating system)	446.1185	336.7917	262.8314	115.7060	32.3981	0.0000	0.0000	0.0000	0.0000	137.9490	317.6422	462.7910	(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	308.1976	272.1896	287.8158	249.3581	239.3108	212.9763	208.0509	217.6656	221.5920	250.3229	270.1895	304.3066	(64)
Efficiency of water heater												186.9480	(216)
(217)m	186.9480	186.9480	186.9480	186.9480	186.9480	186.9480	186.9480	186.9480	186.9480	186.9480	186.9480	186.9480	(217)
Fuel for water heating, kWh/month	164.8575	145.5964	153.9551	133.3837	128.0093	113.9228	111.2881	116.4311	118.5314	133.8998	144.5266	162.7761	(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	20.1389	18.1900	20.1389	19.4893	20.1389	19.4893	20.1389	20.1389	19.4893	20.1389	19.4893	20.1389	(231)
Lighting	33.6833	27.0220	24.3303	17.8254	13.7689	11.2493	12.5604	16.3265	21.2065	27.8241	31.4273	34.6195	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-23.9393	-38.1509	-61.5904	-75.3607	-85.0446	-80.0817	-78.8688	-71.4333	-58.8869	-45.5015	-27.5875	-20.1734	(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	-4.2729	-10.2132	-23.6390	-42.1066	-62.2218	-65.4170	-64.4184	-52.4563	-35.9746	-17.1573	-6.1431	-3.2479	(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 2112.2280 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 186.9480
Water heating fuel used 1627.1779 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 1.1340)
mechanical ventilation fans (SFP = 1.1340) 237.1199 (230a)

Total electricity for the above, kWh/year	237.1199	(231)
Electricity for lighting (calculated in Appendix L)	271.8435	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1053.8872	(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	3194.4821	(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	2112.2280	0.1561	329.7997	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1627.1779	0.1412	229.7846	(264)
Space and water heating			559.5843	(265)
Pumps, fans and electric keep-hot	237.1199	0.1387	32.8915	(267)
Energy for lighting	271.8435	0.1443	39.2354	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-666.6190	0.1329	-88.6232	
PV Unit electricity exported	-387.2682	0.1217	-47.1258	
Total			-135.7490	(269)
Total CO2, kg/year			495.9622	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6900	(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	2112.2280	1.5780	3333.1955	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1627.1779	1.5222	2476.8640	(278)
Space and water heating			5810.0595	(279)
Pumps, fans and electric keep-hot	237.1199	1.5128	358.7150	(281)
Energy for lighting	271.8435	1.5338	416.9626	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-666.6190	1.4913	-994.1009	
PV Unit electricity exported	-387.2682	0.4465	-172.8985	
Total			-1166.9994	(283)
Total Primary energy kWh/year			5418.7377	(286)
Dwelling Primary energy Rate (DPER)			40.3100	(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		250.0000 (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

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.4244 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	92.8871 (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	164.5546	164.1324	163.7186	161.7750	161.4113	159.7185	159.7185	159.4050	160.3706	161.4113	162.1470	162.9161	(39)
Average = Sum(39)m / 12 =												161.7732	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2243	1.2211	1.2181	1.2036	1.2009	1.1883	1.1883	1.1860	1.1931	1.2009	1.2064	1.2121	(40)
HLP (average)												1.2036	
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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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:													
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)

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)

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	56.7230	56.8689	57.0126	57.6976	57.8276	58.4405	58.4405	58.5554	58.2029	57.8276	57.5652	57.2935	
alpha	4.7815	4.7913	4.8008	4.8465	4.8552	4.8960	4.8960	4.9037	4.8802	4.8552	4.8377	4.8196	
util living area													
	0.9972	0.9927	0.9789	0.9231	0.7868	0.5890	0.4378	0.5058	0.7807	0.9632	0.9937	0.9979	(86)
MIT	19.5193	19.7418	20.0802	20.5275	20.8419	20.9700	20.9942	20.9888	20.8885	20.4489	19.9065	19.4888	(87)
Th 2	19.9006	19.9031	19.9056	19.9171	19.9193	19.9294	19.9294	19.9312	19.9255	19.9193	19.9149	19.9103	(88)
util rest of house													
	0.9963	0.9902	0.9715	0.8975	0.7272	0.5000	0.3337	0.3933	0.6971	0.9458	0.9912	0.9971	(89)
MIT 2	18.1825	18.4679	18.8973	19.4503	19.7933	19.9135	19.9277	19.9276	19.8525	19.3710	18.6877	18.1502	(90)
Living area fraction									fLA = Living area / (4) =			0.2912	(91)
MIT	18.5718	18.8389	19.2418	19.7640	20.0987	20.2211	20.2383	20.2366	20.1541	19.6849	19.0426	18.5400	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5718	18.8389	19.2418	19.7640	20.0987	20.2211	20.2383	20.2366	20.1541	19.6849	19.0426	18.5400	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9868	0.9657	0.8933	0.7379	0.5251	0.3641	0.4262	0.7167	0.9409	0.9882	0.9958	(94)
Useful gains	864.0885	1038.3084	1190.0859	1315.3826	1220.2383	877.4380	578.4104	605.9700	886.5475	958.5238	863.8347	818.9864	(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													
	2348.4872	2287.8175	2086.0662	1757.5216	1355.6404	897.7985	581.0971	611.5732	970.9065	1466.4020	1936.4596	2336.2185	(97)
Space heating kWh													
	1104.3926	839.6701	666.6093	318.3401	100.7392	0.0000	0.0000	0.0000	0.0000	377.8614	772.2899	1128.8207	(98a)
Space heating requirement - total per year (kWh/year)												5308.7233	
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													
	1104.3926	839.6701	666.6093	318.3401	100.7392	0.0000	0.0000	0.0000	0.0000	377.8614	772.2899	1128.8207	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5308.7233	
Space heating per m2											(98c) / (4) =	39.4965	(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													
	1104.3926	839.6701	666.6093	318.3401	100.7392	0.0000	0.0000	0.0000	0.0000	377.8614	772.2899	1128.8207	(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)													
	1196.5250	909.7185	722.2203	344.8972	109.1432	0.0000	0.0000	0.0000	0.0000	409.3839	836.7171	1222.9910	(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	87.1520	86.9401	86.4730	85.2707	82.8190	79.8000	79.8000	79.8000	79.8000	85.6002	86.8006	87.1947	(217)

Fuel for water heating, kWh/month

	255.2714	226.0734	241.5753	216.4317	216.5601	203.2101	201.4172	209.2690	211.3285	218.8419	228.3487	252.5609 (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	5751.5962 (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	2680.8883 (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	6523.9037 (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	5751.5962	0.2100	1207.8352	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2680.8883	0.2100	562.9865	(264)
Space and water heating			1770.8217	(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			1528.3698	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.3700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5751.5962	1.1300	6499.3037	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2680.8883	1.1300	3029.4038	(278)
Space and water heating			9528.7075	(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			8008.8067	(286)
Target Primary Energy Rate (TPER)			59.5800	(287)