Mendick Waring Limited

13 Netherhall Gardens, London, NW3

Outline Sustainability Report for Phases 1, 2, 3

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1.0 Executive Summary

This report describes the energy & sustainability strategy for the development in 13 Netherhall Gardens in London and will be submitted for review to Camden Borough Council.

The purpose of this report is to illustrate that the proposed development will achieve energy & sustainability improvements much beyond the Part L baseline and the minimum requirements of Camden Council's policy.

The scheme consists of 3 different Phases. Phase 1 consisting of an existing building with 7 units (plots 1-7), Phase 2 consisting of an extension to the existing building adding 4 new flats (2 on the lower ground floor and 2 on the basement floor, plots 8-11), and Phase 3 consisting of a new building with 6 new-build units (plots 12-17).

This document seeks to address the measures of Sustainability and demonstrate the design intention in relation to policies at National, Regional and Local level as appropriate.

SAP calculations have been carried out for the scheme and viability of the available options have been explored. The proposed strategy complies with the minimum requirements of Building Regulations Camden's policy and London Plan.

Requirements, Energy Efficient Features and Approach

In accordance with Building Regulations Part L1A (2013 edition with 2016amendments) the new-build residential units (Phase 3) are required to achieve a Dwelling CO2 Emission Rate (DER) below the notional Target CO2 Emission Rate (TER) and a Dwelling Fabric Energy Efficiency (DFEE) rate below the notional Target Fabric Energy Efficiency (TFEE) rate.

The existing units (Phase 1) and the extension units (Phase 2) need to comply with the requirements of Building Regulations Part L1B (2013 edition with 2016 amendments).

New developments should be assessed for their potential to contribute to the local community, and to ensure that they provide a sufficient and balanced contribution across each of the social, economic and environmental sectors to underpin the necessary integration required to ensure the sustained success of the development, and quality of life for the people it is designed to support. The scheme implements the Mayors Energy Hierarchy by using passive design and energy efficient features such as insulation, low air permeability and hi h-performance glazing.

The proposed strategy follows a best practice approach, based on the Mayor of London's Energy Hierarchy:

- Use less energy 'Be Lean'
- Supply energy efficiently 'Be Clean'
- Use Renewable Energy 'Be Green'

Phase 3, which contains the new-build residential units, is considered as a medium development under Camden local policy (and not as a major one) as it contains less than 10 units (6 units total). Minor and medium new-build residential developments are required to achieve an on-site reduction in regulated CO2 emissions of at least 19% over Building Regulations Part L 2013.

A fabric first approach has been followed, incorporating passive design measures such as low u-values, low air leakage and low thermal bridging.

Active design measures have then incorporated via energy efficient building services, such as 100% low energy lighting and mechanical ventilation with heat recovery (MVHR).

All the residential units (of all the Phases, both existing and new-build) will benefit by using a LTHW communal Air Source Heat Pumps (ASHPs) system along with a thermal buffer vessel, which will provide space heating and hot water to the dwellings (with the use of plate heat exchangers).

Use of renewable technology with the introduction of PV Panels on the roof has been considered in order to further reduce the carbon emissions of the new-build units of the development.

The SAP 2012 methodology has been used to calculate the energy consumption and resultant CO2 emissions for the proposed dwellings.

Summary of the Results

By incorporating a combination of all the feasible passive measures along with the use of the communal Air Source Heat Pumps system, both the existing building (Phases 1 and 2) and the new building (Phase 3) and PV Panels for the new units, the 13 Netherhall Gardens Site have achieved a remarkable CO2 reduction which is much beyond the Part L 2013 Baseline and the minimum requirements of Camden policy.

The above is presented in the tables & graphs below, which include the results of the SAP testing for all the Phases of 13 Netherhall Gardens site:

New Building (Phase 3) CO2 Emissions - SAP 10			
Energy Hierarchy	**Regulated CO2 Emissions / Annum (tonnes)**	**% Improvements by Energy Hierarchy**	**% Cumulative Improvements**
Baseline	9.60	-	-
Be Lean	8.07	15.97%	15.97%
Be Green	3.20	60.27%	66.62%
		Overall CO2 Emissions Reduction:	**66.62%**

Existing Building (Phase 1 & 2) CO2 Emissions - SAP 10			
Energy Hierarchy	**Regulated CO2 Emissions / Annum (tonnes)**	**% Improvements by Energy Hierarchy**	**% Cumulative Improvements**
Baseline	16.19	-	-
Be Lean	24.87	-53.68%	-53.68%
Be Green	11.42	54.10%	29.46%
		Overall CO2 Emissions Reduction:	**29.46%**

The above results illustrate the following:

- **The existing building (Phases 1 & 2) achieves a CO2 reduction of 29.46% over Part L 2013 of Building Regulations, much better than the target which is to just comply with Part L1B.**

- **The new building (Phase 3) achieves a CO2 reduction of 66.62% over Part L 2013 of Building Regulations, much better than the 19% CO2 reduction target. In addition, the achieved CO2 reduction through energy efficiency measures only is 15.97%, which is better than the 10% target for major new-build developments (even though Phase 3 is considered a minor new-build development).**

2.0 Site Location and Development Proposal

The existing development is located at 13 Netherhall Gardens, in London. It is a fully residential building, consisting of ground floor, first floor, second floor and third floor. That's Phase 1 of the project, which includes 7 existing units (plots 1 to 7).

Phase 2 design includes a new-build extension to the existing development, which consists of 2 extra floors, a lower ground floor containing 2 new flats and a basement floor containing another 2 new flats (plots 8-11).

The proposed Phase 3 development includes 6 new-build units (plots 12 to 17) ranging from lower ground floor to second floor and it is located near the existing Phase 1&2 development.

The site is located in the London borough of Camden, in North London. The surrounding area is a mix of open spaces and low-rise residential developments. There are many nearby transport links close to the development, including a short walk to the closest bus stop and Finchley Road tube station.

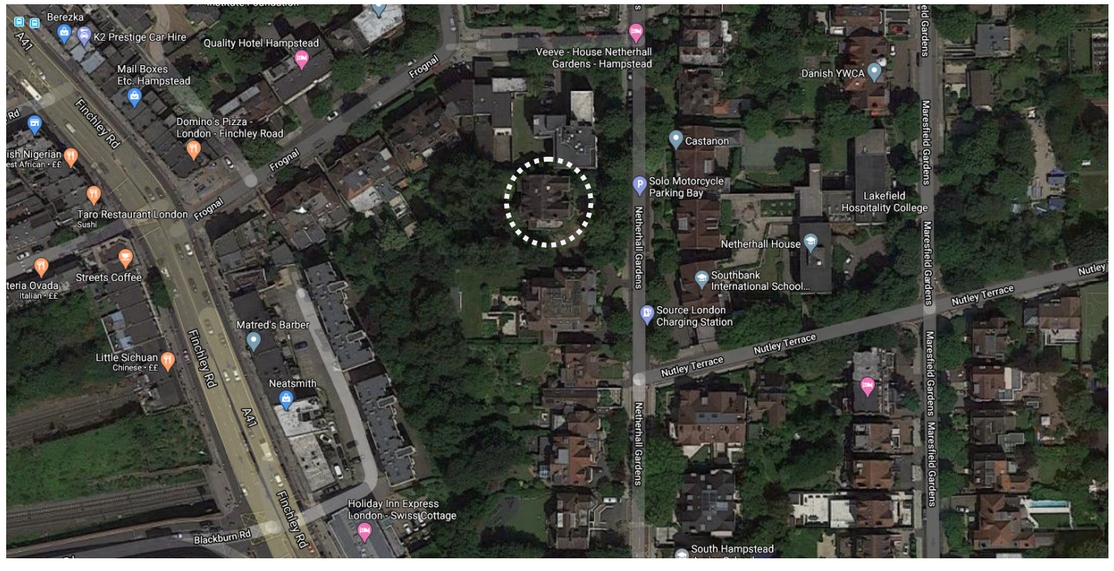


Figure 1: Site location, showing the 13 Netherhall Gardens development

3.0 Policy Context

In this section of the report, National, Regional and Local planning policies and requirements are presented. The energy and sustainability strategies to meet the policies have also briefly been introduced. The details of how the scheme

incorporates these policies have been presented in the body of this report.

National Planning Policy Framework (July 2021)

Policy 14. Meeting the challenge of climate change, flooding and coastal change:

155. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

156. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

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

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

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

London Plan (March 2021)

In Chapter 9 Sustainable Infrastructure, the following policies are included for minor developments.

Policy SI 2: Minimising greenhouse gas emission

Development proposals should follow the below energy hierarchy:

1. Be lean: use less energy.

2. Be clean: supply energy efficiently and cleanly, exploit local energy resource.

3. Be green: maximise use of renewable energy.

Energy strategies should contain the following information:

a. A calculation of the energy demand and carbon emissions covered by Building Regulations and, separately, the energy demand and carbon emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (i.e. the unregulated emissions), at each stage of the energy hierarchy.

b. Proposals to reduce carbon emissions beyond Building Regulations through the energy efficient design of the site, buildings and services, whether it is categorised as a new build, a major refurbishment or a consequential improvement.

d. Proposals to further reduce carbon emissions by maximising opportunities to produce and use renewable energy on-site, utilising storage technologies where appropriate.

i. Proposals explaining how the site has been future-proofed to achieve zero-carbon on-site emissions by 2050.

j. Confirmation of offsetting arrangements, if required.

Policy SI 5: Water infrastructure

Development proposals should, through the use of Planning Conditions, minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving **mains water consumption of 105 litres or less per head per day** (excluding allowance of up to five litres for external water consumption) and incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future-proofing.

Camden Planning Policy: Local Plan (adopted in July 2017) and Energy Efficiency CPG (adopted in January 2021)

Phase 3 (new-build units) is considered as a medium development (5-9 units) as contains 6 units. Phase 2 is considered as a minor development as it contains 4 units (less than 5).

With specific regards to the energy requirements, the following local policies apply for minor and medium developments:

- Energy statements are required for all developments involving 5 or more dwellings and/or more than 500sqm of any (gross internal) floorspace.
- Energy statements should demonstrate how a development has been designed following the steps in the energy hierarchy.
- The energy reductions should accord with those set out in the Chapter below 'Energy reduction.
- All development in Camden is expected to reduce carbon dioxide emissions through the application of the energy hierarchy.
- All new build major development to demonstrate compliance with London Plan targets for carbon dioxide emissions.
- All new build residential development of 1 - 9 dwellings (minor and medium developments) must meet 19% carbon dioxide reduction.
- Developments of five or more dwellings and/or more than 500sqm of any gross internal floorspace (medium developments) to achieve 20% reduction in carbon dioxide emissions from on-site renewable energy generation.
- All developments should demonstrate how sustainable design principles have been considered and incorporated.
- Sensitive improvements can be made to historic buildings to reduce carbon dioxide emissions.
- Warm homes and buildings are key to good health and wellbeing. As a guide, at least 10% of the project cost should be spent on environmental improvements.
- All developments involving 5 or more residential units or 500 sqm or more of any additional floorspace should address sustainable design and construction measures (proposed in design and implementation) in a Sustainability Statement (Local Plan policy CC2).

Approved Documents Part L1A 2013 and Part L1B 2013 of Building Regulations

Approved document Part L1A sets the standard for energy performance for the new residential buildings and Part L1B for the existing residential buildings (including extensions).

The proposed new-build residential units of Phase 3 must comply with the criteria set out in the Approved Document Part L1A, as follows:

- For domestic units, the calculated Dwelling CO_2 Emission Rate (DER) must not be greater than the Target CO_2 Emission Rate (TER).
- For domestic units, the calculated Dwelling Fabric Energy Efficiency (DFEE) rate must not be greater than the Target Fabric Energy Efficiency (TFEE) rate.
- The performance of the individual building fabric elements and fixed building services should achieve reasonable overall standards of energy efficiency.
- The dwellings should have appropriate passive control measures to limit the effect of heat gains on indoor temperatures in summer, irrespective of whether the dwelling has mechanical cooling.
- For domestic units, the performance of the buildings as-built should be consistent with the DER rates.

The proposed existing refurbished residential units of Phase 1 and the extension units of Phase 2 must comply with the requirements set out in the Approved Document Part L1B, which provides:

- Guidance for both new and retained thermal elements in the case of existing buildings. There are standard fabric parameters which should be considered.
- Guidance for the proposed building services in the case of existing buildings. There are standard requirements in terms of performance and controls, which should be considered.

Figure 2: Approved Document Part L of Building Regulations

4.0 Energy Efficient Design

Carbon reduction and energy performance have been maximised through measures developed in line with the energy hierarchy. This includes:

Passive Design: Facades developed to find balance between daylight and reducing heat losses. Elevations therefore have a reasonable window to wall area ratio. Low U-values will reduce the heat loss through the building envelope.

Energy Efficient Fabric: Opaque elements will target excellent U-values, whilst envelope air permeability will be reduced to a target rate of 3 m^3/hm^2 at 50 Pa through an airtight layer on the warm side of the insulation, and efficient windows are currently proposed for all the dwellings' facades.

Energy Efficient Lighting: All lighting will be energy efficient: the dwellings will be equipped with 100% energy efficient lighting.

Efficient Ventilation Strategy: The dwellings will benefit from a mechanical ventilation with heat recovery (MVHR), which is the most efficient ventilation system.

Low and Zero Carbon Technologies: The development will achieve carbon offsetting through the use of a LTHW communal Air Source Heat Pumps (ASHPs) system along with a thermal buffer vessel, which will provide space heating and hot water to all the dwellings (with the use of plate heat exchangers).

Renewable Technologies: Photovoltaic panels will offset electricity demands and further reducing the carbon emissions of the new-build units of the development.

Methodology:

The energy strategy is based on the GLA energy hierarchy:

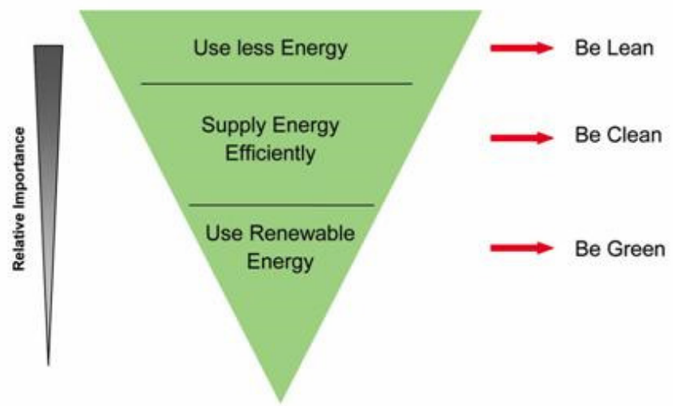


Figure 3: GLA Energy Hierarchy

Government Approved Software **Elmhurst Design SAP 2012** has been used to calculate energy consumption and resultant CO_2 emissions of the dwellings.

From this, the Target Emissions Rate (TER) and the potential improvement through energy efficiency, the Dwellings Emissions Rate (DER), are established.

SAP calculations have been completed based on representative units.

5.0 Outline Design Specifications

MWL has carried out the sample SAP calculations for the proposed dwellings of all the phases with the below listed fabric and system specifications.

Passive Design

Phase 3: New Build Residential Units

Building Element	Limiting Fabric Parameters Part L1A 2013	Proposed Fabric Parameters
External Walls	0.30 W/m²K	0.17 W/m²K
Sheltered Walls	0.30 W/m²K	0.17 W/m²K
Party Walls	0.20 W/m²K	0 W/m²K (Fully Filled Cavity)
Roofs	0.20 W/m²K	0.11 W/m²K
Floors	0.25 W/m²K	0.11 W/m²K
External Windows	2.00 W/m²K	1.20 W/m²K / 50% (g-value)
External Glazed Doors	2.00 W/m²K	1.20 W/m²K / 50% (g-value)
Entrance Internal Doors	2.00 W/m²K	1.40 W/m²K
Air permeability	10.00 m³/m².h @ 50pa	3.00 m³/m².h @ 50pa
Ψ values (Thermal Bridging)	Accredited Construction Details Used	

Phases 1&2: New-Build Building Elements

Thermal Element	Standards for New Thermal Elements by Part L1B 2013	Proposed Fabric Parameters for Phase 2
Heat Loss Walls	0.28 W/m²K	0.18 W/m²K
Heat Loss Roofs	0.18 W/m²K	0.15 W/m²K
Heat Loss Floors	0.22 W/m²K	0.18 W/m²K
External Windows	1.60 W/m²K	1.40 W/m²K / 63%
External Glazed Doors	1.80 W/m²K	1.40 W/m²K / 63%
Entrance Internal Doors	1.80 W/m²K	1.40 W/m²K
Air permeability	Reasonable provision to reduce unwanted air leakage.	5.00 m³/m².h @ 50pa, for the extension units only
Ψ values (Thermal Bridging)	The building fabric should be constructed so that there are no reasonably avoidable thermal bridges.	Accredited Construction Details (ACD) used to avoid thermal bridges, for the extension units only

Phases 1& 2: Existing Building Elements

All the retained thermal elements of Phase 1 units will follow where feasible the improved U-Values of the table below (table 3 of Part L1B Building Regulations) if their existing U-Value is above the threshold U-Values (as presented below).

Table 3 Upgrading retained thermal elements

Element[1]	(a) Threshold U-value W/(m²·K)[8]	(b) Improved U-value W/(m²·K)[8]
Wall – cavity insulation[2]	0.70	0.55
Wall – external or internal insulation[3]	0.70	0.30
Floor[4,5]	0.70	0.25
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation between rafters[6]	0.35	0.18
Flat roof or roof with integral insulation[7]	0.35	0.18

Source: Part L1B 2013

Active Design

All Phases (both existing, extension and new-build residential units)

Services	Proposals
Space Heating	LTHW Communal System – Air Source Heat Pumps ASHP Model – Daikin or Mitsubishi
Hot Water	From ASHPs, Plate Heat Exchangers (HIUs)
Renewables	22 PV Panels of 250Wp each – 5.5 kWp in total
Ventilation	MVHR (Mechanical Ventilation with Heat Recovery) MVHR Model: Vent Axia Kinetic Plus E or equivalent
Lighting	100% have luminous efficacy ≥ 45 lm/W

The above specifications (both for fabric and systems) are sufficient for Phase 3 units to achieve a reduction in carbon dioxide emissions (CO2) much higher than the required target of 19% over Part L 2013 of Building Regulations Baseline, as required by Camden policy for new-build developments (chapter 3).

In addition, the above specifications (both for fabric and systems) are sufficient for Phases 1 and 2 units to comply with Part L1B 2013 requirements and achieve a significant improvement.

6.0 District Energy Network Connection

As detailed under London Plan policies, consideration should be made to provision of a Decentralised Energy Network, including specifically:

• Require developers to prioritise connection to existing or planned decentralised energy networks where feasible.

A review of documentation at the time of writing has been undertaken based on the following:

• London Heat Map: https://maps.london.gov.uk/heatmap

The London Heat Map is an online tool which exists to assist and promote this aim by enabling information relating to large heat loads and energy supplies within the Greater London area to be collated and searched and hence identify any opportunities that may exist for connecting a proposed development to an existing network, or identify centres of significant energy demand which could help the viability of a proposed new heat network.

Having reviewed the London Heat map, no existing or future potential district heat networks are within a 500m vicinity of the site (as shown in figure 4).

As such, the connection to any existing or potential district heating network **is not feasible.**

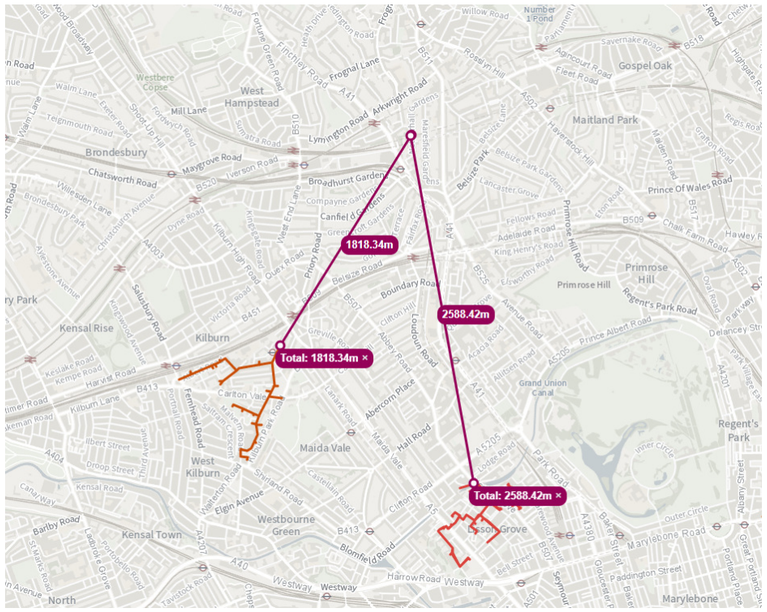


Figure 4: London Heat map showing the location of the proposed development and its distance from existing & future district heating networks

7.0 Low and Zero Carbon Technologies

This section of the report defines all LZC technologies and identifies the one which is considered feasible.

Wind Energy

Although wind turbines can generate up to 3MW of electricity, smaller units are available generating between 0.5 kW to 6.0 kW. The area would need to be accessed to establish the practicality of installing a wind turbine. Electricity is generated in DC and requires an inverter to convert to AC to operate domestic appliances. Where electricity is generated but not required, it can be sold to the local electricity company.

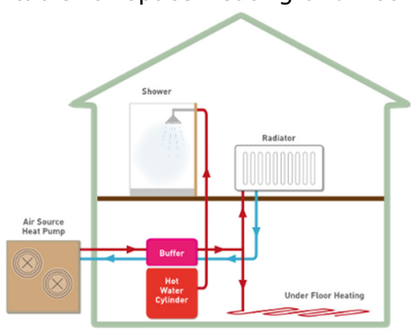
Given the location and the wind speed available provides minimal feasible electrical generation and as such has been discounted. It should also be noted there are a number of considerations with regards to daylight impact on the surrounding buildings, further providing rational for discounting wind technology.

This technology is not considered feasible for the development.

Air Source Heat Pump

Air Source Heat Pumps (ASHP) provide an efficient method of providing space heating and cooling requirements. Heat is absorbed from the air into liquid via a heat exchanger where 'useful' heat is extracted and absorbed. Low grade heat is then extracted by a refrigeration system, compressed and concentrated to temperatures suitable for space heating and hot water requirements.

While ASHP utilise electricity to generate this process, the heat gained is taken directly from the available air and produces fewer greenhouse gases when compared to a conventional gas system.



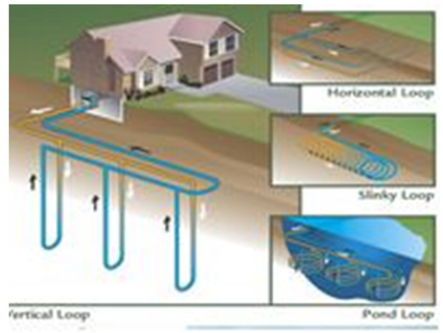
ASHP have been classified as a renewable system under the European Directive on 'Promotion of Renewable Energy Sources' and Policy 5.7 'Renewable Energy' of the London Plan 2011.

ASHP and associated plant require annual maintenance and adequate space for condensing units. Expected lifetimes range from 7-10 years.

Air Source Heat Pumps have been considered as a viable option to provide heating and hot water for the residential units of all the development Phases of 13 Netherhall Gardens site.

Ground Source Heat Pump

A Ground Source Heat Pump (GSHP) transfers energy from the ground to the building to provide space heating or pre-heating of domestic hot water. Unlike wind and solar heating, it requires an electrical input, however, the heat recovered is three to four times the required electrical input. Heat is transferred from the ground using a ground loop, which can either be within a vertical borehole arrangement or laid as coils in a horizontal trench. The heat pump works in the same way as a domestic refrigerator in reverse, by extracting heat from the borehole/trench to evaporate the refrigerant on the heat pump circuit. Heat is then input to the building as the refrigerant condenses.

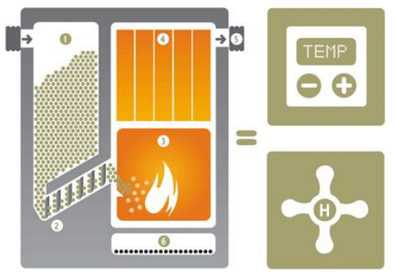


Any proposed GSHP would require the use of a large number of vertical boreholes across the site. Given the site's size, the piling of the foundations and the network pipes that run below ground, this has been discounted owing to practical constraints associated with GSHP.

This technology is not feasible for the development.

Biomass

Biomass boilers burn renewable fuel to generate hot water for direct use, or for heating purposes. The fuel they burn is renewable because it is in a constant carbon cycle. There are three main forms of biomass boilers available, namely those using wood chips as fuel, those using wood pellets as fuel and those using wood logs.



The operation and installation of Biomass requires additional plant space for the storage of solid fuel and design of access routes for delivery of fuel. Given the urban location of the development, this has been discounted owing to practical constraints associated with Biomass.

This technology is considered not feasible for this scheme.

Combined Heat & Power (CHP)

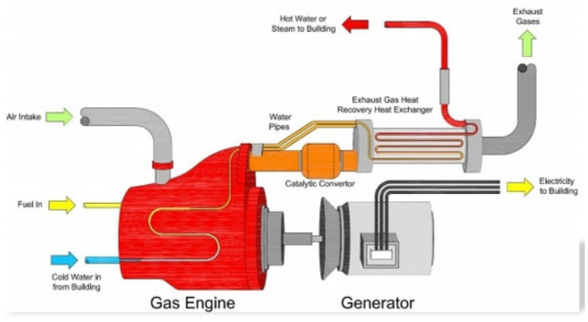
CHP effectively uses waste heat from the electricity generation process to provide useful heat for space and water heating; the advantage of this system is that it leads to higher system efficiencies when compared to a typical supply arrangement of grid-imported electricity and conventional boilers. A further advantage is that because electricity is generated close to the point of use, the losses incurred in High Voltage (HV) transmission are avoided. CHP is considered as a low carbon technology when fired by gas or fuel oil to generate electricity and provide heating and hot water.

CHP units should be replaced every 15-17 years, with replacement timeframes subject to alteration pending regular maintenance and part failure.

Once an understanding of the site's heat and electricity demand profile has been established the designer is then faced with the task of deciding on the size of the CHP. There is no straightforward way to size a CHP. Some guidance recommends sizing only to meet the lowest demand that occurs — the base-load that will result in the longest running hours and the shortest payback period. However, this is not necessarily the most economically advantageous approach and certainly would limit the amount of CO_2 savings that could be achieved on a given site.

The most accurate models are hourly models simulated over a whole year with occupancy, heat, DHW and electricity demand profiles representing an average year. This is the recommended approach for new buildings where dynamic simulation modelling can be carried out.

Whereas in most engineering calculations it is possible to make simplifications that result in a conservative or a worst-case scenario, simplifying a CHP model generally will result in a more optimistic result (best case scenario) with respect to the CHP operating hours and hence the economic payback and efficiency, which is usually not the case.



<u>The upcoming change in the electricity carbon factor, makes weak the case for using gas-fired combined heat and power (CHP) and has resulted in an instant step-change towards electrical forms of heating.</u>

<u>Therefore, a CHP unit is considered not feasible because of the use of Air Source Heat Pumps for the heating and the hot water of all the units of all the Phases of 13 Netherhall Gardens site.</u>

Photovoltaics (PV Panels)

Photovoltaic (PV) panels create electricity from solar radiation with efficiency ranging between 5 and 19%. PV modules generally require minimal maintenance, usually consisting of a visual inspection and associated electrical testing. They have no moving parts and an expected lifetime of over 30-40 years. Manufacturers typically offer a warranty on power output of 20-25 years. PV modules have no operating emissions and produce no noise, making them the most benign zero-carbon technology.

<u>Given that the proposed development incorporates a good amount of free roof space, PV should be considered as a viable system to generate electricity for use on-site.</u>

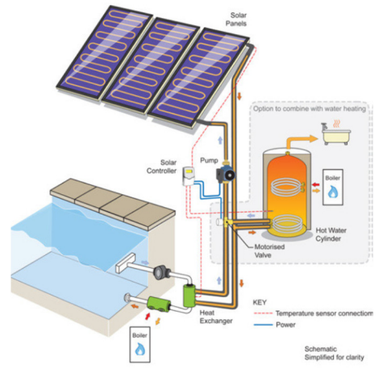
<u>Based on this, 5.5 kWp of roof mounted PV panels will serve the new-build residential units of the Phase 3 building.</u>

Solar Thermal Collectors

Solar thermal collectors utilise solar radiation to heat water for use in water heating of a building. The radiation is converted using a solar collector, of which there are two main types available: Flat Plate and Evacuated Tube collectors. Evacuated tube systems occupy a smaller area and are more efficient, but also generally more expensive. Flat plate systems are cheaper to install but generally less efficient.

The solar coverage indicates what percentage of the annual domestic hot water energy requirement can be covered by a solar water heating system. The higher the solar coverage, the more conventional energy usage can be offset, but can cause excess heat generation in the peak summer months and generally lower the average collector efficiency. Therefore, solar coverage of 40-70% are recommended for most domestic applications and up to 40% in non-domestic buildings.

Solar thermal systems in the UK normally operate with a back-up fuel source, such as gas or electricity. The solar system pre-heats the water up to a maximum hot water temperature. If there is not enough solar power available to fully meet the required hot water load, then the back-up fuel system fires up to meet this short fall. The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30º from the horizontal. However, orientation is not critical, with azimuths of +/-30o from South and angles of +/-20o



from 30o still achieve reasonable outputs.

For the solar water heating system to run safely and efficiently, a series of temperature sensors are connected to a digital solar controller to switch the system on or off according to the solar energy available. The roof area required depends on the efficiency of the modules specified and will vary depending on the product selected. This will be determined by the relevant contractor.

The hot water demand of the development is higher in the commercial units and this is a fully residential development, which makes solar hot water panels a non-viable option.

Summary of LZC feasibility study

The table, below, presents the result of the feasibility study carried out for the scheme.

Technology	End Use	Result
Wind Turbine	Electricity	NOT Feasible
Ground Source Heat Pumps (GSHP)	Thermal Energy	NOT Feasible
Air Source Heat Pumps (ASHP)	**Thermal Energy**	**FEASIBLE**
Biomass	Thermal Energy	NOT Feasible
Combined Heat & Power (CHP)	Electricity and Thermal Energy	NOT Feasible
Solar Hot Water	Thermal Energy	NOT Feasible
Photovoltaics	**Electricity**	**FEASIBLE**

Table 1: Summary of LZC Technologies

8.0 Water Usage

Based on London Plan policies (as analysed in Chapter 3) the water consumption (internal) for the residential units must be equal or less than 105 litres/person/day.

The sanitary ware specification which yet to be clearly defined, however could achieve the desired savings with the following selection:

Sanitaryware Element	Targeted Water Consumption
WC Cistern	6 / 3 litres dual flush
Basin Taps	3 litres per min at 3 bar (possible use of flow restrictors)
Shower	9 litres per min at 3 bar (possible use of flow restrictors)
Bath	150 litres capacity to overflow
Kitchen Sink Taps	8 litres per min at 3 bar (possible use flow restrictors)
Washing Machine	8.17 litres per kg
Dishwasher	1.25 litres per place setting

Table 2: Summary of proposed sanitaryware specification.

By implementing measures such as those recommended above will reduce the internal potable water consumption to less than 105 litres per person per day, as required by the policies (chapter 3).

The preliminary water calculation for the new-build residential units of Phase 3 has been included in Appendix C.

9.0 SAP Performance - Conclusion

As mentioned in the above chapters, the energy strategy for the proposed 13 Netherhall Gardens site is based on the London Plan Energy Hierarchy as follows:

- Use less energy (be lean)
- Supply energy efficiently (be clean) and
- Use renewable energy (be green)

The SAP methodology is used to calculate the energy consumption and resultant CO2 emissions for the proposed dwellings.

For the Be Lean stage, a fabric first approach has been followed, incorporating passive design measures such as low u-values, low air leakage and low thermal bridging. Active design measures have been incorporated such as 100% low energy lighting, and mechanical ventilation with heat recovery (MVHR).

The Be Clean step of the energy hierarchy doesn't exist as the implemented strategy is not based on the use of a CHP system or a district heating connection.

The last step of energy hierarchy (Be Green) is based on the use of an efficient communal system containing LTHW communal Air Source Heat Pumps (ASHPs) along with a thermal buffer vessel, which will provide space heating and hot water to the dwellings (by using plate heat exchangers, located in the HIUs of each dwelling). In addition, PV Panels are introduced for the new-build units of Phase 3, in order to reduce further the produced carbon emissions.

From January 2019, planning applicants are encouraged to use updated, based on the new SAP 10 policy, carbon emission factors to assess the expected carbon performance of a new development. Applicants should continue to use the current Building Regulations methodology for estimating energy performance against Part L 2013 requirements but with the outputs manually converted for the SAP 10 emission factors. A spreadsheet has been developed for this purpose by GLA.

The most significant change of the new SAP 10 policy compared to current one (SAP 2012) is the difference in electricity carbon emissions factor. The electricity CO2 emissions will reduce significantly from 0.519 kgCO2/kWh to 0.233 kgCO2/kWh, now only slightly higher than mains gas (0.210 kgCO2/kWh). Current SAP (SAP 2012) assumes that electricity used produces 2.4 times the carbon emissions of mains gas. Electricity CO2 emissions factor in SAP 10 falls by 55%.

From the above, it is obvious that using air source heat pumps (ASHPs) will be beneficial due to the high COP of heat pumps and reduced carbon intensity of electricity.

Therefore, by incorporating a combination of all the feasible passive measures along with the use of the communal Air Source Heat Pumps system, both the existing building (Phases 1 and 2) and the new building (Phase 3) and use of PVs for the new-build units, the 13 Netherhall Gardens Site have achieved a remarkable CO2 reduction which is much beyond the Part L Baseline and the minimum requirements of Camden policy for medium and minor developments (each Phase includes less than 10 units).

The relevant CO2 reduction figures, based on the SAP testing (with using SAP 10 carbon factors), separately for the existing building (Phases 1 and 2) and the new building (Phase 3), are presented in the following tables and graphs:

New Building (Phase 3) CO2 Emissions - SAP 10			
Energy Hierarchy	**Regulated CO2 Emissions / Annum (tonnes)**	**% Improvements by Energy Hierarchy**	**% Cumulative Improvements**
Baseline	9.60	-	-
Be Lean	8.07	15.97%	15.97%
Be Green	3.20	60.27%	66.62%
		Overall CO2 Emissions Reduction:	**66.62%**

Table 3: Reduction of Regulated CO_2 Emissions for the new-build residential units of the new building (Phase 3) based on the SAP 10 carbon factors

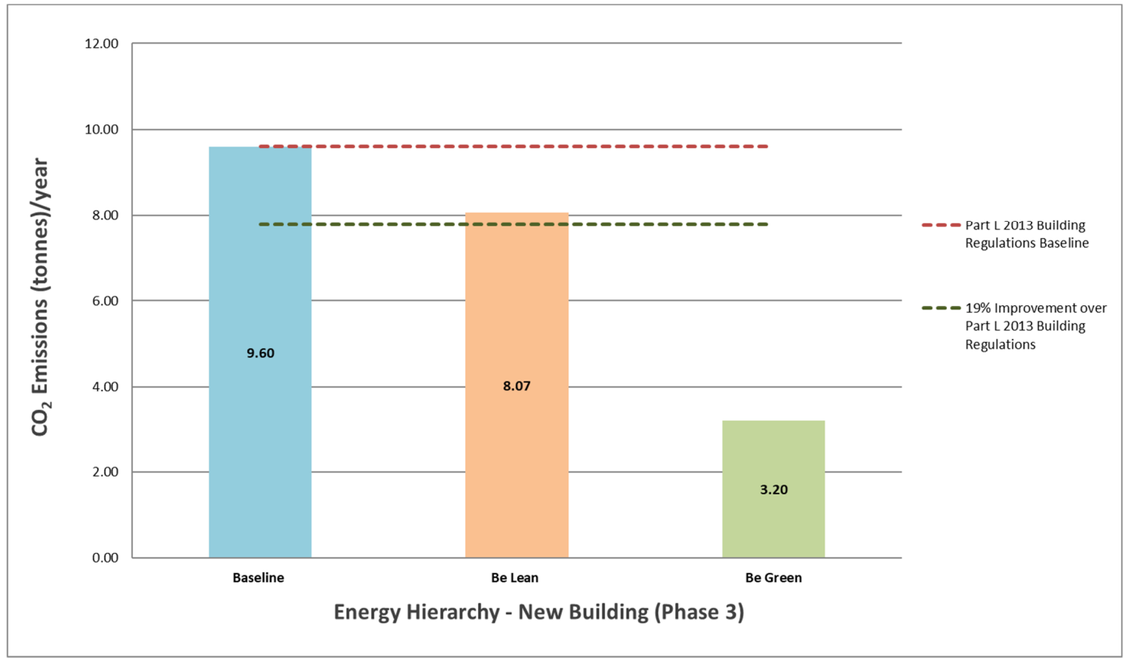


Figure 5: Energy Hierarchy & CO2 Emissions Reduction for the new-build residential units of the new building (Phase 3)

Existing Building (Phase 1 & 2) CO2 Emissions - SAP 10			
Energy Hierarchy	**Regulated CO2 Emissions / Annum (tonnes)**	**% Improvements by Energy Hierarchy**	**% Cumulative Improvements**
Baseline	16.19	-	-
Be Lean	24.87	-53.68%	-53.68%
Be Green	11.42	54.10%	29.46%
		Overall CO2 Emissions Reduction:	**29.46%**

Table 4: Reduction of Regulated CO_2 Emissions for the residential units of the existing building (Phase 1 and Phase 2) based on the SAP 10 carbon factors

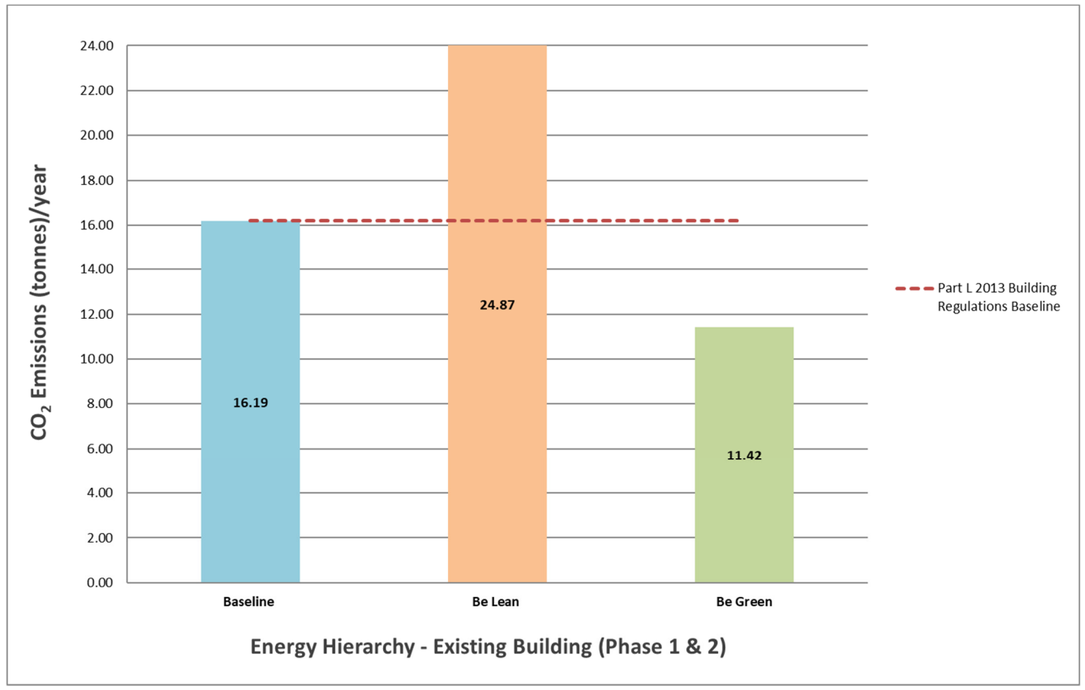


Figure 6: Energy Hierarchy & CO2 Emissions Reduction for the residential units of the existing building (Phase 1 and Phase 2)

The above results illustrate the following:

- **The existing building (Phases 1 & 2) achieves a CO2 reduction of 29.46% over Part L 2013 of Building Regulations, much better than the target which is to just comply with Part L1B 2013.**

- **The new building (Phase 3) achieves a CO2 reduction of 66.62% over Part L 2013 of Building Regulations, much better than the 19% CO2 reduction target. In addition, the achieved CO2 reduction through energy efficiency measures only is 15.97%, which is better than the 10% target for major new-build developments (even though Phase 3 is considered a minor new-build development).**

Appendix A – Be Lean Sample SAP Reports

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Flat 1 - Phase 3	**Issued on Date**	25/09/2022
Assessment Reference	Be Lean	**Prop Type Ref**	
Property	Phase 3, Flat 1, 13 Netherhall Gardens, London, NW3		

SAP Rating	85 B	**DER**	14.52	**TER**	15.94
Environmental	87 B	**% DER<TER**	8.90		
CO_2 Emissions (t/year)	1.71	**DFEE**	52.61	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.60		

Assessor Details	Mr. Ioannis Protonotarios, Ioannis Protonotarios, Tel: 02084469696, ioannis.p@mendickwaring.co.uk	**Assessor ID**	T299-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas (c)		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	15.94	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.52	$kgCO_2/m^2$	Pass
	-1.42 (-8.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.19	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.61	$kWh/m^2/yr$	
	-5.6 (-9.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.21 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Community heating scheme	-
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 0.25 kWh/day Permitted by DBSCG 0.29		Pass
Primary pipework insulated	No primary pipework		

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room stats		Pass
Hot water controls	No cylinderstat		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous supply and extract system			
Specific fan power	0.53		
Maximum	1.5		Pass
MVHR efficiency	94	%	
Minimum	70	%	Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Slight		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	13.70 m², No overhang 28.87 m², No overhang 2.16 m², No overhang		
Air change rate	4.00 ach		
Blinds/curtains	None		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.11	W/m²K
Floor U-value	0.11	W/m²K
Air permeability	3.0	m³/m²h

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

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

Design SAP
elmhurst energy

Property Reference	Flat 1 - Phase 3	**Issued on Date**	25/09/2022
Assessment Reference	Be Lean	**Prop Type Ref**	
Property	Phase 3, Flat 1, 13 Netherhall Gardens, London, NW3		

SAP Rating	85 B	**DER**	14.52	**TER**	15.94
Environmental	87 B	**% DER<TER**	8.90		
CO_2 Emissions (t/year)	1.71	**DFEE**	52.61	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.60		

Assessor Details	Mr. Ioannis Protonotarios, Ioannis Protonotarios, Tel: 02084469696, ioannis.p@mendickwaring.co.uk	**Assessor ID**	T299-0001
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

Ground-floor flat, total floor area 145 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:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.94 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.52 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.21 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Nominal cylinder loss: 0.25 kWh/day
Permitted by DBSCG 0.29 OK
Primary pipework insulated: No primary pipework

---
6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

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

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.53
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 13.70 m², No overhang
Windows facing East: 28.87 m², No overhang
Windows facing South: 2.16 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.11 W/m²K
Air permeability 3.0 m³/m²h

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)	
Ground floor	75.2400	(1b)	x 2.9000	(2b) =	218.1960	(1b) - (3b)
First floor	69.6700	(1c)	x 2.4000	(2c) =	167.2080	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	385.4040	(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					3.0000	
Infiltration rate					0.1500	(18)
Number of sides sheltered					2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000 (23c)

Effective ac	0.2631	0.2599	0.2567	0.2408	0.2376	0.2216	0.2216	0.2184	0.2280	0.2376	0.2439	0.2503	(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)			44.7300	1.1450	51.2176			(27)
Opening Type 6			2.1800	1.4000	3.0520			(26)
Floor 1			75.2400	0.1100	8.2764			(28a)
External Wall	178.4400	44.7300	133.7100	0.1700	22.7307			(29a)
Sheltered Wall	27.0000	2.1800	24.8200	0.1700	4.2194			(29a)
External Roof 1	9.8400		9.8400	0.1100	1.0824			(30)
Total net area of external elements Aum(A, m2)			290.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.5785			(33)
Party Walls			22.0300	0.0000	0.0000			(32)
Party Ceiling 1			139.1300					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	23.1811	(36)
Total fabric heat loss (33) + (36) =	113.7596	(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	33.4572	33.0518	32.6464	30.6194	30.2140	28.1870	28.1870	27.7816	28.9978	30.2140	31.0248	31.8356	(38)
Heat transfer coeff	147.2167	146.8113	146.4059	144.3789	143.9735	141.9466	141.9466	141.5412	142.7574	143.9735	144.7843	145.5951	(39)
Average = Sum(39)m / 12 =												144.2776	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0159	1.0131	1.0103	0.9963	0.9935	0.9795	0.9795	0.9768	0.9851	0.9935	0.9991	1.0047	(40)
HLP (average)												0.9956	(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	2.9259 (42)
Average daily hot water use (litres/day)	103.6903 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.0593	109.9117	105.7641	101.6165	97.4689	93.3213	93.3213	97.4689	101.6165	105.7641	109.9117	114.0593	(44)
Energy conte	169.1467	147.9368	152.6575	133.0905	127.7035	110.1984	102.1150	117.1785	118.5780	138.1912	150.8465	163.8095	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1631.4520	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.3720	22.1905	22.8986	19.9636	19.1555	16.5298	15.3173	17.5768	17.7867	20.7287	22.6270	24.5714	(46)
Water storage loss:													
Store volume												1.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0516	(51)
Volume factor from Table 2a												4.9324	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2543	(55)
Total storage loss													
	7.8839	7.1210	7.8839	7.6296	7.8839	7.6296	7.8839	7.8839	7.6296	7.8839	7.6296	7.8839	(56)
If cylinder contains dedicated solar storage													
	7.8839	7.1210	7.8839	7.6296	7.8839	7.6296	7.8839	7.8839	7.6296	7.8839	7.6296	7.8839	(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													
	200.2930	176.0689	183.8038	163.2321	158.8498	140.3400	133.2613	148.3248	148.7196	169.3375	180.9881	194.9558	(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													
	200.2930	176.0689	183.8038	163.2321	158.8498	140.3400	133.2613	148.3248	148.7196	169.3375	180.9881	194.9558	(64)
										Total per year (kWh/year) = Sum(64)m =		1998.1748	(64)
Heat gains from water heating, kWh/month													
	81.1583	71.6947	75.6757	68.3659	67.3785	60.7543	58.8703	63.8789	63.5405	70.8656	74.2697	79.3837	(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	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0761	24.9370	20.2801	15.3533	11.4768	9.6892	10.4695	13.6087	18.2656	23.1923	27.0689	28.8565	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.9288	318.1968	309.9616	292.4299	270.2992	249.4995	235.6040	232.3360	240.5712	258.1029	280.2336	301.0334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	(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)													
	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	(71)
Water heating gains (Table 5)													
	109.0838	106.6885	101.7146	94.9526	90.5625	84.3809	79.1268	85.8587	88.2506	95.2495	103.1524	106.6986	(72)
Total internal gains													
	518.9774	516.7109	498.8450	469.6244	439.2271	410.4582	392.0888	398.6920	413.9760	443.4334	477.3435	503.4770	(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	13.7000	10.6334	0.5000	0.8000	0.7700	40.3818	(74)
East	28.8700	19.6403	0.5000	0.8000	0.7700	157.1764	(76)
South	2.1600	46.7521	0.5000	0.8000	0.7700	27.9929	(78)

Solar gains	225.5511	430.4872	695.8920	1015.1329	1257.5769	1296.4305	1230.3178	1045.4705	807.5868	506.1506	278.9778	187.1069	(83)
Total gains	744.5284	947.1981	1194.7370	1484.7573	1696.8040	1706.8887	1622.4066	1444.1626	1221.5627	949.5840	756.3213	690.5839	(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	68.3563	68.5451	68.7349	69.6999	69.8961	70.8942	70.8942	71.0973	70.4916	69.8961	69.5047	69.1177	
alpha	5.5571	5.5697	5.5823	5.6467	5.6597	5.7263	5.7263	5.7398	5.6994	5.6597	5.6336	5.6078	
util living area													
	0.9991	0.9963	0.9819	0.9093	0.7342	0.5254	0.3840	0.4483	0.7464	0.9708	0.9975	0.9994	(86)
MIT	19.8609	20.0562	20.3684	20.7354	20.9379	20.9922	20.9989	20.9975	20.9510	20.6161	20.1616	19.8311	(87)
Th 2	20.0701	20.0724	20.0747	20.0864	20.0887	20.1004	20.1004	20.1028	20.0957	20.0887	20.0841	20.0794	(88)
util rest of house													
	0.9988	0.9951	0.9759	0.8829	0.6784	0.4546	0.3060	0.3622	0.6703	0.9573	0.9965	0.9992	(89)
MIT 2	18.5347	18.8215	19.2746	19.7893	20.0333	20.0957	20.1000	20.1018	20.0594	19.6421	18.9848	18.4980	(90)
Living area fraction										fLA = Living area / (4) =		0.3450	(91)
MIT	18.9923	19.2475	19.6520	20.1157	20.3454	20.4050	20.4102	20.4108	20.3670	19.9782	19.3908	18.9580	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9923	19.2475	19.6520	20.1157	20.3454	20.4050	20.4102	20.4108	20.3670	19.9782	19.3908	18.9580	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9935	0.9724	0.8838	0.6948	0.4789	0.3329	0.3920	0.6945	0.9552	0.9953	0.9988	(94)
Useful gains	743.2247	941.0869	1161.7298	1312.2456	1178.9363	817.3681	540.1729	566.0757	848.3372	907.0754	752.8023	689.7773	(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													
	2162.9512	2106.3792	1925.5295	1619.3133	1244.7120	824.0023	540.8417	567.6996	894.6641	1350.2087	1779.5191	2148.6862	(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													
	1056.2765	783.0764	568.2670	221.0887	48.9371	0.0000	0.0000	0.0000	0.0000	329.6912	739.2361	1085.4282	(98)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 4832.0012 (98)
Space heating per m2 (98) / (4) = 33.3448 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1334.2977	1050.4045	1075.7128	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9721	0.9882	0.9785	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1297.0518	1038.0180	1052.5951	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2110.2991	2008.9815	1802.6286	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	585.5380	722.3969	558.0250	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling 1865.9599 (104)
Cooled fraction fC = cooled area / (4) = 0.2760 (105)

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.4070	49.8514	38.5084	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling 128.7668 (107)
Space cooling per m2 0.8886 (108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (301)
Fraction of space heat from community system 1.0000 (302)
Fraction of heat from community Boilers 1.0000 (303a)
Fraction of total space heat from community Boilers 1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating 1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating 1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system 1.0500 (306)
Space heating:
Annual space heating requirement 4832.0012 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05 5073.6012 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0.0000 (308)
Space heating fuel for secondary/supplementary system 0.0000 (309)

Water heating
Annual water heating requirement 1998.1748 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05 2098.0836 (310a)
Electricity used for heat distribution 71.7168 (313)
Cooling System Energy Efficiency Ratio 4.0000 (314)
Space cooling (if there is a fixed cooling system, if not enter 0) 32.1917 (315)
Annual totals kWh/year

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)
mechanical ventilation fans (SFP = 0.6625) 311.5028 (330a)
Total electricity for the above, kWh/year 311.5028 (331)
Electricity for lighting (calculated in Appendix L) 495.8333 (332)
Total delivered energy for all uses 8011.2126 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	7549.1419	0.2160	1630.6146	(367)
Electrical energy for heat distribution	71.7168	0.5190	37.2210	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1667.8357	(373)
Space and water heating			1667.8357	(376)
Space cooling	32.1917	0.5190	16.7075	(377)
Pumps and fans	311.5028	0.5190	161.6699	(378)
Energy for lighting	495.8333	0.5190	257.3375	(379)
Total CO2, kg/year			2103.5506	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5200	(384)

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

DER		14.5200	ZC1
Total Floor Area	TFA	144.9100	
Assumed number of occupants	N	2.9259	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.8784	ZC2
CO2 emissions from cooking, equation (L16)		1.3058	ZC3
Total CO2 emissions		28.7041	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		28.7041	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)	
Ground floor	75.2400	(1b)	x 2.9000	(2b) =	218.1960	(1b) - (3b)
First floor	69.6700	(1c)	x 2.4000	(2c) =	167.2080	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		385.4040	(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) =	0.1038	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3538	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3007	(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	0.3834	0.3759	0.3684	0.3308	0.3233	0.2857	0.2857	0.2782	0.3007	0.3233	0.3383	0.3533	(22b)
Effective ac	0.5735	0.5706	0.5679	0.5547	0.5523	0.5408	0.5408	0.5387	0.5452	0.5523	0.5572	0.5624	(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			2.1800	1.0000	2.1800			(26)
TER Opening Type (Uw = 1.40)			34.0500	1.3258	45.1420			(27)
Floor 1			75.2400	0.1300	9.7812			(28a)
External Wall	178.4400	34.0500	144.3900	0.1800	25.9902			(29a)
Sheltered Wall	27.0000	2.1800	24.8200	0.1800	4.4676			(29a)
External Roof 1	9.8400		9.8400	0.1300	1.2792			(30)
Total net area of external elements Aum(A, m2)			290.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		88.8402			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0241	(36)
Total fabric heat loss					(33) + (36) =		99.8643	(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	72.9402	72.5772	72.2213	70.5500	70.2373	68.7817	68.7817	68.5121	69.3424	70.2373	70.8699	71.5312	(38)
Heat transfer coeff	172.8045	172.4415	172.0857	170.4144	170.1017	168.6460	168.6460	168.3765	169.2067	170.1017	170.7343	171.3956	(39)
Average = Sum(39)m / 12 =												170.4129	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1925	1.1900	1.1875	1.1760	1.1738	1.1638	1.1638	1.1619	1.1677	1.1738	1.1782	1.1828	(40)
HLP (average)												1.1760	(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	2.9259	(42)
Average daily hot water use (litres/day)	103.6903	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.0593	109.9117	105.7641	101.6165	97.4689	93.3213	93.3213	97.4689	101.6165	105.7641	109.9117	114.0593	(44)
Energy conte	169.1467	147.9368	152.6575	133.0905	127.7035	110.1984	102.1150	117.1785	118.5780	138.1912	150.8465	163.8095	(45)
Energy content (annual)										Total = Sum(45)m =		1631.4520	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3720	22.1905	22.8986	19.9636	19.1555	16.5298	15.3173	17.5768	17.7867	20.7287	22.6270	24.5714	(46)
Water storage loss:													
Store volume												1.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2134	(48)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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  Temperature factor from Table 2b                                                                                0.5400 (49)
Enter (49) or (54) in (55)                                                                                        0.1152 (55)
Total storage loss
                3.5715     3.2259     3.5715     3.4563     3.5715     3.4563     3.5715     3.5715     3.4563     3.5715     3.4563     3.5715 (56)
If cylinder contains dedicated solar storage
                3.5715     3.2259     3.5715     3.4563     3.5715     3.4563     3.5715     3.5715     3.4563     3.5715     3.4563     3.5715 (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
              195.9806   172.1738   179.4914   159.0588   154.5374   136.1667   128.9489   144.0124   144.5462   165.0251   176.8148   190.6434 (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
              195.9806   172.1738   179.4914   159.0588   154.5374   136.1667   128.9489   144.0124   144.5462   165.0251   176.8148   190.6434 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1947.3993 (64)
Heat gains from water heating, kWh/month
               77.7084    68.5786    72.2257    65.0272    63.9285    57.4156    55.4204    60.4290    60.2018    67.4157    70.9311    75.9338 (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         146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                28.0761    24.9370    20.2801    15.3533    11.4768     9.6892    10.4695    13.6087    18.2656    23.1923    27.0689    28.8565 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               314.9288   318.1968   309.9616   292.4299   270.2992   249.4995   235.6040   232.3360   240.5712   258.1029   280.2336   301.0334 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295 (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)
              -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363 (71)
Water heating gains (Table 5)
               104.4467   102.0515    97.0776    90.3156    85.9254    79.7439    74.4897    81.2217    83.6136    90.6125    98.5154   102.0615 (72)
Total internal gains
               517.3403   515.0739   497.2079   467.9874   437.5900   408.8211   390.4518   397.0550   412.3389   441.7963   475.7065   501.8399 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data      factor                W
                                                           W/m2         or Table 6b      or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------
North                                  10.4300            10.6334           0.6300           0.7000           0.7700           33.8944 (74)
East                                   21.9800            19.6403           0.6300           0.7000           0.7700          131.9310 (76)
South                                   1.6400            46.7521           0.6300           0.7000           0.7700           23.4324 (78)
-------------------------------------------------------------------------------------------------------

Solar gains    189.2578   361.2351   583.9805   851.9253  1055.4196  1088.0379  1032.5482   877.3970   677.7281   424.7369   234.0909   156.9974 (83)
Total gains    706.5981   876.3091  1081.1884  1319.9127  1493.0096  1496.8590  1423.0000  1274.4520  1090.0670   866.5332   709.7974   658.8373 (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           58.2346    58.3571    58.4778    59.0513    59.1599    59.6705    59.6705    59.7660    59.4728    59.1599    58.9407    58.7133
alpha          4.8823     4.8905     4.8985     4.9368     4.9440     4.9780     4.9780     4.9844     4.9649     4.9440     4.9294     4.9142
util living area
                0.9992     0.9976     0.9905     0.9572     0.8549     0.6751     0.5115     0.5868     0.8596     0.9848     0.9982     0.9995 (86)

MIT            19.5981    19.7761    20.0832    20.4849    20.8028    20.9555    20.9908    20.9827    20.8511    20.4091    19.9266    19.5691 (87)
Th 2           19.9260    19.9280    19.9300    19.9392    19.9410    19.9491    19.9491    19.9506    19.9460    19.9410    19.9375    19.9338 (88)
util rest of house
                0.9989     0.9967     0.9870     0.9409     0.8045     0.5824     0.3945     0.4633     0.7895     0.9767     0.9974     0.9993 (89)
MIT 2          18.0474    18.3090    18.7571    19.3352    19.7513    19.9204    19.9458    19.9436    19.8243    19.2391    18.5361    18.0104 (90)
Living area fraction                                                                                fLA = Living area / (4) =      0.3450 (91)
MIT            18.5825    18.8152    19.2147    19.7319    20.1141    20.2775    20.3064    20.3021    20.1786    19.6428    19.0159    18.5482 (92)
Temperature adjustment                                                                                          0.0000
adjusted MIT   18.5825    18.8152    19.2147    19.7319    20.1141    20.2775    20.3064    20.3021    20.1786    19.6428    19.0159    18.5482 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9984     0.9954     0.9837     0.9370     0.8137     0.6129     0.4351     0.5062     0.8073     0.9735     0.9964     0.9989 (94)
Useful gains   705.4736   872.2634  1063.6052  1236.7451  1214.8942   917.4076   619.1886   645.0877   879.9885   843.6074   707.2189   658.0918 (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
              2468.0744  2399.5610  2188.0146  1845.9123  1431.2573   957.4957   625.0680   657.0261  1028.5385  1538.1994  2034.4555  2459.2238 (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
              1311.3750  1026.3440   836.5607   438.6004   160.9741     0.0000     0.0000     0.0000     0.0000   516.7765   955.6103  1340.0422 (98)
Space heating                                                                                                  6586.2831 (98)
Space heating per m2                                                                                  (98) / (4) =     45.4509 (99)


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8c. Space cooling requirement
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	7044.1531	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1311.3750	1026.3440	836.5607	438.6004	160.9741	0.0000	0.0000	0.0000	0.0000	516.7765	955.6103	1340.0422	(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)													
	1402.5401	1097.6941	894.7173	469.0913	172.1648	0.0000	0.0000	0.0000	0.0000	552.7021	1022.0431	1433.2002	(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													
	195.9806	172.1738	179.4914	159.0588	154.5374	136.1667	128.9489	144.0124	144.5462	165.0251	176.8148	190.6434	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.9493	88.7897	88.4059	87.3818	84.9227	79.8000	79.8000	79.8000	79.8000	87.6552	88.6442	89.0135	(217)
Fuel for water heating, kWh/month													
	220.3283	193.9119	203.0309	182.0274	181.9741	170.6349	161.5901	180.4666	181.1356	188.2661	199.4658	214.1736	(219)
Water heating fuel used												2277.0055	(219)
Annual totals kWh/year													
Space heating fuel - main system												7044.1531	(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)												495.8333	(232)
Total delivered energy for all uses												9891.9919	(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	7044.1531	0.2160	1521.5371	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2277.0055	0.2160	491.8332	(264)
Space and water heating			2013.3702	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	495.8333	0.5190	257.3375	(268)
Total CO2, kg/m2/year			2309.6328	(272)
Emissions per m2 for space and water heating			13.8939	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.7758	(272b)
Emissions per m2 for pumps and fans			0.2686	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8939 * 1.00) + 1.7758 + 0.2686, rounded to 2 d.p.			15.9400	(273)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.2400	(1b)	x 2.9000	(2b) =	218.1960	(1b) - (3b)
First floor	69.6700	(1c)	x 2.4000	(2c) =	167.2080	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		385.4040	(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) =	0.1038	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.2538	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2157	(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	0.2750	0.2696	0.2643	0.2373	0.2319	0.2049	0.2049	0.1995	0.2157	0.2319	0.2427	0.2535	(22b)
Effective ac	0.5378	0.5364	0.5349	0.5282	0.5269	0.5210	0.5210	0.5199	0.5233	0.5269	0.5294	0.5321	(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)			44.7300	1.1450	51.2176			(27)
Opening Type 6			2.1800	1.4000	3.0520			(26)
Floor 1			75.2400	0.1100	8.2764			(28a)
External Wall	178.4400	44.7300	133.7100	0.1700	22.7307			(29a)
Sheltered Wall	27.0000	2.1800	24.8200	0.1700	4.2194			(29a)
External Roof 1	9.8400		9.8400	0.1100	1.0824			(30)
Total net area of external elements Aum(A, m2)			290.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.5785			(33)
Party Walls			22.0300	0.0000	0.0000			(32)
Party Ceiling 1			139.1300					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.1811	(36)
Total fabric heat loss					(33) + (36) =		113.7596	(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	68.4022	68.2154	68.0323	67.1723	67.0114	66.2624	66.2624	66.1236	66.5509	67.0114	67.3369	67.6772	(38)
Heat transfer coeff	182.1618	181.9750	181.7919	180.9319	180.7710	180.0219	180.0219	179.8832	180.3104	180.7710	181.0965	181.4368	(39)
Average = Sum(39)m / 12 =												180.9311	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2571	1.2558	1.2545	1.2486	1.2475	1.2423	1.2423	1.2413	1.2443	1.2475	1.2497	1.2521	(40)
HLP (average)												1.2486	(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	2.9259	(42)
Average daily hot water use (litres/day)	103.6903	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.0593	109.9117	105.7641	101.6165	97.4689	93.3213	93.3213	97.4689	101.6165	105.7641	109.9117	114.0593	(44)
Energy conte	169.1467	147.9368	152.6575	133.0905	127.7035	110.1984	102.1150	117.1785	118.5780	138.1912	150.8465	163.8095	(45)
Energy content (annual)										Total = Sum(45)m =		1631.4520	(45)
Distribution loss (46)m = 0.15 x (45)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	(46)

Water storage loss:

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Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

35.9437	31.4366	32.4397	28.2817	27.1370	23.4172	21.6994	24.9004	25.1978	29.3656	32.0549	34.8095	(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	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	(66)

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

28.0761	24.9370	20.2801	15.3533	11.4768	9.6892	10.4695	13.6087	18.2656	23.1923	27.0689	28.8565	(67)

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

314.9288	318.1968	309.9616	292.4299	270.2992	249.4995	235.6040	232.3360	240.5712	258.1029	280.2336	301.0334	(68)

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

37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	(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)

-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	(71)

Water heating gains (Table 5)

48.3114	46.7806	43.6018	39.2802	36.4745	32.5238	29.1659	33.4683	34.9970	39.4699	44.5207	46.7870	(72)

Total internal gains

458.2050	456.8030	440.7321	413.9520	385.1391	358.6011	342.1280	346.3016	360.7223	387.6538	418.7118	443.5654	(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	13.7000	10.6334	0.5000	0.8000	0.7700	40.3818	(74)
East	28.8700	19.6403	0.5000	0.8000	0.7700	157.1764	(76)
South	2.1600	46.7521	0.5000	0.8000	0.7700	27.9929	(78)

Solar gains	225.5511	430.4872	695.8920	1015.1329	1257.5769	1296.4305	1230.3178	1045.4705	807.5868	506.1506	278.9778	187.1069	(83)
Total gains	683.7561	887.2902	1136.6241	1429.0849	1642.7160	1655.0316	1572.4458	1391.7721	1168.3091	893.8044	697.6895	630.6723	(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	55.2432	55.2999	55.3556	55.6187	55.6682	55.8998	55.8998	55.9429	55.8104	55.6682	55.5681	55.4639	
alpha	4.6829	4.6867	4.6904	4.7079	4.7112	4.7267	4.7267	4.7295	4.7207	4.7112	4.7045	4.6976	
util living area	0.9993	0.9974	0.9889	0.9489	0.8343	0.6525	0.4938	0.5728	0.8501	0.9840	0.9983	0.9995	(86)
MIT	19.5005	19.6998	20.0384	20.4695	20.8022	20.9539	20.9900	20.9807	20.8401	20.3629	19.8410	19.4616	(87)
Th 2	19.8746	19.8756	19.8766	19.8813	19.8822	19.8863	19.8863	19.8871	19.8847	19.8822	19.8804	19.8786	(88)
util rest of house	0.9990	0.9965	0.9848	0.9298	0.7790	0.5564	0.3739	0.4449	0.7754	0.9753	0.9975	0.9993	(89)
MIT 2	18.5053	18.7050	19.0419	19.4623	19.7553	19.8666	19.8840	19.8819	19.7973	19.3688	18.8502	18.4696	(90)
Living area fraction									fLA = Living area / (4) =			0.3450	(91)
MIT	18.8487	19.0483	19.3857	19.8099	20.1165	20.2418	20.2656	20.2611	20.1571	19.7118	19.1921	18.8119	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8487	19.0483	19.3857	19.8099	20.1165	20.2418	20.2656	20.2611	20.1571	19.7118	19.1921	18.8119	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9955	0.9824	0.9283	0.7919	0.5886	0.4156	0.4895	0.7963	0.9735	0.9969	0.9991	(94)
Useful gains	682.8644	883.3339	1116.6117	1326.6590	1300.7967	974.0846	653.5253	681.2996	930.3008	870.1367	695.4981	630.1069	(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	2650.2151	2574.6317	2342.5247	1973.9404	1521.4570	1015.6468	659.8893	694.5423	1092.1637	1647.1480	2189.8291	2651.1366	(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	1463.7089	1136.5521	912.0793	466.0426	164.1713	0.0000	0.0000	0.0000	0.0000	578.0965	1075.9183	1503.6461	(98)
Space heating												7300.2150	(98)
Space heating per m2											(98) / (4) =	50.3776	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1692.2060	1332.1622	1367.1123	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8955	0.9419	0.9101	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1515.3507	1254.7862	1244.2562	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2058.4420	1959.0207	1750.2382	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

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Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000   391.0257   523.9504   376.4506     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                             1291.4268 (104)
Cooled fraction                                                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    97.7564   130.9876    94.1127     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                              322.8567 (107)
Space cooling per m2                                                                                                                         2.2280 (108)
Energy for space heating                                                                                                                    50.3776 (99)
Energy for space cooling                                                                                                                     2.2280 (108)
Total                                                                                                                                       52.6056 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                      52.6 (109)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.2400	(1b)	x 2.9000	(2b) =	218.1960	(1b) - (3b)
First floor	69.6700	(1c)	x 2.4000	(2c) =	167.2080	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		385.4040	(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) =	0.1038	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3538	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3007	(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	0.3834	0.3759	0.3684	0.3308	0.3233	0.2857	0.2857	0.2782	0.3007	0.3233	0.3383	0.3533	(22b)
Effective ac	0.5735	0.5706	0.5679	0.5547	0.5523	0.5408	0.5408	0.5387	0.5452	0.5523	0.5572	0.5624	(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			2.1800	1.0000	2.1800			(26)
TER Opening Type (Uw = 1.40)			34.0500	1.3258	45.1420			(27)
Floor 1			75.2400	0.1300	9.7812			(28a)
External Wall	178.4400	34.0500	144.3900	0.1800	25.9902			(29a)
Sheltered Wall	27.0000	2.1800	24.8200	0.1800	4.4676			(29a)
External Roof 1	9.8400		9.8400	0.1300	1.2792			(30)
Total net area of external elements Aum(A, m2)			290.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.8402			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.0241	(36)
Total fabric heat loss (33) + (36) =	99.8643	(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	72.9402	72.5772	72.2213	70.5500	70.2373	68.7817	68.7817	68.5121	69.3424	70.2373	70.8699	71.5312	(38)
Heat transfer coeff	172.8045	172.4415	172.0857	170.4144	170.1017	168.6460	168.6460	168.3765	169.2067	170.1017	170.7343	171.3956	(39)
Average = Sum(39)m / 12 =												170.4129	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1925	1.1900	1.1875	1.1760	1.1738	1.1638	1.1638	1.1619	1.1677	1.1738	1.1782	1.1828	(40)
HLP (average)												1.1760	(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	2.9259 (42)
Average daily hot water use (litres/day)	103.6903 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.0593	109.9117	105.7641	101.6165	97.4689	93.3213	93.3213	97.4689	101.6165	105.7641	109.9117	114.0593	(44)
Energy conte	169.1467	147.9368	152.6575	133.0905	127.7035	110.1984	102.1150	117.1785	118.5780	138.1912	150.8465	163.8095	(45)
Energy content (annual)										Total = Sum(45)m =		1631.4520	(45)
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.9437	31.4366	32.4397	28.2817	27.1370	23.4172	21.6994	24.9004	25.1978	29.3656	32.0549	34.8095	(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	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0761	24.9370	20.2801	15.3533	11.4768	9.6892	10.4695	13.6087	18.2656	23.1923	27.0689	28.8565	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.9288	318.1968	309.9616	292.4299	270.2992	249.4995	235.6040	232.3360	240.5712	258.1029	280.2336	301.0334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	(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)													
	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	(71)
Water heating gains (Table 5)													
	48.3114	46.7806	43.6018	39.2802	36.4745	32.5238	29.1659	33.4683	34.9970	39.4699	44.5207	46.7870	(72)
Total internal gains													
	458.2050	456.8030	440.7321	413.9520	385.1391	358.6011	342.1280	346.3016	360.7223	387.6538	418.7118	443.5654	(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	10.4300	10.6334	0.6300	0.7000	0.7700	33.8944	(74)
East	21.9800	19.6403	0.6300	0.7000	0.7700	131.9310	(76)
South	1.6400	46.7521	0.6300	0.7000	0.7700	23.4324	(78)

Solar gains	189.2578	361.2351	583.9805	851.9253	1055.4196	1088.0379	1032.5482	877.3970	677.7281	424.7369	234.0909	156.9974	(83)
Total gains	647.4627	818.0382	1024.7126	1265.8773	1440.5586	1446.6390	1374.6762	1223.6986	1038.4504	812.3906	652.8027	600.5628	(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	58.2346	58.3571	58.4778	59.0513	59.1599	59.6705	59.6705	59.7660	59.4728	59.1599	58.9407	58.7133	
alpha	4.8823	4.8905	4.8985	4.9368	4.9440	4.9780	4.9780	4.9844	4.9649	4.9440	4.9294	4.9142	
util living area													
	0.9995	0.9982	0.9924	0.9632	0.8682	0.6928	0.5280	0.6075	0.8771	0.9883	0.9987	0.9996	(86)
MIT	19.5602	19.7391	20.0484	20.4564	20.7862	20.9501	20.9895	20.9799	20.8342	20.3766	19.8902	19.5317	(87)
Th 2	19.9260	19.9280	19.9300	19.9392	19.9410	19.9491	19.9491	19.9506	19.9460	19.9410	19.9375	19.9338	(88)
util rest of house													
	0.9993	0.9976	0.9896	0.9489	0.8202	0.5998	0.4080	0.4814	0.8115	0.9819	0.9982	0.9995	(89)
MIT 2	18.6055	18.7857	19.0950	19.5006	19.7989	19.9268	19.9465	19.9449	19.8513	19.4304	18.9444	18.5832	(90)
Living area fraction										fLA = Living area / (4) =		0.3450	(91)
MIT	18.9349	19.1147	19.4240	19.8304	20.1395	20.2799	20.3064	20.3020	20.1904	19.7569	19.2707	18.9104	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9349	19.1147	19.4240	19.8304	20.1395	20.2799	20.3064	20.3020	20.1904	19.7569	19.2707	18.9104	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9969	0.9878	0.9471	0.8303	0.6307	0.4498	0.5254	0.8292	0.9804	0.9977	0.9993	(94)
Useful gains	646.8406	815.4897	1012.1706	1198.8629	1196.1250	912.4622	618.2620	642.9635	861.0360	796.5005	651.3143	600.1660	(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													
	2528.9837	2451.1963	2224.0356	1862.6931	1435.5815	957.8942	625.0637	657.0103	1030.5443	1557.6005	2077.9608	2521.3061	(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													
	1400.3145	1099.1949	901.6276	477.9577	178.1556	0.0000	0.0000	0.0000	0.0000	566.2584	1027.1854	1429.3282	(98)
Space heating												7080.0224	(98)
Space heating per m2											(98) / (4) =	48.8581	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1585.2727	1247.9806	1279.6611	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8836	0.9358	0.9024	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1400.8121	1167.9155	1154.7723	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1814.8661	1727.8614	1553.7887	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	298.1189	416.5998	296.8682	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											1011.5869	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	74.5297	104.1499	74.2170	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											252.8967	(107)
Space cooling per m2											1.7452	(108)
Energy for space heating											48.8581	(99)
Energy for space cooling											1.7452	(108)
Total											50.6033	(109)
Target Fabric Energy Efficiency (TFEE)											58.2	(109)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Flat 2 - Phase 3	**Issued on Date**	25/09/2022
Assessment Reference	Be Lean	**Prop Type Ref**	
Property	Phase 3 , Flat 2, 13 Netherhall Gardens, London, NW3		

SAP Rating	84 B	**DER**	15.77	**TER**	18.00
Environmental	87 B	**% DER<TER**	12.40		
CO_2 Emissions (t/year)	1.31	**DFEE**	52.65	**TFEE**	61.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	14.22		

Assessor Details	Mr. Ioannis Protonotarios, Ioannis Protonotarios, Tel: 02084469696, ioannis.p@mendickwaring.co.uk	**Assessor ID**	T299-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas (c)		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.00	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.77	$kgCO_2/m^2$	Pass
	-2.23 (-12.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.38	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.65	$kWh/m^2/yr$	
	-8.8 (-14.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Community heating scheme	-
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 0.25 kWh/day Permitted by DBSCG 0.29	Pass

Primary pipework insulated	No primary pipework		

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room stats		Pass
Hot water controls	No cylinderstat		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous supply and extract system			
Specific fan power	0.53		
Maximum	1.5		Pass
MVHR efficiency	94	%	
Minimum	70	%	Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Slight		Pass

Based on:

Overshading	Average		
Windows facing North	2.93 m², No overhang		
Windows facing South	4.99 m², No overhang		
Windows facing West	16.04 m², No overhang		
Air change rate	4.00 ach		
Blinds/curtains	None		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Floor U-value	0.11	W/m²K
Air permeability	3.0	m³/m²h

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

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

Design SAP
elmhurst energy

Property Reference	Flat 2 - Phase 3	**Issued on Date**	25/09/2022
Assessment Reference	Be Lean	**Prop Type Ref**	
Property	Phase 3 , Flat 2, 13 Netherhall Gardens, London, NW3		

SAP Rating	84 B	**DER**	15.77	**TER**	18.00
Environmental	87 B	**% DER<TER**	12.40		
CO_2 Emissions (t/year)	1.31	**DFEE**	52.65	**TFEE**	61.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	14.22		

Assessor Details	Mr. Ioannis Protonotarios, Ioannis Protonotarios, Tel: 02084469696, ioannis.p@mendickwaring.co.uk	**Assessor ID**	T299-0001
Client			

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 102 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:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.00 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.77 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)61.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 0.25 kWh/day
Permitted by DBSCG 0.29 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

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

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.53
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 2.93 m², No overhang
Windows facing South: 4.99 m², No overhang
Windows facing West: 16.04 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Floor U-value 0.11 W/m²K
Air permeability 3.0 m³/m²h

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)	
Ground floor	101.6500 (1b)	x	2.9000 (2b)	=	294.7850	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.7850	(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		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2631	0.2599	0.2567	0.2408	0.2376	0.2216	0.2216	0.2184	0.2280	0.2376	0.2439	0.2503	(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)			23.9600	1.1450	27.4351			(27)
Opening Type 6			2.1800	1.4000	3.0520			(26)
Heat Loss Floor 1			101.6500	0.1100	11.1815			(28a)
External Wall	107.7600	23.9600	83.8000	0.1700	14.2460			(29a)
Sheltered Wall	22.8800	2.1800	20.7000	0.1700	3.5190			(29a)
Total net area of external elements Aum(A, m2)			232.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.4336			(33)
Party Walls			13.3600	0.0000	0.0000			(32)
Party Ceiling 1			139.1300					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	20.3544 (36)
Total fabric heat loss (33) + (36) =	79.7880 (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	25.5905	25.2804	24.9703	23.4199	23.1099	21.5595	21.5595	21.2494	22.1796	23.1099	23.7300	24.3502	(38)
Heat transfer coeff	105.3785	105.0684	104.7583	103.2079	102.8979	101.3475	101.3475	101.0374	101.9676	102.8979	103.5180	104.1382	(39)
Average = Sum(39)m / 12 =												103.1304	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0367	1.0336	1.0306	1.0153	1.0123	0.9970	0.9970	0.9940	1.0031	1.0123	1.0184	1.0245	(40)
HLP (average)												1.0146	(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	2.7543 (42)
Average daily hot water use (litres/day)	99.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5757	105.5911	101.6065	97.6220	93.6374	89.6528	89.6528	93.6374	97.6220	101.6065	105.5911	109.5757	(44)
Energy conte	162.4976	142.1214	146.6566	127.8587	122.6835	105.8665	98.1009	112.5722	113.9167	132.7589	144.9168	157.3702	(45)
Energy content (annual)										Total = Sum(45)m =		1567.3200	(45)

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

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	24.3746	21.3182	21.9985	19.1788	18.4025	15.8800	14.7151	16.8858	17.0875	19.9138	21.7375	23.6055	(46)
Water storage loss:													
Store volume												1.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0516	(51)
Volume factor from Table 2a												4.9324	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2543	(55)
Total storage loss													
	7.8839	7.1210	7.8839	7.6296	7.8839	7.6296	7.8839	7.8839	7.6296	7.8839	7.6296	7.8839	(56)
If cylinder contains dedicated solar storage													
	7.8839	7.1210	7.8839	7.6296	7.8839	7.6296	7.8839	7.8839	7.6296	7.8839	7.6296	7.8839	(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													
	193.6439	170.2536	177.8029	158.0003	153.8298	136.0081	129.2472	143.7185	144.0583	163.9052	175.0583	188.5165	(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													
	193.6439	170.2536	177.8029	158.0003	153.8298	136.0081	129.2472	143.7185	144.0583	163.9052	175.0583	188.5165	(64)
									Total per year (kWh/year) = Sum(64)m =			1934.0428	(64)
Heat gains from water heating, kWh/month													
	78.9475	69.7611	73.6804	66.6263	65.7093	59.3139	57.5356	62.3473	61.9906	69.0594	72.2981	77.2426	(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	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0872	20.5058	16.6765	12.6252	9.4375	7.9675	8.6092	11.1905	15.0199	19.0712	22.2589	23.7288	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.9679	261.6552	254.8834	240.4669	222.2687	205.1650	193.7386	191.0513	197.8232	212.2396	230.4378	247.5416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	(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)													
	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	(71)
Water heating gains (Table 5)													
	106.1122	103.8112	99.0327	92.5365	88.3190	82.3804	77.3328	83.8002	86.0980	92.8218	100.4140	103.8208	(72)
Total internal gains													
	452.4816	450.2865	434.9068	409.9429	384.3394	359.8271	343.9948	350.3563	363.2553	388.4469	417.4250	439.4055	(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	2.9300	10.6334	0.5000	0.8000	0.7700	8.6364	(74)
South	4.9900	46.7521	0.5000	0.8000	0.7700	64.6688	(78)
West	16.0400	19.6403	0.5000	0.8000	0.7700	87.3263	(80)

Solar gains	160.6314	293.2441	444.2874	607.8312	722.4194	732.6256	700.1192	614.1688	501.8497	336.5839	196.1942	134.8924	(83)
Total gains	613.1130	743.5305	879.1943	1017.7740	1106.7588	1092.4528	1044.1140	964.5250	865.1050	725.0308	613.6193	574.2978	(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	66.9874	67.1851	67.3839	68.3962	68.6023	69.6517	69.6517	69.8655	69.2281	68.6023	68.1913	67.7852	
alpha	5.4658	5.4790	5.4923	5.5597	5.5735	5.6434	5.6434	5.6577	5.6152	5.5735	5.5461	5.5190	
util living area													
	0.9980	0.9938	0.9785	0.9197	0.7801	0.5806	0.4251	0.4778	0.7494	0.9601	0.9949	0.9986	(86)
MIT	19.9170	20.1007	20.3779	20.7038	20.9113	20.9864	20.9980	20.9963	20.9476	20.6455	20.2158	19.8880	(87)
Th 2	20.0529	20.0554	20.0579	20.0706	20.0731	20.0858	20.0858	20.0884	20.0807	20.0731	20.0680	20.0630	(88)
util rest of house													
	0.9973	0.9917	0.9714	0.8951	0.7256	0.5033	0.3379	0.3853	0.6725	0.9426	0.9929	0.9981	(89)
MIT 2	18.6040	18.8734	19.2746	19.7350	19.9918	20.0773	20.0851	20.0869	20.0417	19.6687	19.0515	18.5691	(90)
Living area fraction									fLA = Living area / (4) =			0.2459	(91)
MIT	18.9270	19.1752	19.5459	19.9733	20.2180	20.3009	20.3096	20.3105	20.2645	19.9089	19.3379	18.8934	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9270	19.1752	19.5459	19.9733	20.2180	20.3009	20.3096	20.3105	20.2645	19.9089	19.3379	18.8934	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9891	0.9665	0.8921	0.7347	0.5219	0.3594	0.4081	0.6890	0.9387	0.9907	0.9972	(94)
Useful gains	610.7137	735.4241	849.7039	907.9579	813.1156	570.1850	375.2047	393.6117	596.0540	680.5810	607.8914	572.6885	(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													
	1541.3661	1499.8767	1366.6713	1142.8481	876.4823	577.7708	375.9603	395.1117	628.5822	957.8693	1266.8423	1530.1487	(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													
	692.4054	513.7122	384.6237	169.1209	47.1449	0.0000	0.0000	0.0000	0.0000	206.3025	474.4446	712.3504	(98)
Space heating												3200.1046	(98)
Space heating per m2											(98) / (4) =	31.4816	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	952.6663	749.9714	767.8843	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9575	0.9815	0.9721	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	912.1470	736.1243	746.4707	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1374.1969	1315.7046	1224.1529	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	332.6759	431.2077	355.3956	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1119.2792	(104)
Cooled fraction											fC = cooled area / (4) =	0.3935	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	32.7276	42.4208	34.9627	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												110.1111	(107)
Space cooling per m2												1.0832	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	3200.1046	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	3360.1098	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1934.0428	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	2030.7449	(310a)
Electricity used for heat distribution	53.9085	(313)
Cooling System Energy Efficiency Ratio	4.0000	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	27.5278	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)		
mechanical ventilation fans (SFP = 0.6625)	238.2600	(330a)
Total electricity for the above, kWh/year	238.2600	(331)
Electricity for lighting (calculated in Appendix L)	407.7268	(332)
Total delivered energy for all uses	6064.3693	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	5674.5839	0.2160	1225.7101	(367)
Electrical energy for heat distribution	53.9085	0.5190	27.9785	(372)
Total CO2 associated with community systems			1253.6887	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1253.6887	(376)
Space cooling	27.5278	0.5190	14.2869	(377)
Pumps and fans	238.2600	0.5190	123.6569	(378)
Energy for lighting	407.7268	0.5190	211.6102	(379)
Total CO2, kg/year			1603.2427	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			15.7700	(384)

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

DER		15.7700	ZC1
Total Floor Area	TFA	101.6500	
Assumed number of occupants	N	2.7543	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0968	ZC2
CO2 emissions from cooking, equation (L16)		1.8210	ZC3
Total CO2 emissions		32.6878	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		32.6878	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)	
Ground floor	101.6500 (1b)	x	2.9000 (2b)	=	294.7850	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.7850	(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) =	0.1357	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3857	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3278	(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	0.4180	0.4098	0.4016	0.3606	0.3524	0.3114	0.3114	0.3033	0.3278	0.3524	0.3688	0.3852	(22b)
Effective ac	0.5874	0.5840	0.5806	0.5650	0.5621	0.5485	0.5485	0.5460	0.5537	0.5621	0.5680	0.5742	(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			2.1800	1.0000	2.1800			(26)
TER Opening Type (Uw = 1.40)			23.2300	1.3258	30.7973			(27)
Heat Loss Floor 1			101.6500	0.1300	13.2145			(28a)
External Wall	107.7600	23.2300	84.5300	0.1800	15.2154			(29a)
Sheltered Wall	22.8800	2.1800	20.7000	0.1800	3.7260			(29a)
Total net area of external elements Aum(A, m2)			232.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.1332			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.0833	(36)
Total fabric heat loss					(33) + (36) =		79.2165	(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	57.1378	56.8078	56.4843	54.9650	54.6808	53.3575	53.3575	53.1125	53.8672	54.6808	55.2558	55.8570	(38)
Heat transfer coeff	136.3543	136.0243	135.7009	134.1816	133.8973	132.5741	132.5741	132.3290	133.0837	133.8973	134.4724	135.0735	(39)
Average = Sum(39)m / 12 =												134.1802	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3414	1.3382	1.3350	1.3200	1.3172	1.3042	1.3042	1.3018	1.3092	1.3172	1.3229	1.3288	(40)
HLP (average)												1.3200	(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		2.7543 (42)
Average daily hot water use (litres/day)		99.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5757	105.5911	101.6065	97.6220	93.6374	89.6528	89.6528	93.6374	97.6220	101.6065	105.5911	109.5757	(44)
Energy conte	162.4976	142.1214	146.6566	127.8587	122.6835	105.8665	98.1009	112.5722	113.9167	132.7589	144.9168	157.3702	(45)
Energy content (annual)										Total = Sum(45)m =		1567.3200	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3746	21.3182	21.9985	19.1788	18.4025	15.8800	14.7151	16.8858	17.0875	19.9138	21.7375	23.6055	(46)

Water storage loss:		
Store volume		1.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		0.2134 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.1152 (55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
3.5715 3.2259 3.5715 3.4563 3.5715 3.4563 3.5715 3.5715 3.4563 3.5715 3.4563 3.5715 (56)
If cylinder contains dedicated solar storage
3.5715 3.2259 3.5715 3.4563 3.5715 3.4563 3.5715 3.5715 3.4563 3.5715 3.4563 3.5715 (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
189.3314 166.3585 173.4904 153.8270 149.5174 131.8348 124.9348 139.4061 139.8850 159.5928 170.8850 184.2041 (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
189.3314 166.3585 173.4904 153.8270 149.5174 131.8348 124.9348 139.4061 139.8850 159.5928 170.8850 184.2041 (64)
Total per year (kWh/year) = Sum(64)m = 1883.2673 (64)
Heat gains from water heating, kWh/month
75.4975 66.6450 70.2304 63.2876 62.2594 55.9752 54.0857 58.8974 58.6519 65.6094 68.9594 73.7927 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0872	20.5058	16.6765	12.6252	9.4375	7.9675	8.6092	11.1905	15.0199	19.0712	22.2589	23.7288	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.9679	261.6552	254.8834	240.4669	222.2687	205.1650	193.7386	191.0513	197.8232	212.2396	230.4378	247.5416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	(71)
Water heating gains (Table 5)													
	101.4752	99.1741	94.3957	87.8995	83.6819	77.7434	72.6958	79.1631	81.4610	88.1847	95.7770	99.1837	(72)
Total internal gains													
	450.8446	448.6494	433.2698	408.3058	382.7024	358.1901	342.3578	348.7192	361.6183	386.8098	415.7880	437.7684	(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	2.8400	10.6334	0.6300	0.7000	0.7700	9.2292	(74)
South	4.8400	46.7521	0.6300	0.7000	0.7700	69.1541	(78)
West	15.5500	19.6403	0.6300	0.7000	0.7700	93.3361	(80)

Solar gains	171.7193	313.4792	474.9308	649.7360	772.2108	783.1153	748.3707	656.5052	536.4567	359.8056	209.7357	144.2044	(83)
Total gains	622.5639	762.1286	908.2006	1058.0418	1154.9131	1141.3054	1090.7285	1005.2244	898.0750	746.6154	625.5237	581.9729	(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	51.7697	51.8953	52.0190	52.6080	52.7197	53.2459	53.2459	53.3445	53.0420	52.7197	52.4943	52.2606	
alpha	4.4513	4.4597	4.4679	4.5072	4.5146	4.5497	4.5497	4.5563	4.5361	4.5146	4.4996	4.4840	
util living area													
	0.9977	0.9941	0.9827	0.9442	0.8481	0.6821	0.5199	0.5797	0.8284	0.9713	0.9952	0.9983	(86)
MIT	19.5216	19.7205	20.0390	20.4402	20.7617	20.9371	20.9854	20.9766	20.8435	20.4016	19.8833	19.4894	(87)
Th 2	19.8085	19.8111	19.8135	19.8252	19.8274	19.8375	19.8375	19.8394	19.8336	19.8274	19.8229	19.8183	(88)
util rest of house													
	0.9969	0.9920	0.9764	0.9233	0.7935	0.5819	0.3901	0.4460	0.7470	0.9566	0.9931	0.9977	(89)
MIT 2	17.8550	18.1465	18.6093	19.1832	19.6017	19.7977	19.8326	19.8304	19.7124	19.1428	18.3934	17.8146	(90)
Living area fraction										fLA = Living area / (4) =		0.2459	(91)
MIT	18.2648	18.5336	18.9610	19.4924	19.8870	20.0779	20.1161	20.1123	19.9905	19.4524	18.7598	18.2265	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2648	18.5336	18.9610	19.4924	19.8870	20.0779	20.1161	20.1123	19.9905	19.4524	18.7598	18.2265	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9887	0.9702	0.9159	0.7967	0.6041	0.4222	0.4789	0.7597	0.9502	0.9903	0.9965	(94)
Useful gains	619.6665	753.5535	881.1419	969.0245	920.1033	689.4659	460.5142	481.4456	682.2360	709.4166	619.4672	579.9424	(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													
	1904.1674	1854.5053	1690.9632	1421.2989	1096.2205	726.2295	466.1447	491.2484	783.9359	1185.3079	1567.9274	1894.6088	(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													
	955.6687	739.8396	602.5071	325.6376	131.0312	0.0000	0.0000	0.0000	0.0000	354.0631	682.8914	978.1118	(98)
Space heating												4769.7504	(98)
Space heating per m2											(98) / (4) =	46.9233	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												5101.3374	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	955.6687	739.8396	602.5071	325.6376	131.0312	0.0000	0.0000	0.0000	0.0000	354.0631	682.8914	978.1118	(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)													
	1022.1055	791.2723	644.3926	348.2755	140.1404	0.0000	0.0000	0.0000	0.0000	378.6772	730.3651	1046.1089	(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													
	189.3314	166.3585	173.4904	153.8270	149.5174	131.8348	124.9348	139.4061	139.8850	159.5928	170.8850	184.2041	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.5370	88.3258	87.8660	86.7674	84.4642	79.8000	79.8000	79.8000	79.8000	86.8805	88.1347	88.6169	(217)
Fuel for water heating, kWh/month													
	213.8445	188.3463	197.4489	177.2867	177.0187	165.2065	156.5599	174.6944	175.2944	183.6922	193.8908	207.8656	(219)
Water heating fuel used												2211.1489	(219)
Annual totals kWh/year													
Space heating fuel - main system												5101.3374	(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)												407.7268	(232)
Total delivered energy for all uses												7795.2131	(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	5101.3374	0.2160	1101.8889	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2211.1489	0.2160	477.6082	(264)
Space and water heating			1579.4970	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	407.7268	0.5190	211.6102	(268)
Total CO2, kg/m2/year			1830.0323	(272)
Emissions per m2 for space and water heating			15.5386	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0818	(272b)
Emissions per m2 for pumps and fans			0.3829	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5386 * 1.00) + 2.0818 + 0.3829, rounded to 2 d.p.			18.0000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.6500 (1b)	x	2.9000 (2b)	=	294.7850	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.7850	(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) =	0.1357	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.2857	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2428	(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	0.3096	0.3035	0.2975	0.2671	0.2611	0.2307	0.2307	0.2246	0.2428	0.2611	0.2732	0.2853	(22b)
Effective ac	0.5479	0.5461	0.5442	0.5357	0.5341	0.5266	0.5266	0.5252	0.5295	0.5341	0.5373	0.5407	(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)			23.9600	1.1450	27.4351			(27)
Opening Type 6			2.1800	1.4000	3.0520			(26)
Heat Loss Floor 1			101.6500	0.1100	11.1815			(28a)
External Wall	107.7600	23.9600	83.8000	0.1700	14.2460			(29a)
Sheltered Wall	22.8800	2.1800	20.7000	0.1700	3.5190			(29a)
Total net area of external elements Aum(A, m2)			232.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.4336			(33)
Party Walls			13.3600	0.0000	0.0000			(32)
Party Ceiling 1			139.1300					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	20.3544	(36)
Total fabric heat loss (33) + (36) =	79.7880	(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	53.3023	53.1212	52.9438	52.1102	51.9542	51.2282	51.2282	51.0937	51.5078	51.9542	52.2697	52.5996	(38)
Heat transfer coeff	133.0903	132.9092	132.7318	131.8982	131.7422	131.0162	131.0162	130.8817	131.2958	131.7422	132.0577	132.3876	(39)
Average = Sum(39)m / 12 =												131.8974	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3093	1.3075	1.3058	1.2976	1.2960	1.2889	1.2889	1.2876	1.2916	1.2960	1.2991	1.3024	(40)
HLP (average)												1.2976	(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	2.7543	(42)
Average daily hot water use (litres/day)	99.6142	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5757	105.5911	101.6065	97.6220	93.6374	89.6528	89.6528	93.6374	97.6220	101.6065	105.5911	109.5757	(44)
Energy conte	162.4976	142.1214	146.6566	127.8587	122.6835	105.8665	98.1009	112.5722	113.9167	132.7589	144.9168	157.3702	(45)
Energy content (annual)										Total = Sum(45)m =		1567.3200	(45)
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(59)
Heat gains from water heating, kWh/month												
	34.5307	30.2008	31.1645	27.1700	26.0702	22.4966	20.8464	23.9216	24.2073	28.2113	30.7948	33.4412 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0872	20.5058	16.6765	12.6252	9.4375	7.9675	8.6092	11.1905	15.0199	19.0712	22.2589	23.7288	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.9679	261.6552	254.8834	240.4669	222.2687	205.1650	193.7386	191.0513	197.8232	212.2396	230.4378	247.5416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	(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)													
	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	(71)
Water heating gains (Table 5)													
	46.4123	44.9417	41.8878	37.7361	35.0407	31.2453	28.0194	32.1527	33.6212	37.9184	42.7706	44.9478	(72)
Total internal gains													
	392.7817	391.4170	377.7619	355.1424	331.0611	308.6920	294.6814	298.7088	310.7786	333.5435	359.7816	380.5325	(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	2.9300	10.6334	0.5000	0.8000	0.7700	8.6364	(74)
South	4.9900	46.7521	0.5000	0.8000	0.7700	64.6688	(78)
West	16.0400	19.6403	0.5000	0.8000	0.7700	87.3263	(80)

Solar gains	160.6314	293.2441	444.2874	607.8312	722.4194	732.6256	700.1192	614.1688	501.8497	336.5839	196.1942	134.8924	(83)
Total gains	553.4131	684.6611	822.0493	962.9736	1053.4805	1041.3177	994.8006	912.8775	812.6283	670.1274	555.9758	515.4249	(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	53.0394	53.1116	53.1827	53.5188	53.5821	53.8791	53.8791	53.9344	53.7643	53.5821	53.4541	53.3209	
alpha	4.5360	4.5408	4.5455	4.5679	4.5721	4.5919	4.5919	4.5956	4.5843	4.5721	4.5636	4.5547	
util living area													
	0.9986	0.9961	0.9879	0.9580	0.8765	0.7226	0.5586	0.6228	0.8625	0.9802	0.9970	0.9990	(86)
MIT	19.5006	19.6907	20.0005	20.3941	20.7283	20.9225	20.9813	20.9698	20.8153	20.3581	19.8475	19.4635	(87)
Th 2	19.8336	19.8349	19.8363	19.8427	19.8439	19.8495	19.8495	19.8506	19.8474	19.8439	19.8415	19.8390	(88)
util rest of house													
	0.9981	0.9948	0.9834	0.9414	0.8279	0.6235	0.4230	0.4847	0.7892	0.9696	0.9957	0.9987	(89)
MIT 2	18.4733	18.6638	18.9722	19.3598	19.6633	19.8148	19.8450	19.8423	19.7454	19.3327	18.8260	18.4405	(90)
Living area fraction									fLA = Living area / (4) =			0.2459	(91)
MIT	18.7260	18.9164	19.2251	19.6142	19.9253	20.0872	20.1245	20.1196	20.0085	19.5849	19.0772	18.6921	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7260	18.9164	19.2251	19.6142	19.9253	20.0872	20.1245	20.1196	20.0085	19.5849	19.0772	18.6921	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9933	0.9802	0.9374	0.8319	0.6458	0.4567	0.5190	0.8014	0.9664	0.9945	0.9982	(94)
Useful gains	552.0157	680.0450	805.7641	902.6482	876.3999	672.4541	454.3722	473.8052	651.2064	647.6130	552.9132	514.4771	(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													
	1919.9562	1862.9069	1689.0285	1413.1817	1083.6149	718.9157	461.7660	486.8287	775.7642	1183.6893	1581.6830	1918.5712	(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													
	1017.7477	794.8832	657.1487	367.5842	154.1680	0.0000	0.0000	0.0000	0.0000	398.8407	740.7142	1044.6460	(98)
Space heating												5175.7327	(98)
Space heating per m2											(98) / (4) =	50.9172	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1231.5520	969.5197	994.7011	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8493	0.9113	0.8816	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1045.9370	883.5639	876.9403	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1323.0618	1266.3912	1172.5055	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	199.5298	284.8235	219.9005	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  704.2539 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   49.8825   71.2059   54.9751    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                  176.0635 (107)
Space cooling per m2                                                                                             1.7321 (108)
Energy for space heating                                                                                        50.9172 (99)
Energy for space cooling                                                                                         1.7321 (108)
Total                                                                                                           52.6492 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                        52.6 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.6500 (1b)	x	2.9000 (2b)	=	294.7850	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.7850	(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) =	0.1357	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3857	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3278	(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	0.4180	0.4098	0.4016	0.3606	0.3524	0.3114	0.3114	0.3033	0.3278	0.3524	0.3688	0.3852	(22b)
Effective ac	0.5874	0.5840	0.5806	0.5650	0.5621	0.5485	0.5485	0.5460	0.5537	0.5621	0.5680	0.5742	(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			2.1800	1.0000	2.1800			(26)
TER Opening Type (Uw = 1.40)			23.2300	1.3258	30.7973			(27)
Heat Loss Floor 1			101.6500	0.1300	13.2145			(28a)
External Wall	107.7600	23.2300	84.5300	0.1800	15.2154			(29a)
Sheltered Wall	22.8800	2.1800	20.7000	0.1800	3.7260			(29a)
Total net area of external elements Aum(A, m2)			232.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.1332			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.0833	(36)
Total fabric heat loss					(33) + (36) =		79.2165	(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	57.1378	56.8078	56.4843	54.9650	54.6808	53.3575	53.3575	53.1125	53.8672	54.6808	55.2558	55.8570	(38)
Heat transfer coeff	136.3543	136.0243	135.7009	134.1816	133.8973	132.5741	132.5741	132.3290	133.0837	133.8973	134.4724	135.0735	(39)
Average = Sum(39)m / 12 =												134.1802	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3414	1.3382	1.3350	1.3200	1.3172	1.3042	1.3042	1.3018	1.3092	1.3172	1.3229	1.3288	(40)
HLP (average)												1.3200	(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		2.7543 (42)
Average daily hot water use (litres/day)		99.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5757	105.5911	101.6065	97.6220	93.6374	89.6528	89.6528	93.6374	97.6220	101.6065	105.5911	109.5757	(44)
Energy conte	162.4976	142.1214	146.6566	127.8587	122.6835	105.8665	98.1009	112.5722	113.9167	132.7589	144.9168	157.3702	(45)
Energy content (annual)										Total = Sum(45)m =		1567.3200	(45)
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Heat gains from water heating, kWh/month													
	34.5307	30.2008	31.1645	27.1700	26.0702	22.4966	20.8464	23.9216	24.2073	28.2113	30.7948	33.4412	(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	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0872	20.5058	16.6765	12.6252	9.4375	7.9675	8.6092	11.1905	15.0199	19.0712	22.2589	23.7288	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.9679	261.6552	254.8834	240.4669	222.2687	205.1650	193.7386	191.0513	197.8232	212.2396	230.4378	247.5416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	(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)													
	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	(71)
Water heating gains (Table 5)													
	46.4123	44.9417	41.8878	37.7361	35.0407	31.2453	28.0194	32.1527	33.6212	37.9184	42.7706	44.9478	(72)
Total internal gains													
	392.7817	391.4170	377.7619	355.1424	331.0611	308.6920	294.6814	298.7088	310.7786	333.5435	359.7816	380.5325	(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	2.8400	10.6334	0.6300	0.7000	0.7700	9.2292	(74)
South	4.8400	46.7521	0.6300	0.7000	0.7700	69.1541	(78)
West	15.5500	19.6403	0.6300	0.7000	0.7700	93.3361	(80)

Solar gains	171.7193	313.4792	474.9308	649.7360	772.2108	783.1153	748.3707	656.5052	536.4567	359.8056	209.7357	144.2044	(83)
Total gains	564.5010	704.8961	852.6927	1004.8784	1103.2718	1091.8074	1043.0522	955.2140	847.2353	693.3490	569.5172	524.7370	(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	51.7697	51.8953	52.0190	52.6080	52.7197	53.2459	53.2459	53.3445	53.0420	52.7197	52.4943	52.2606	
alpha	4.4513	4.4597	4.4679	4.5072	4.5146	4.5497	4.5497	4.5563	4.5361	4.5146	4.4996	4.4840	
util living area													
	0.9985	0.9957	0.9863	0.9528	0.8645	0.7041	0.5410	0.6049	0.8507	0.9780	0.9967	0.9989	(86)
MIT	19.4702	19.6706	19.9930	20.4030	20.7386	20.9284	20.9829	20.9723	20.8227	20.3594	19.8342	19.4386	(87)
Th 2	19.8085	19.8111	19.8135	19.8252	19.8274	19.8375	19.8375	19.8394	19.8336	19.8274	19.8229	19.8183	(88)
util rest of house													
	0.9979	0.9941	0.9813	0.9345	0.8130	0.6038	0.4072	0.4678	0.7740	0.9663	0.9953	0.9985	(89)
MIT 2	18.4235	18.6252	18.9466	19.3530	19.6559	19.8060	19.8335	19.8320	19.7373	19.3203	18.7982	18.3995	(90)
Living area fraction									fLA = Living area / (4) =			0.2459	(91)
MIT	18.6810	18.8823	19.2040	19.6112	19.9222	20.0820	20.1162	20.1124	20.0042	19.5758	19.0530	18.6551	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6810	18.8823	19.2040	19.6112	19.9222	20.0820	20.1162	20.1124	20.0042	19.5758	19.0530	18.6551	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9924	0.9778	0.9303	0.8178	0.6266	0.4405	0.5019	0.7872	0.9629	0.9939	0.9980	(94)
Useful gains	562.9253	699.5686	833.7352	934.8773	902.2470	684.1789	459.4729	479.4361	666.9512	667.6278	566.0544	523.6764	(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													
	1960.9068	1901.9345	1723.9374	1437.2479	1100.9253	726.7754	466.1554	491.2614	785.7584	1201.8419	1607.3468	1952.4976	(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													
	1040.0982	807.9899	662.3105	361.7068	147.8166	0.0000	0.0000	0.0000	0.0000	397.4552	749.7305	1063.0429	(98)
Space heating												5230.1507	(98)
Space heating per m2											(98) / (4) =	51.4525	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1246.1961	981.0480	1005.7004	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8595	0.9181	0.8898	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1071.0862	900.6834	894.8736	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1382.0757	1322.7891	1221.9896	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	223.9125	314.0466	243.3743	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												781.3334	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   55.9781   78.5117   60.8436    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          195.3333 (107)
Space cooling per m2                                                                                                     1.9216 (108)
Energy for space heating                                                                                                51.4525 (99)
Energy for space cooling                                                                                                 1.9216 (108)
Total                                                                                                                   53.3742 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     61.4 (109)
```

Appendix B – Be Green Sample SAP Reports

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Flat 1 - Phase 3	**Issued on Date**	25/09/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Phase 3, Flat 1, 13 Netherhall Gardens, London, NW3		

SAP Rating	85 B	**DER**	11.29	**TER**	23.58
Environmental	90 B	**% DER<TER**	52.12		
CO_2 Emissions (t/year)	1.26	**DFEE**	52.61	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.60		

Assessor Details	Mr. Ioannis Protonotarios, Ioannis Protonotarios, Tel: 02084469696, ioannis.p@mendickwaring.co.uk	**Assessor ID**	Y078-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity (c)		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	23.58	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.29	$kgCO_2/m^2$	Pass
	-12.29 (-52.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.19	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.61	$kWh/m^2/yr$	
	-5.6 (-9.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.21 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Community heating scheme	-
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 0.25 kWh/day Permitted by DBSCG 0.29		Pass
Primary pipework insulated	No primary pipework		

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room stats		Pass
Hot water controls	No cylinderstat		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous supply and extract system			
Specific fan power	0.53		
Maximum	1.5		Pass
MVHR efficiency	94	%	
Minimum	70	%	Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Slight		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	13.70 m², No overhang 28.87 m², No overhang 2.16 m², No overhang		
Air change rate	4.00 ach		
Blinds/curtains	None		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.11	W/m²K
Floor U-value	0.11	W/m²K
Air permeability	3.0	m³/m²h
Photovoltaic array	0.92	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

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

Design SAP
elmhurst energy

Property Reference	Flat 1 - Phase 3	**Issued on Date**	25/09/2022
Assessment Reference	1	**Prop Type Ref**	
Property	Phase 3, Flat 1, 13 Netherhall Gardens, London, NW3		

SAP Rating	85 B	**DER**	11.29	**TER**	23.58
Environmental	90 B	**% DER<TER**	52.12		
CO_2 Emissions (t/year)	1.26	**DFEE**	52.61	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.60		

Assessor Details	Mr. Ioannis Protonotarios, Ioannis Protonotarios, Tel: 02084469696, ioannis.p@mendickwaring.co.uk	**Assessor ID**	Y078-0001
Client			

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 145 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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 23.58 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.29 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.21 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 0.25 kWh/day
Permitted by DBSCG 0.29 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

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

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.53
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 13.70 m², No overhang
Windows facing East: 28.87 m², No overhang
Windows facing South: 2.16 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.11 W/m²K
Air permeability 3.0 m³/m²h
Photovoltaic array 0.92 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)	
Ground floor	75.2400	(1b)	x 2.9000	(2b) =	218.1960	(1b) - (3b)
First floor	69.6700	(1c)	x 2.4000	(2c) =	167.2080	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	385.4040	(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					3.0000	
Infiltration rate					0.1500	(18)
Number of sides sheltered					2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

Effective ac	0.2631	0.2599	0.2567	0.2408	0.2376	0.2216	0.2216	0.2184	0.2280	0.2376	0.2439	0.2503	(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)			44.7300	1.1450	51.2176			(27)
Opening Type 6			2.1800	1.4000	3.0520			(26)
Floor 1			75.2400	0.1100	8.2764			(28a)
External Wall	178.4400	44.7300	133.7100	0.1700	22.7307			(29a)
Sheltered Wall	27.0000	2.1800	24.8200	0.1700	4.2194			(29a)
External Roof 1	9.8400		9.8400	0.1100	1.0824			(30)
Total net area of external elements Aum(A, m2)			290.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.5785			(33)
Party Walls			22.0300	0.0000	0.0000			(32)
Party Ceiling 1			139.1300					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	23.1811	(36)
Total fabric heat loss (33) + (36) =	113.7596	(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	33.4572	33.0518	32.6464	30.6194	30.2140	28.1870	28.1870	27.7816	28.9978	30.2140	31.0248	31.8356	(38)
Heat transfer coeff	147.2167	146.8113	146.4059	144.3789	143.9735	141.9466	141.9466	141.5412	142.7574	143.9735	144.7843	145.5951	(39)
Average = Sum(39)m / 12 =												144.2776	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0159	1.0131	1.0103	0.9963	0.9935	0.9795	0.9795	0.9768	0.9851	0.9935	0.9991	1.0047	(40)
HLP (average)												0.9956	(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	2.9259 (42)
Average daily hot water use (litres/day)	103.6903 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.0593	109.9117	105.7641	101.6165	97.4689	93.3213	93.3213	97.4689	101.6165	105.7641	109.9117	114.0593	(44)
Energy conte	169.1467	147.9368	152.6575	133.0905	127.7035	110.1984	102.1150	117.1785	118.5780	138.1912	150.8465	163.8095	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1631.4520	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.3720	22.1905	22.8986	19.9636	19.1555	16.5298	15.3173	17.5768	17.7867	20.7287	22.6270	24.5714	(46)
Water storage loss:													
Store volume												1.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0516	(51)
Volume factor from Table 2a												4.9324	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2543	(55)
Total storage loss													
	7.8839	7.1210	7.8839	7.6296	7.8839	7.6296	7.8839	7.8839	7.6296	7.8839	7.6296	7.8839	(56)
If cylinder contains dedicated solar storage													
	7.8839	7.1210	7.8839	7.6296	7.8839	7.6296	7.8839	7.8839	7.6296	7.8839	7.6296	7.8839	(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													
	200.2930	176.0689	183.8038	163.2321	158.8498	140.3400	133.2613	148.3248	148.7196	169.3375	180.9881	194.9558	(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													
	200.2930	176.0689	183.8038	163.2321	158.8498	140.3400	133.2613	148.3248	148.7196	169.3375	180.9881	194.9558	(64)
									Total per year (kWh/year) = Sum(64)m =			1998.1748	(64)
Heat gains from water heating, kWh/month													
	81.1583	71.6947	75.6757	68.3659	67.3785	60.7543	58.8703	63.8789	63.5405	70.8656	74.2697	79.3837	(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	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0761	24.9370	20.2801	15.3533	11.4768	9.6892	10.4695	13.6087	18.2656	23.1923	27.0689	28.8565	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.9288	318.1968	309.9616	292.4299	270.2992	249.4995	235.6040	232.3360	240.5712	258.1029	280.2336	301.0334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	(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)													
	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	(71)
Water heating gains (Table 5)													
	109.0838	106.6885	101.7146	94.9526	90.5625	84.3809	79.1268	85.8587	88.2506	95.2495	103.1524	106.6986	(72)
Total internal gains													
	518.9774	516.7109	498.8450	469.6244	439.2271	410.4582	392.0888	398.6920	413.9760	443.4334	477.3435	503.4770	(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	13.7000	10.6334	0.5000	0.8000	0.7700	40.3818	(74)
East	28.8700	19.6403	0.5000	0.8000	0.7700	157.1764	(76)
South	2.1600	46.7521	0.5000	0.8000	0.7700	27.9929	(78)

Solar gains	225.5511	430.4872	695.8920	1015.1329	1257.5769	1296.4305	1230.3178	1045.4705	807.5868	506.1506	278.9778	187.1069	(83)
Total gains	744.5284	947.1981	1194.7370	1484.7573	1696.8040	1706.8887	1622.4066	1444.1626	1221.5627	949.5840	756.3213	690.5839	(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	68.3563	68.5451	68.7349	69.6999	69.8961	70.8942	70.8942	71.0973	70.4916	69.8961	69.5047	69.1177	
alpha	5.5571	5.5697	5.5823	5.6467	5.6597	5.7263	5.7263	5.7398	5.6994	5.6597	5.6336	5.6078	
util living area													
	0.9991	0.9963	0.9819	0.9093	0.7342	0.5254	0.3840	0.4483	0.7464	0.9708	0.9975	0.9994	(86)
MIT	19.8609	20.0562	20.3684	20.7354	20.9379	20.9922	20.9989	20.9975	20.9510	20.6161	20.1616	19.8311	(87)
Th 2	20.0701	20.0724	20.0747	20.0864	20.0887	20.1004	20.1004	20.1028	20.0957	20.0887	20.0841	20.0794	(88)
util rest of house													
	0.9988	0.9951	0.9759	0.8829	0.6784	0.4546	0.3060	0.3622	0.6703	0.9573	0.9965	0.9992	(89)
MIT 2	18.5347	18.8215	19.2746	19.7893	20.0333	20.0957	20.1000	20.1018	20.0594	19.6421	18.9848	18.4980	(90)
Living area fraction									fLA = Living area / (4) =			0.3450	(91)
MIT	18.9923	19.2475	19.6520	20.1157	20.3454	20.4050	20.4102	20.4108	20.3670	19.9782	19.3908	18.9580	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9923	19.2475	19.6520	20.1157	20.3454	20.4050	20.4102	20.4108	20.3670	19.9782	19.3908	18.9580	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9935	0.9724	0.8838	0.6948	0.4789	0.3329	0.3920	0.6945	0.9552	0.9953	0.9988	(94)
Useful gains	743.2247	941.0869	1161.7298	1312.2456	1178.9363	817.3681	540.1729	566.0757	848.3372	907.0754	752.8023	689.7773	(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													
	2162.9512	2106.3792	1925.5295	1619.3133	1244.7120	824.0023	540.8417	567.6996	894.6641	1350.2087	1779.5191	2148.6862	(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													
	1056.2765	783.0764	568.2670	221.0887	48.9371	0.0000	0.0000	0.0000	0.0000	329.6912	739.2361	1085.4282	(98)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 4832.0012 (98)
Space heating per m2 (98) / (4) = 33.3448 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1334.2977	1050.4045	1075.7128	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9721	0.9882	0.9785	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1297.0518	1038.0180	1052.5951	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2110.2991	2008.9815	1802.6286	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	585.5380	722.3969	558.0250	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1865.9599	(104)
Cooled fraction										fC = cooled area / (4) =		0.2760	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.4070	49.8514	38.5084	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												128.7668	(107)
Space cooling per m2												0.8886	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (301)
Fraction of space heat from community system 1.0000 (302)
Fraction of heat from community Heat pump 1.0000 (303a)
Fraction of total space heat from community Heat pump 1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating 1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating 1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system 1.0500 (306)
Space heating:
Annual space heating requirement 4832.0012 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05 5073.6012 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0.0000 (308)
Space heating fuel for secondary/supplementary system 0.0000 (309)

Water heating
Annual water heating requirement 1998.1748 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05 2098.0836 (310a)
Electricity used for heat distribution 71.7168 (313)
Cooling System Energy Efficiency Ratio 4.0000 (314)
Space cooling (if there is a fixed cooling system, if not enter 0) 32.1917 (315)
Annual totals kWh/year

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)
mechanical ventilation fans (SFP = 0.6625) 311.5028 (330a)
Total electricity for the above, kWh/year 311.5028 (331)
Electricity for lighting (calculated in Appendix L) 495.8333 (332)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.92 * 853 * 1.00) = -627.8300 (333)
Total delivered energy for all uses 7383.3826 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			250.0000	(367a)
Space heating from Heat pump	2868.6739	0.5190	1488.8418	(367)
Electrical energy for heat distribution	71.7168	0.5190	37.2210	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1526.0628	(373)
Space and water heating			1526.0628	(376)
Space cooling	32.1917	0.5190	16.7075	(377)
Pumps and fans	311.5028	0.5190	161.6699	(378)
Energy for lighting	495.8333	0.5190	257.3375	(379)
Energy saving/generation technologies				
PV Unit	-627.8300	0.5190	-325.8438	(380)
Total CO2, kg/year			1635.9340	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			11.2900	(384)

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

DER		11.2900	ZC1
Total Floor Area	TFA	144.9100	
Assumed number of occupants	N	2.9259	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.8784	ZC2
CO2 emissions from cooking, equation (L16)		1.3058	ZC3
Total CO2 emissions		25.4741	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		25.4741	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)	
Ground floor	75.2400	(1b)	x 2.9000	(2b) =	218.1960	(1b) - (3b)
First floor	69.6700	(1c)	x 2.4000	(2c) =	167.2080	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		385.4040	(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) =	0.1038	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3538	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3007	(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	0.3834	0.3759	0.3684	0.3308	0.3233	0.2857	0.2857	0.2782	0.3007	0.3233	0.3383	0.3533	(22b)
Effective ac	0.5735	0.5706	0.5679	0.5547	0.5523	0.5408	0.5408	0.5387	0.5452	0.5523	0.5572	0.5624	(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			2.1800	1.0000	2.1800			(26)
TER Opening Type (Uw = 1.40)			34.0500	1.3258	45.1420			(27)
Floor 1			75.2400	0.1300	9.7812			(28a)
External Wall	178.4400	34.0500	144.3900	0.1800	25.9902			(29a)
Sheltered Wall	27.0000	2.1800	24.8200	0.1800	4.4676			(29a)
External Roof 1	9.8400		9.8400	0.1300	1.2792			(30)
Total net area of external elements Aum(A, m2)			290.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.8402			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0241	(36)
Total fabric heat loss					(33) + (36) =		99.8643	(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	72.9402	72.5772	72.2213	70.5500	70.2373	68.7817	68.7817	68.5121	69.3424	70.2373	70.8699	71.5312	(38)
Heat transfer coeff	172.8045	172.4415	172.0857	170.4144	170.1017	168.6460	168.6460	168.3765	169.2067	170.1017	170.7343	171.3956	(39)
Average = Sum(39)m / 12 =												170.4129	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1925	1.1900	1.1875	1.1760	1.1738	1.1638	1.1638	1.1619	1.1677	1.1738	1.1782	1.1828	(40)
HLP (average)												1.1760	(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												2.9259	(42)
Average daily hot water use (litres/day)												103.6903	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.0593	109.9117	105.7641	101.6165	97.4689	93.3213	93.3213	97.4689	101.6165	105.7641	109.9117	114.0593	(44)
Energy conte	169.1467	147.9368	152.6575	133.0905	127.7035	110.1984	102.1150	117.1785	118.5780	138.1912	150.8465	163.8095	(45)
Energy content (annual)										Total = Sum(45)m =		1631.4520	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3720	22.1905	22.8986	19.9636	19.1555	16.5298	15.3173	17.5768	17.7867	20.7287	22.6270	24.5714	(46)
Water storage loss:													
Store volume												1.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2134	(48)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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  Temperature factor from Table 2b                                                                                0.5400 (49)
Enter (49) or (54) in (55)                                                                                        0.1152 (55)
Total storage loss
                3.5715     3.2259     3.5715     3.4563     3.5715     3.4563     3.5715     3.5715     3.4563     3.5715     3.4563     3.5715 (56)
If cylinder contains dedicated solar storage
                3.5715     3.2259     3.5715     3.4563     3.5715     3.4563     3.5715     3.5715     3.4563     3.5715     3.4563     3.5715 (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
              195.9806   172.1738   179.4914   159.0588   154.5374   136.1667   128.9489   144.0124   144.5462   165.0251   176.8148   190.6434 (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
              195.9806   172.1738   179.4914   159.0588   154.5374   136.1667   128.9489   144.0124   144.5462   165.0251   176.8148   190.6434 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1947.3993 (64)
Heat gains from water heating, kWh/month
               77.7084    68.5786    72.2257    65.0272    63.9285    57.4156    55.4204    60.4290    60.2018    67.4157    70.9311    75.9338 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954   146.2954 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                28.0761    24.9370    20.2801    15.3533    11.4768     9.6892    10.4695    13.6087    18.2656    23.1923    27.0689    28.8565 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               314.9288   318.1968   309.9616   292.4299   270.2992   249.4995   235.6040   232.3360   240.5712   258.1029   280.2336   301.0334 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295    37.6295 (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)
              -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363  -117.0363 (71)
Water heating gains (Table 5)
               104.4467   102.0515    97.0776    90.3156    85.9254    79.7439    74.4897    81.2217    83.6136    90.6125    98.5154   102.0615 (72)
Total internal gains
               517.3403   515.0739   497.2079   467.9874   437.5900   408.8211   390.4518   397.0550   412.3389   441.7963   475.7065   501.8399 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data       factor                W
                                                           W/m2         or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------
North                                  10.4300            10.6334           0.6300           0.7000           0.7700           33.8944 (74)
East                                   21.9800            19.6403           0.6300           0.7000           0.7700          131.9310 (76)
South                                   1.6400            46.7521           0.6300           0.7000           0.7700           23.4324 (78)
-------------------------------------------------------------------------------------------------------

Solar gains    189.2578   361.2351   583.9805   851.9253  1055.4196  1088.0379  1032.5482   877.3970   677.7281   424.7369   234.0909   156.9974 (83)
Total gains    706.5981   876.3091  1081.1884  1319.9127  1493.0096  1496.8590  1423.0000  1274.4520  1090.0670   866.5332   709.7974   658.8373 (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           58.2346    58.3571    58.4778    59.0513    59.1599    59.6705    59.6705    59.7660    59.4728    59.1599    58.9407    58.7133
alpha          4.8823     4.8905     4.8985     4.9368     4.9440     4.9780     4.9780     4.9844     4.9649     4.9440     4.9294     4.9142
util living area
                0.9992     0.9976     0.9905     0.9572     0.8549     0.6751     0.5115     0.5868     0.8596     0.9848     0.9982     0.9995 (86)

MIT            19.5981    19.7761    20.0832    20.4849    20.8028    20.9555    20.9908    20.9827    20.8511    20.4091    19.9266    19.5691 (87)
Th 2           19.9260    19.9280    19.9300    19.9392    19.9410    19.9491    19.9491    19.9506    19.9460    19.9410    19.9375    19.9338 (88)
util rest of house
                0.9989     0.9967     0.9870     0.9409     0.8045     0.5824     0.3945     0.4633     0.7895     0.9767     0.9974     0.9993 (89)
MIT 2          18.0474    18.3090    18.7571    19.3352    19.7513    19.9204    19.9458    19.9436    19.8243    19.2391    18.5361    18.0104 (90)
Living area fraction                                                                                fLA = Living area / (4) =      0.3450 (91)
MIT            18.5825    18.8152    19.2147    19.7319    20.1141    20.2775    20.3064    20.3021    20.1786    19.6428    19.0159    18.5482 (92)
Temperature adjustment                                                                                           0.0000
adjusted MIT   18.5825    18.8152    19.2147    19.7319    20.1141    20.2775    20.3064    20.3021    20.1786    19.6428    19.0159    18.5482 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9984     0.9954     0.9837     0.9370     0.8137     0.6129     0.4351     0.5062     0.8073     0.9735     0.9964     0.9989 (94)
Useful gains   705.4736   872.2634  1063.6052  1236.7451  1214.8942   917.4076   619.1886   645.0877   879.9885   843.6074   707.2189   658.0918 (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
             2468.0744  2399.5610  2188.0146  1845.9123  1431.2573   957.4957   625.0680   657.0261  1028.5385  1538.1994  2034.4555  2459.2238 (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
             1311.3750  1026.3440   836.5607   438.6004   160.9741     0.0000     0.0000     0.0000     0.0000   516.7765   955.6103  1340.0422 (98)
Space heating                                                                                                   6586.2831 (98)
Space heating per m2                                                                                 (98) / (4) =     45.4509 (99)


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8c. Space cooling requirement
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	7044.1531	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1311.3750	1026.3440	836.5607	438.6004	160.9741	0.0000	0.0000	0.0000	0.0000	516.7765	955.6103	1340.0422	(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)													
	1402.5401	1097.6941	894.7173	469.0913	172.1648	0.0000	0.0000	0.0000	0.0000	552.7021	1022.0431	1433.2002	(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													
	195.9806	172.1738	179.4914	159.0588	154.5374	136.1667	128.9489	144.0124	144.5462	165.0251	176.8148	190.6434	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.9493	88.7897	88.4059	87.3818	84.9227	79.8000	79.8000	79.8000	79.8000	87.6552	88.6442	89.0135	(217)
Fuel for water heating, kWh/month													
	220.3283	193.9119	203.0309	182.0274	181.9741	170.6349	161.5901	180.4666	181.1356	188.2661	199.4658	214.1736	(219)
Water heating fuel used												2277.0055	(219)
Annual totals kWh/year													
Space heating fuel - main system												7044.1531	(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)												495.8333	(232)
Total delivered energy for all uses												9891.9919	(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	7044.1531	0.2160	1521.5371	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2277.0055	0.2160	491.8332	(264)
Space and water heating			2013.3702	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	495.8333	0.5190	257.3375	(268)
Total CO2, kg/m2/year			2309.6328	(272)
Emissions per m2 for space and water heating			13.8939	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.7758	(272b)
Emissions per m2 for pumps and fans			0.2686	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8939 * 1.55) + 1.7758 + 0.2686, rounded to 2 d.p.			23.5800	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.2400	(1b)	x 2.9000	(2b) =	218.1960	(1b) - (3b)
First floor	69.6700	(1c)	x 2.4000	(2c) =	167.2080	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		385.4040	(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) =	0.1038	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.2538	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2157	(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	0.2750	0.2696	0.2643	0.2373	0.2319	0.2049	0.2049	0.1995	0.2157	0.2319	0.2427	0.2535	(22b)
Effective ac	0.5378	0.5364	0.5349	0.5282	0.5269	0.5210	0.5210	0.5199	0.5233	0.5269	0.5294	0.5321	(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)			44.7300	1.1450	51.2176			(27)
Opening Type 6			2.1800	1.4000	3.0520			(26)
Floor 1			75.2400	0.1100	8.2764			(28a)
External Wall	178.4400	44.7300	133.7100	0.1700	22.7307			(29a)
Sheltered Wall	27.0000	2.1800	24.8200	0.1700	4.2194			(29a)
External Roof 1	9.8400		9.8400	0.1100	1.0824			(30)
Total net area of external elements Aum(A, m2)			290.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.5785			(33)
Party Walls			22.0300	0.0000	0.0000			(32)
Party Ceiling 1			139.1300					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.1811	(36)
Total fabric heat loss					(33) + (36) =		113.7596	(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	68.4022	68.2154	68.0323	67.1723	67.0114	66.2624	66.2624	66.1236	66.5509	67.0114	67.3369	67.6772	(38)
Heat transfer coeff	182.1618	181.9750	181.7919	180.9319	180.7710	180.0219	180.0219	179.8832	180.3104	180.7710	181.0965	181.4368	(39)
Average = Sum(39)m / 12 =												180.9311	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2571	1.2558	1.2545	1.2486	1.2475	1.2423	1.2423	1.2413	1.2443	1.2475	1.2497	1.2521	(40)
HLP (average)												1.2486	(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	2.9259	(42)
Average daily hot water use (litres/day)	103.6903	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.0593	109.9117	105.7641	101.6165	97.4689	93.3213	93.3213	97.4689	101.6165	105.7641	109.9117	114.0593	(44)
Energy conte	169.1467	147.9368	152.6575	133.0905	127.7035	110.1984	102.1150	117.1785	118.5780	138.1912	150.8465	163.8095	(45)
Energy content (annual)										Total = Sum(45)m =		1631.4520	(45)
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

35.9437	31.4366	32.4397	28.2817	27.1370	23.4172	21.6994	24.9004	25.1978	29.3656	32.0549	34.8095	(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	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	(66)

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

28.0761	24.9370	20.2801	15.3533	11.4768	9.6892	10.4695	13.6087	18.2656	23.1923	27.0689	28.8565	(67)

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

314.9288	318.1968	309.9616	292.4299	270.2992	249.4995	235.6040	232.3360	240.5712	258.1029	280.2336	301.0334	(68)

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

37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	(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)

-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	(71)

Water heating gains (Table 5)

48.3114	46.7806	43.6018	39.2802	36.4745	32.5238	29.1659	33.4683	34.9970	39.4699	44.5207	46.7870	(72)

Total internal gains

458.2050	456.8030	440.7321	413.9520	385.1391	358.6011	342.1280	346.3016	360.7223	387.6538	418.7118	443.5654	(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	13.7000	10.6334	0.5000	0.8000	0.7700	40.3818	(74)
East	28.8700	19.6403	0.5000	0.8000	0.7700	157.1764	(76)
South	2.1600	46.7521	0.5000	0.8000	0.7700	27.9929	(78)

Solar gains	225.5511	430.4872	695.8920	1015.1329	1257.5769	1296.4305	1230.3178	1045.4705	807.5868	506.1506	278.9778	187.1069	(83)
Total gains	683.7561	887.2902	1136.6241	1429.0849	1642.7160	1655.0316	1572.4458	1391.7721	1168.3091	893.8044	697.6895	630.6723	(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	55.2432	55.2999	55.3556	55.6187	55.6682	55.8998	55.8998	55.9429	55.8104	55.6682	55.5681	55.4639	
alpha	4.6829	4.6867	4.6904	4.7079	4.7112	4.7267	4.7267	4.7295	4.7207	4.7112	4.7045	4.6976	
util living area	0.9993	0.9974	0.9889	0.9489	0.8343	0.6525	0.4938	0.5728	0.8501	0.9840	0.9983	0.9995	(86)
MIT	19.5005	19.6998	20.0384	20.4695	20.8022	20.9539	20.9900	20.9807	20.8401	20.3629	19.8410	19.4616	(87)
Th 2	19.8746	19.8756	19.8766	19.8813	19.8822	19.8863	19.8863	19.8871	19.8847	19.8822	19.8804	19.8786	(88)
util rest of house	0.9990	0.9965	0.9848	0.9298	0.7790	0.5564	0.3739	0.4449	0.7754	0.9753	0.9975	0.9993	(89)
MIT 2	18.5053	18.7050	19.0419	19.4623	19.7553	19.8666	19.8840	19.8819	19.7973	19.3688	18.8502	18.4696	(90)
Living area fraction									fLA = Living area / (4) =			0.3450	(91)
MIT	18.8487	19.0483	19.3857	19.8099	20.1165	20.2418	20.2656	20.2611	20.1571	19.7118	19.1921	18.8119	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8487	19.0483	19.3857	19.8099	20.1165	20.2418	20.2656	20.2611	20.1571	19.7118	19.1921	18.8119	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9955	0.9824	0.9283	0.7919	0.5886	0.4156	0.4895	0.7963	0.9735	0.9969	0.9991	(94)
Useful gains	682.8644	883.3339	1116.6117	1326.6590	1300.7967	974.0846	653.5253	681.2996	930.3008	870.1367	695.4981	630.1069	(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	2650.2151	2574.6317	2342.5247	1973.9404	1521.4570	1015.6468	659.8893	694.5423	1092.1637	1647.1480	2189.8291	2651.1366	(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	1463.7089	1136.5521	912.0793	466.0426	164.1713	0.0000	0.0000	0.0000	0.0000	578.0965	1075.9183	1503.6461	(98)
Space heating												7300.2150	(98)
Space heating per m2											(98) / (4) =	50.3776	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1692.2060	1332.1622	1367.1123	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8955	0.9419	0.9101	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1515.3507	1254.7862	1244.2562	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2058.4420	1959.0207	1750.2382	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000   391.0257   523.9504   376.4506     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                             1291.4268 (104)
Cooled fraction                                                                                          fC = cooled area / (4) =          1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    97.7564   130.9876    94.1127     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                              322.8567 (107)
Space cooling per m2                                                                                                                         2.2280 (108)
Energy for space heating                                                                                                                    50.3776 (99)
Energy for space cooling                                                                                                                     2.2280 (108)
Total                                                                                                                                       52.6056 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                    52.6 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.2400	(1b)	x 2.9000	(2b) =	218.1960	(1b) - (3b)
First floor	69.6700	(1c)	x 2.4000	(2c) =	167.2080	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		385.4040	(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) =	0.1038	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3538	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3007	(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	0.3834	0.3759	0.3684	0.3308	0.3233	0.2857	0.2857	0.2782	0.3007	0.3233	0.3383	0.3533	(22b)
Effective ac	0.5735	0.5706	0.5679	0.5547	0.5523	0.5408	0.5408	0.5387	0.5452	0.5523	0.5572	0.5624	(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			2.1800	1.0000	2.1800			(26)
TER Opening Type (Uw = 1.40)			34.0500	1.3258	45.1420			(27)
Floor 1			75.2400	0.1300	9.7812			(28a)
External Wall	178.4400	34.0500	144.3900	0.1800	25.9902			(29a)
Sheltered Wall	27.0000	2.1800	24.8200	0.1800	4.4676			(29a)
External Roof 1	9.8400		9.8400	0.1300	1.2792			(30)
Total net area of external elements Aum(A, m2)			290.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.8402			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0241	(36)
Total fabric heat loss					(33) + (36) =		99.8643	(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	72.9402	72.5772	72.2213	70.5500	70.2373	68.7817	68.7817	68.5121	69.3424	70.2373	70.8699	71.5312	(38)
Heat transfer coeff	172.8045	172.4415	172.0857	170.4144	170.1017	168.6460	168.6460	168.3765	169.2067	170.1017	170.7343	171.3956	(39)
Average = Sum(39)m / 12 =												170.4129	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1925	1.1900	1.1875	1.1760	1.1738	1.1638	1.1638	1.1619	1.1677	1.1738	1.1782	1.1828	(40)
HLP (average)												1.1760	(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	2.9259	(42)
Average daily hot water use (litres/day)	103.6903	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.0593	109.9117	105.7641	101.6165	97.4689	93.3213	93.3213	97.4689	101.6165	105.7641	109.9117	114.0593	(44)
Energy conte	169.1467	147.9368	152.6575	133.0905	127.7035	110.1984	102.1150	117.1785	118.5780	138.1912	150.8465	163.8095	(45)
Energy content (annual)										Total = Sum(45)m =		1631.4520	(45)
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.9437	31.4366	32.4397	28.2817	27.1370	23.4172	21.6994	24.9004	25.1978	29.3656	32.0549	34.8095	(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	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	146.2954	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0761	24.9370	20.2801	15.3533	11.4768	9.6892	10.4695	13.6087	18.2656	23.1923	27.0689	28.8565	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.9288	318.1968	309.9616	292.4299	270.2992	249.4995	235.6040	232.3360	240.5712	258.1029	280.2336	301.0334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	37.6295	(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)													
	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	-117.0363	(71)
Water heating gains (Table 5)													
	48.3114	46.7806	43.6018	39.2802	36.4745	32.5238	29.1659	33.4683	34.9970	39.4699	44.5207	46.7870	(72)
Total internal gains													
	458.2050	456.8030	440.7321	413.9520	385.1391	358.6011	342.1280	346.3016	360.7223	387.6538	418.7118	443.5654	(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	10.4300	10.6334	0.6300	0.7000	0.7700	33.8944	(74)
East	21.9800	19.6403	0.6300	0.7000	0.7700	131.9310	(76)
South	1.6400	46.7521	0.6300	0.7000	0.7700	23.4324	(78)

Solar gains	189.2578	361.2351	583.9805	851.9253	1055.4196	1088.0379	1032.5482	877.3970	677.7281	424.7369	234.0909	156.9974	(83)
Total gains	647.4627	818.0382	1024.7126	1265.8773	1440.5586	1446.6390	1374.6762	1223.6986	1038.4504	812.3906	652.8027	600.5628	(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	58.2346	58.3571	58.4778	59.0513	59.1599	59.6705	59.6705	59.7660	59.4728	59.1599	58.9407	58.7133	
alpha	4.8823	4.8905	4.8985	4.9368	4.9440	4.9780	4.9780	4.9844	4.9649	4.9440	4.9294	4.9142	
util living area													
	0.9995	0.9982	0.9924	0.9632	0.8682	0.6928	0.5280	0.6075	0.8771	0.9883	0.9987	0.9996	(86)
MIT	19.5602	19.7391	20.0484	20.4564	20.7862	20.9501	20.9895	20.9799	20.8342	20.3766	19.8902	19.5317	(87)
Th 2	19.9260	19.9280	19.9300	19.9392	19.9410	19.9491	19.9491	19.9506	19.9460	19.9410	19.9375	19.9338	(88)
util rest of house													
	0.9993	0.9976	0.9896	0.9489	0.8202	0.5998	0.4080	0.4814	0.8115	0.9819	0.9982	0.9995	(89)
MIT 2	18.6055	18.7857	19.0950	19.5006	19.7989	19.9268	19.9465	19.9449	19.8513	19.4304	18.9444	18.5832	(90)
Living area fraction										fLA = Living area / (4) =		0.3450	(91)
MIT	18.9349	19.1147	19.4240	19.8304	20.1395	20.2799	20.3064	20.3020	20.1904	19.7569	19.2707	18.9104	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9349	19.1147	19.4240	19.8304	20.1395	20.2799	20.3064	20.3020	20.1904	19.7569	19.2707	18.9104	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9969	0.9878	0.9471	0.8303	0.6307	0.4498	0.5254	0.8292	0.9804	0.9977	0.9993	(94)
Useful gains	646.8406	815.4897	1012.1706	1198.8629	1196.1250	912.4622	618.2620	642.9635	861.0360	796.5005	651.3143	600.1660	(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													
	2528.9837	2451.1963	2224.0356	1862.6931	1435.5815	957.8942	625.0637	657.0103	1030.5443	1557.6005	2077.9608	2521.3061	(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													
	1400.3145	1099.1949	901.6276	477.9577	178.1556	0.0000	0.0000	0.0000	0.0000	566.2584	1027.1854	1429.3282	(98)
Space heating												7080.0224	(98)
Space heating per m2											(98) / (4) =	48.8581	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1585.2727	1247.9806	1279.6611	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8836	0.9358	0.9024	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1400.8121	1167.9155	1154.7723	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1814.8661	1727.8614	1553.7887	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	298.1189	416.5998	296.8682	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											1011.5869	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	74.5297	104.1499	74.2170	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											252.8967	(107)
Space cooling per m2											1.7452	(108)
Energy for space heating											48.8581	(99)
Energy for space cooling											1.7452	(108)
Total											50.6033	(109)
Target Fabric Energy Efficiency (TFEE)											58.2	(109)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Flat 2 - Phase 3	**Issued on Date**	25/09/2022
Assessment Reference	2	**Prop Type Ref**	
Property	Phase 3 , Flat 2, 13 Netherhall Gardens, London, NW3		

SAP Rating	84 B	**DER**	11.52	**TER**	26.55
Environmental	91 B	**% DER<TER**	56.61		
CO_2 Emissions (t/year)	0.88	**DFEE**	52.65	**TFEE**	61.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	14.22		

Assessor Details	Mr. Ioannis Protonotarios, Ioannis Protonotarios, Tel: 02084469696, ioannis.p@mendickwaring.co.uk	**Assessor ID**	Y078-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity (c)		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	26.55	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.52	$kgCO_2/m^2$	Pass
	-15.03 (-56.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.38	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.65	$kWh/m^2/yr$	
	-8.8 (-14.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Community heating scheme	-
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 0.25 kWh/day Permitted by DBSCG 0.29	Pass

Primary pipework insulated	No primary pipework		

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room stats		Pass
Hot water controls	No cylinderstat		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous supply and extract system			
Specific fan power	0.53		
Maximum	1.5		Pass
MVHR efficiency	94	%	
Minimum	70	%	Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Slight		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	2.93 m², No overhang 4.99 m², No overhang 16.04 m², No overhang		
Air change rate	4.00 ach		
Blinds/curtains	None		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Floor U-value	0.11	W/m²K
Air permeability	3.0	m³/m²h
Photovoltaic array	0.92	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

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

Design SAP
elmhurst energy

Property Reference	Flat 2 - Phase 3	**Issued on Date**	25/09/2022
Assessment Reference	2	**Prop Type Ref**	
Property	Phase 3 , Flat 2, 13 Netherhall Gardens, London, NW3		

SAP Rating	84 B	**DER**	11.52	**TER**	26.55
Environmental	91 B	**% DER<TER**	56.61		
CO_2 Emissions (t/year)	0.88	**DFEE**	52.65	**TFEE**	61.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	14.22		

Assessor Details	Mr. Ioannis Protonotarios, Ioannis Protonotarios, Tel: 02084469696, ioannis.p@mendickwaring.co.uk	**Assessor ID**	Y078-0001
Client			

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 102 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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 26.55 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.52 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)61.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 0.25 kWh/day
Permitted by DBSCG 0.29 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

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

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.53
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 2.93 m², No overhang
Windows facing South: 4.99 m², No overhang
Windows facing West: 16.04 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Floor U-value 0.11 W/m²K
Air permeability 3.0 m³/m²h
Photovoltaic array 0.92 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)	
Ground floor	101.6500 (1b)	x	2.9000 (2b)	=	294.7850	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.7850	(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		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2631	0.2599	0.2567	0.2408	0.2376	0.2216	0.2216	0.2184	0.2280	0.2376	0.2439	0.2503	(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)			23.9600	1.1450	27.4351			(27)
Opening Type 6			2.1800	1.4000	3.0520			(26)
Heat Loss Floor 1			101.6500	0.1100	11.1815			(28a)
External Wall	107.7600	23.9600	83.8000	0.1700	14.2460			(29a)
Sheltered Wall	22.8800	2.1800	20.7000	0.1700	3.5190			(29a)
Total net area of external elements Aum(A, m2)			232.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.4336			(33)
Party Walls			13.3600	0.0000	0.0000			(32)
Party Ceiling 1			139.1300					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	20.3544 (36)
Total fabric heat loss (33) + (36) =	79.7880 (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	25.5905	25.2804	24.9703	23.4199	23.1099	21.5595	21.5595	21.2494	22.1796	23.1099	23.7300	24.3502	(38)
Heat transfer coeff	105.3785	105.0684	104.7583	103.2079	102.8979	101.3475	101.3475	101.0374	101.9676	102.8979	103.5180	104.1382	(39)
Average = Sum(39)m / 12 =												103.1304	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0367	1.0336	1.0306	1.0153	1.0123	0.9970	0.9970	0.9940	1.0031	1.0123	1.0184	1.0245	(40)
HLP (average)												1.0146	(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	2.7543 (42)
Average daily hot water use (litres/day)	99.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5757	105.5911	101.6065	97.6220	93.6374	89.6528	89.6528	93.6374	97.6220	101.6065	105.5911	109.5757	(44)
Energy conte	162.4976	142.1214	146.6566	127.8587	122.6835	105.8665	98.1009	112.5722	113.9167	132.7589	144.9168	157.3702	(45)
Energy content (annual)										Total = Sum(45)m =		1567.3200	(45)

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

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	24.3746	21.3182	21.9985	19.1788	18.4025	15.8800	14.7151	16.8858	17.0875	19.9138	21.7375	23.6055	(46)
Water storage loss:													
Store volume												1.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0516	(51)
Volume factor from Table 2a												4.9324	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2543	(55)
Total storage loss													
	7.8839	7.1210	7.8839	7.6296	7.8839	7.6296	7.8839	7.8839	7.6296	7.8839	7.6296	7.8839	(56)
If cylinder contains dedicated solar storage													
	7.8839	7.1210	7.8839	7.6296	7.8839	7.6296	7.8839	7.8839	7.6296	7.8839	7.6296	7.8839	(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													
	193.6439	170.2536	177.8029	158.0003	153.8298	136.0081	129.2472	143.7185	144.0583	163.9052	175.0583	188.5165	(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													
	193.6439	170.2536	177.8029	158.0003	153.8298	136.0081	129.2472	143.7185	144.0583	163.9052	175.0583	188.5165	(64)
									Total per year (kWh/year) = Sum(64)m =			1934.0428	(64)
Heat gains from water heating, kWh/month													
	78.9475	69.7611	73.6804	66.6263	65.7093	59.3139	57.5356	62.3473	61.9906	69.0594	72.2981	77.2426	(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	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0872	20.5058	16.6765	12.6252	9.4375	7.9675	8.6092	11.1905	15.0199	19.0712	22.2589	23.7288	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.9679	261.6552	254.8834	240.4669	222.2687	205.1650	193.7386	191.0513	197.8232	212.2396	230.4378	247.5416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	(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)													
	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	(71)
Water heating gains (Table 5)													
	106.1122	103.8112	99.0327	92.5365	88.3190	82.3804	77.3328	83.8002	86.0980	92.8218	100.4140	103.8208	(72)
Total internal gains													
	452.4816	450.2865	434.9068	409.9429	384.3394	359.8271	343.9948	350.3563	363.2553	388.4469	417.4250	439.4055	(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	2.9300	10.6334	0.5000	0.8000	0.7700	8.6364	(74)
South	4.9900	46.7521	0.5000	0.8000	0.7700	64.6688	(78)
West	16.0400	19.6403	0.5000	0.8000	0.7700	87.3263	(80)

Solar gains	160.6314	293.2441	444.2874	607.8312	722.4194	732.6256	700.1192	614.1688	501.8497	336.5839	196.1942	134.8924	(83)
Total gains	613.1130	743.5305	879.1943	1017.7740	1106.7588	1092.4528	1044.1140	964.5250	865.1050	725.0308	613.6193	574.2978	(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	66.9874	67.1851	67.3839	68.3962	68.6023	69.6517	69.6517	69.8655	69.2281	68.6023	68.1913	67.7852	
alpha	5.4658	5.4790	5.4923	5.5597	5.5735	5.6434	5.6434	5.6577	5.6152	5.5735	5.5461	5.5190	
util living area													
	0.9980	0.9938	0.9785	0.9197	0.7801	0.5806	0.4251	0.4778	0.7494	0.9601	0.9949	0.9986	(86)
MIT	19.9170	20.1007	20.3779	20.7038	20.9113	20.9864	20.9980	20.9963	20.9476	20.6455	20.2158	19.8880	(87)
Th 2	20.0529	20.0554	20.0579	20.0706	20.0731	20.0858	20.0858	20.0884	20.0807	20.0731	20.0680	20.0630	(88)
util rest of house													
	0.9973	0.9917	0.9714	0.8951	0.7256	0.5033	0.3379	0.3853	0.6725	0.9426	0.9929	0.9981	(89)
MIT 2	18.6040	18.8734	19.2746	19.7350	19.9918	20.0773	20.0851	20.0869	20.0417	19.6687	19.0515	18.5691	(90)
Living area fraction									fLA = Living area / (4) =			0.2459	(91)
MIT	18.9270	19.1752	19.5459	19.9733	20.2180	20.3009	20.3096	20.3105	20.2645	19.9089	19.3379	18.8934	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9270	19.1752	19.5459	19.9733	20.2180	20.3009	20.3096	20.3105	20.2645	19.9089	19.3379	18.8934	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9891	0.9665	0.8921	0.7347	0.5219	0.3594	0.4081	0.6890	0.9387	0.9907	0.9972	(94)
Useful gains	610.7137	735.4241	849.7039	907.9579	813.1156	570.1850	375.2047	393.6117	596.0540	680.5810	607.8914	572.6885	(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													
	1541.3661	1499.8767	1366.6713	1142.8481	876.4823	577.7708	375.9603	395.1117	628.5822	957.8693	1266.8423	1530.1487	(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													
	692.4054	513.7122	384.6237	169.1209	47.1449	0.0000	0.0000	0.0000	0.0000	206.3025	474.4446	712.3504	(98)
Space heating												3200.1046	(98)
Space heating per m2											(98) / (4) =	31.4816	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	952.6663	749.9714	767.8843	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9575	0.9815	0.9721	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	912.1470	736.1243	746.4707	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1374.1969	1315.7046	1224.1529	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	332.6759	431.2077	355.3956	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1119.2792	(104)
Cooled fraction											fC = cooled area / (4) =	0.3935	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	32.7276	42.4208	34.9627	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												110.1111	(107)
Space cooling per m2												1.0832	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	3200.1046	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3360.1098	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1934.0428	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2030.7449	(310a)
Electricity used for heat distribution	53.9085	(313)
Cooling System Energy Efficiency Ratio	4.0000	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	27.5278	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)		
mechanical ventilation fans (SFP = 0.6625)	238.2600	(330a)
Total electricity for the above, kWh/year	238.2600	(331)
Electricity for lighting (calculated in Appendix L)	407.7268	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.92 * 853 * 1.00) =	-627.8300	(333)
Total delivered energy for all uses	5436.5393	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			250.0000	(367a)
Space heating from Heat pump	2156.3419	0.5190	1119.1414	(367)
Electrical energy for heat distribution	53.9085	0.5190	27.9785	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1147.1200	(373)
Space and water heating			1147.1200	(376)
Space cooling	27.5278	0.5190	14.2869	(377)
Pumps and fans	238.2600	0.5190	123.6569	(378)
Energy for lighting	407.7268	0.5190	211.6102	(379)
Energy saving/generation technologies				
PV Unit	-627.8300	0.5190	-325.8438	(380)
Total CO2, kg/year			1170.8303	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			11.5200	(384)

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

DER		11.5200	ZC1
Total Floor Area	TFA	101.6500	
Assumed number of occupants	N	2.7543	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0968	ZC2
CO2 emissions from cooking, equation (L16)		1.8210	ZC3
Total CO2 emissions		28.4378	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		28.4378	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)	
Ground floor	101.6500 (1b)	x	2.9000 (2b)	=	294.7850	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.7850	(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) =	0.1357	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3857	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3278	(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	0.4180	0.4098	0.4016	0.3606	0.3524	0.3114	0.3114	0.3033	0.3278	0.3524	0.3688	0.3852	(22b)
Effective ac	0.5874	0.5840	0.5806	0.5650	0.5621	0.5485	0.5485	0.5460	0.5537	0.5621	0.5680	0.5742	(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			2.1800	1.0000	2.1800			(26)
TER Opening Type (Uw = 1.40)			23.2300	1.3258	30.7973			(27)
Heat Loss Floor 1			101.6500	0.1300	13.2145			(28a)
External Wall	107.7600	23.2300	84.5300	0.1800	15.2154			(29a)
Sheltered Wall	22.8800	2.1800	20.7000	0.1800	3.7260			(29a)
Total net area of external elements Aum(A, m2)			232.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.1332			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.0833	(36)
Total fabric heat loss					(33) + (36) =		79.2165	(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	57.1378	56.8078	56.4843	54.9650	54.6808	53.3575	53.3575	53.1125	53.8672	54.6808	55.2558	55.8570	(38)
Heat transfer coeff	136.3543	136.0243	135.7009	134.1816	133.8973	132.5741	132.5741	132.3290	133.0837	133.8973	134.4724	135.0735	(39)
Average = Sum(39)m / 12 =												134.1802	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3414	1.3382	1.3350	1.3200	1.3172	1.3042	1.3042	1.3018	1.3092	1.3172	1.3229	1.3288	(40)
HLP (average)												1.3200	(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		2.7543 (42)
Average daily hot water use (litres/day)		99.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5757	105.5911	101.6065	97.6220	93.6374	89.6528	89.6528	93.6374	97.6220	101.6065	105.5911	109.5757	(44)
Energy conte	162.4976	142.1214	146.6566	127.8587	122.6835	105.8665	98.1009	112.5722	113.9167	132.7589	144.9168	157.3702	(45)
Energy content (annual)										Total = Sum(45)m =		1567.3200	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3746	21.3182	21.9985	19.1788	18.4025	15.8800	14.7151	16.8858	17.0875	19.9138	21.7375	23.6055	(46)

Water storage loss:		
Store volume		1.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		0.2134 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.1152 (55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
3.5715 3.2259 3.5715 3.4563 3.5715 3.4563 3.5715 3.5715 3.4563 3.5715 3.4563 3.5715 (56)
If cylinder contains dedicated solar storage
3.5715 3.2259 3.5715 3.4563 3.5715 3.4563 3.5715 3.5715 3.4563 3.5715 3.4563 3.5715 (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
189.3314 166.3585 173.4904 153.8270 149.5174 131.8348 124.9348 139.4061 139.8850 159.5928 170.8850 184.2041 (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
189.3314 166.3585 173.4904 153.8270 149.5174 131.8348 124.9348 139.4061 139.8850 159.5928 170.8850 184.2041 (64)
Total per year (kWh/year) = Sum(64)m = 1883.2673 (64)
Heat gains from water heating, kWh/month
75.4975 66.6450 70.2304 63.2876 62.2594 55.9752 54.0857 58.8974 58.6519 65.6094 68.9594 73.7927 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0872	20.5058	16.6765	12.6252	9.4375	7.9675	8.6092	11.1905	15.0199	19.0712	22.2589	23.7288	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.9679	261.6552	254.8834	240.4669	222.2687	205.1650	193.7386	191.0513	197.8232	212.2396	230.4378	247.5416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	(71)
Water heating gains (Table 5)													
	101.4752	99.1741	94.3957	87.8995	83.6819	77.7434	72.6958	79.1631	81.4610	88.1847	95.7770	99.1837	(72)
Total internal gains													
	450.8446	448.6494	433.2698	408.3058	382.7024	358.1901	342.3578	348.7192	361.6183	386.8098	415.7880	437.7684	(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	2.8400	10.6334	0.6300	0.7000	0.7700	9.2292	(74)
South	4.8400	46.7521	0.6300	0.7000	0.7700	69.1541	(78)
West	15.5500	19.6403	0.6300	0.7000	0.7700	93.3361	(80)

Solar gains	171.7193	313.4792	474.9308	649.7360	772.2108	783.1153	748.3707	656.5052	536.4567	359.8056	209.7357	144.2044	(83)
Total gains	622.5639	762.1286	908.2006	1058.0418	1154.9131	1141.3054	1090.7285	1005.2244	898.0750	746.6154	625.5237	581.9729	(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	51.7697	51.8953	52.0190	52.6080	52.7197	53.2459	53.2459	53.3445	53.0420	52.7197	52.4943	52.2606	
alpha	4.4513	4.4597	4.4679	4.5072	4.5146	4.5497	4.5497	4.5563	4.5361	4.5146	4.4996	4.4840	
util living area													
	0.9977	0.9941	0.9827	0.9442	0.8481	0.6821	0.5199	0.5797	0.8284	0.9713	0.9952	0.9983	(86)
MIT	19.5216	19.7205	20.0390	20.4402	20.7617	20.9371	20.9854	20.9766	20.8435	20.4016	19.8833	19.4894	(87)
Th 2	19.8085	19.8111	19.8135	19.8252	19.8274	19.8375	19.8375	19.8394	19.8336	19.8274	19.8229	19.8183	(88)
util rest of house													
	0.9969	0.9920	0.9764	0.9233	0.7935	0.5819	0.3901	0.4460	0.7470	0.9566	0.9931	0.9977	(89)
MIT 2	17.8550	18.1465	18.6093	19.1832	19.6017	19.7977	19.8326	19.8304	19.7124	19.1428	18.3934	17.8146	(90)
Living area fraction										fLA = Living area / (4) =		0.2459	(91)
MIT	18.2648	18.5336	18.9610	19.4924	19.8870	20.0779	20.1161	20.1123	19.9905	19.4524	18.7598	18.2265	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2648	18.5336	18.9610	19.4924	19.8870	20.0779	20.1161	20.1123	19.9905	19.4524	18.7598	18.2265	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9887	0.9702	0.9159	0.7967	0.6041	0.4222	0.4789	0.7597	0.9502	0.9903	0.9965	(94)
Useful gains	619.6665	753.5535	881.1419	969.0245	920.1033	689.4659	460.5142	481.4456	682.2360	709.4166	619.4672	579.9424	(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													
	1904.1674	1854.5053	1690.9632	1421.2989	1096.2205	726.2295	466.1447	491.2484	783.9359	1185.3079	1567.9274	1894.6088	(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													
	955.6687	739.8396	602.5071	325.6376	131.0312	0.0000	0.0000	0.0000	0.0000	354.0631	682.8914	978.1118	(98)
Space heating												4769.7504	(98)
Space heating per m2											(98) / (4) =	46.9233	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												5101.3374	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	955.6687	739.8396	602.5071	325.6376	131.0312	0.0000	0.0000	0.0000	0.0000	354.0631	682.8914	978.1118	(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)													
	1022.1055	791.2723	644.3926	348.2755	140.1404	0.0000	0.0000	0.0000	0.0000	378.6772	730.3651	1046.1089	(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													
	189.3314	166.3585	173.4904	153.8270	149.5174	131.8348	124.9348	139.4061	139.8850	159.5928	170.8850	184.2041	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.5370	88.3258	87.8660	86.7674	84.4642	79.8000	79.8000	79.8000	79.8000	86.8805	88.1347	88.6169	(217)
Fuel for water heating, kWh/month													
	213.8445	188.3463	197.4489	177.2867	177.0187	165.2065	156.5599	174.6944	175.2944	183.6922	193.8908	207.8656	(219)
Water heating fuel used												2211.1489	(219)
Annual totals kWh/year													
Space heating fuel - main system												5101.3374	(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)												407.7268	(232)
Total delivered energy for all uses												7795.2131	(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	5101.3374	0.2160	1101.8889	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2211.1489	0.2160	477.6082	(264)
Space and water heating			1579.4970	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	407.7268	0.5190	211.6102	(268)
Total CO2, kg/m2/year			1830.0323	(272)
Emissions per m2 for space and water heating			15.5386	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.0818	(272b)
Emissions per m2 for pumps and fans			0.3829	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5386 * 1.55) + 2.0818 + 0.3829, rounded to 2 d.p.			26.5500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.6500 (1b)	x	2.9000 (2b)	=	294.7850	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.7850	(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) =	0.1357	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.2857	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2428	(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	0.3096	0.3035	0.2975	0.2671	0.2611	0.2307	0.2307	0.2246	0.2428	0.2611	0.2732	0.2853	(22b)
Effective ac	0.5479	0.5461	0.5442	0.5357	0.5341	0.5266	0.5266	0.5252	0.5295	0.5341	0.5373	0.5407	(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)			23.9600	1.1450	27.4351			(27)
Opening Type 6			2.1800	1.4000	3.0520			(26)
Heat Loss Floor 1			101.6500	0.1100	11.1815			(28a)
External Wall	107.7600	23.9600	83.8000	0.1700	14.2460			(29a)
Sheltered Wall	22.8800	2.1800	20.7000	0.1700	3.5190			(29a)
Total net area of external elements Aum(A, m2)			232.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.4336			(33)
Party Walls			13.3600	0.0000	0.0000			(32)
Party Ceiling 1			139.1300					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	20.3544	(36)
Total fabric heat loss (33) + (36) =	79.7880	(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	53.3023	53.1212	52.9438	52.1102	51.9542	51.2282	51.2282	51.0937	51.5078	51.9542	52.2697	52.5996	(38)
Heat transfer coeff	133.0903	132.9092	132.7318	131.8982	131.7422	131.0162	131.0162	130.8817	131.2958	131.7422	132.0577	132.3876	(39)
Average = Sum(39)m / 12 =												131.8974	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3093	1.3075	1.3058	1.2976	1.2960	1.2889	1.2889	1.2876	1.2916	1.2960	1.2991	1.3024	(40)
HLP (average)												1.2976	(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	2.7543	(42)
Average daily hot water use (litres/day)	99.6142	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5757	105.5911	101.6065	97.6220	93.6374	89.6528	89.6528	93.6374	97.6220	101.6065	105.5911	109.5757	(44)
Energy conte	162.4976	142.1214	146.6566	127.8587	122.6835	105.8665	98.1009	112.5722	113.9167	132.7589	144.9168	157.3702	(45)
Energy content (annual)										Total = Sum(45)m =		1567.3200	(45)
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(59)
Heat gains from water heating, kWh/month												
	34.5307	30.2008	31.1645	27.1700	26.0702	22.4966	20.8464	23.9216	24.2073	28.2113	30.7948	33.4412 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0872	20.5058	16.6765	12.6252	9.4375	7.9675	8.6092	11.1905	15.0199	19.0712	22.2589	23.7288	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.9679	261.6552	254.8834	240.4669	222.2687	205.1650	193.7386	191.0513	197.8232	212.2396	230.4378	247.5416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	(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)													
	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	(71)
Water heating gains (Table 5)													
	46.4123	44.9417	41.8878	37.7361	35.0407	31.2453	28.0194	32.1527	33.6212	37.9184	42.7706	44.9478	(72)
Total internal gains													
	392.7817	391.4170	377.7619	355.1424	331.0611	308.6920	294.6814	298.7088	310.7786	333.5435	359.7816	380.5325	(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	2.9300	10.6334	0.5000	0.8000	0.7700	8.6364	(74)
South	4.9900	46.7521	0.5000	0.8000	0.7700	64.6688	(78)
West	16.0400	19.6403	0.5000	0.8000	0.7700	87.3263	(80)

Solar gains	160.6314	293.2441	444.2874	607.8312	722.4194	732.6256	700.1192	614.1688	501.8497	336.5839	196.1942	134.8924	(83)
Total gains	553.4131	684.6611	822.0493	962.9736	1053.4805	1041.3177	994.8006	912.8775	812.6283	670.1274	555.9758	515.4249	(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	53.0394	53.1116	53.1827	53.5188	53.5821	53.8791	53.8791	53.9344	53.7643	53.5821	53.4541	53.3209	
alpha	4.5360	4.5408	4.5455	4.5679	4.5721	4.5919	4.5919	4.5956	4.5843	4.5721	4.5636	4.5547	
util living area													
	0.9986	0.9961	0.9879	0.9580	0.8765	0.7226	0.5586	0.6228	0.8625	0.9802	0.9970	0.9990	(86)
MIT	19.5006	19.6907	20.0005	20.3941	20.7283	20.9225	20.9813	20.9698	20.8153	20.3581	19.8475	19.4635	(87)
Th 2	19.8336	19.8349	19.8363	19.8427	19.8439	19.8495	19.8495	19.8506	19.8474	19.8439	19.8415	19.8390	(88)
util rest of house													
	0.9981	0.9948	0.9834	0.9414	0.8279	0.6235	0.4230	0.4847	0.7892	0.9696	0.9957	0.9987	(89)
MIT 2	18.4733	18.6638	18.9722	19.3598	19.6633	19.8148	19.8450	19.8423	19.7454	19.3327	18.8260	18.4405	(90)
Living area fraction									fLA = Living area / (4) =			0.2459	(91)
MIT	18.7260	18.9164	19.2251	19.6142	19.9253	20.0872	20.1245	20.1196	20.0085	19.5849	19.0772	18.6921	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7260	18.9164	19.2251	19.6142	19.9253	20.0872	20.1245	20.1196	20.0085	19.5849	19.0772	18.6921	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9933	0.9802	0.9374	0.8319	0.6458	0.4567	0.5190	0.8014	0.9664	0.9945	0.9982	(94)
Useful gains	552.0157	680.0450	805.7641	902.6482	876.3999	672.4541	454.3722	473.8052	651.2064	647.6130	552.9132	514.4771	(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													
	1919.9562	1862.9069	1689.0285	1413.1817	1083.6149	718.9157	461.7660	486.8287	775.7642	1183.6893	1581.6830	1918.5712	(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													
	1017.7477	794.8832	657.1487	367.5842	154.1680	0.0000	0.0000	0.0000	0.0000	398.8407	740.7142	1044.6460	(98)
Space heating												5175.7327	(98)
Space heating per m2											(98) / (4) =	50.9172	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1231.5520	969.5197	994.7011	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8493	0.9113	0.8816	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1045.9370	883.5639	876.9403	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1323.0618	1266.3912	1172.5055	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	199.5298	284.8235	219.9005	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												704.2539 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	49.8825	71.2059	54.9751	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												176.0635 (107)
Space cooling per m2												1.7321 (108)
Energy for space heating												50.9172 (99)
Energy for space cooling												1.7321 (108)
Total												52.6492 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.6 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.6500 (1b)	x	2.9000 (2b)	=	294.7850	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.7850	(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) =	0.1357	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3857	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3278	(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	0.4180	0.4098	0.4016	0.3606	0.3524	0.3114	0.3114	0.3033	0.3278	0.3524	0.3688	0.3852	(22b)
Effective ac	0.5874	0.5840	0.5806	0.5650	0.5621	0.5485	0.5485	0.5460	0.5537	0.5621	0.5680	0.5742	(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			2.1800	1.0000	2.1800			(26)
TER Opening Type (Uw = 1.40)			23.2300	1.3258	30.7973			(27)
Heat Loss Floor 1			101.6500	0.1300	13.2145			(28a)
External Wall	107.7600	23.2300	84.5300	0.1800	15.2154			(29a)
Sheltered Wall	22.8800	2.1800	20.7000	0.1800	3.7260			(29a)
Total net area of external elements Aum(A, m2)			232.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.1332			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.0833	(36)
Total fabric heat loss					(33) + (36) =		79.2165	(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	57.1378	56.8078	56.4843	54.9650	54.6808	53.3575	53.3575	53.1125	53.8672	54.6808	55.2558	55.8570	(38)
Heat transfer coeff	136.3543	136.0243	135.7009	134.1816	133.8973	132.5741	132.5741	132.3290	133.0837	133.8973	134.4724	135.0735	(39)
Average = Sum(39)m / 12 =												134.1802	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3414	1.3382	1.3350	1.3200	1.3172	1.3042	1.3042	1.3018	1.3092	1.3172	1.3229	1.3288	(40)
HLP (average)												1.3200	(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		2.7543 (42)
Average daily hot water use (litres/day)		99.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5757	105.5911	101.6065	97.6220	93.6374	89.6528	89.6528	93.6374	97.6220	101.6065	105.5911	109.5757	(44)
Energy conte	162.4976	142.1214	146.6566	127.8587	122.6835	105.8665	98.1009	112.5722	113.9167	132.7589	144.9168	157.3702	(45)
Energy content (annual)										Total = Sum(45)m =		1567.3200	(45)
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Heat gains from water heating, kWh/month													
	34.5307	30.2008	31.1645	27.1700	26.0702	22.4966	20.8464	23.9216	24.2073	28.2113	30.7948	33.4412	(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	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	137.7142	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0872	20.5058	16.6765	12.6252	9.4375	7.9675	8.6092	11.1905	15.0199	19.0712	22.2589	23.7288	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.9679	261.6552	254.8834	240.4669	222.2687	205.1650	193.7386	191.0513	197.8232	212.2396	230.4378	247.5416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	36.7714	(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)													
	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	-110.1714	(71)
Water heating gains (Table 5)													
	46.4123	44.9417	41.8878	37.7361	35.0407	31.2453	28.0194	32.1527	33.6212	37.9184	42.7706	44.9478	(72)
Total internal gains													
	392.7817	391.4170	377.7619	355.1424	331.0611	308.6920	294.6814	298.7088	310.7786	333.5435	359.7816	380.5325	(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	2.8400	10.6334	0.6300	0.7000	0.7700	9.2292	(74)
South	4.8400	46.7521	0.6300	0.7000	0.7700	69.1541	(78)
West	15.5500	19.6403	0.6300	0.7000	0.7700	93.3361	(80)

Solar gains	171.7193	313.4792	474.9308	649.7360	772.2108	783.1153	748.3707	656.5052	536.4567	359.8056	209.7357	144.2044	(83)
Total gains	564.5010	704.8961	852.6927	1004.8784	1103.2718	1091.8074	1043.0522	955.2140	847.2353	693.3490	569.5172	524.7370	(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	51.7697	51.8953	52.0190	52.6080	52.7197	53.2459	53.2459	53.3445	53.0420	52.7197	52.4943	52.2606	
alpha	4.4513	4.4597	4.4679	4.5072	4.5146	4.5497	4.5497	4.5563	4.5361	4.5146	4.4996	4.4840	
util living area													
	0.9985	0.9957	0.9863	0.9528	0.8645	0.7041	0.5410	0.6049	0.8507	0.9780	0.9967	0.9989	(86)
MIT	19.4702	19.6706	19.9930	20.4030	20.7386	20.9284	20.9829	20.9723	20.8227	20.3594	19.8342	19.4386	(87)
Th 2	19.8085	19.8111	19.8135	19.8252	19.8274	19.8375	19.8375	19.8394	19.8336	19.8274	19.8229	19.8183	(88)
util rest of house													
	0.9979	0.9941	0.9813	0.9345	0.8130	0.6038	0.4072	0.4678	0.7740	0.9663	0.9953	0.9985	(89)
MIT 2	18.4235	18.6252	18.9466	19.3530	19.6559	19.8060	19.8335	19.8320	19.7373	19.3203	18.7982	18.3995	(90)
Living area fraction									fLA = Living area / (4) =			0.2459	(91)
MIT	18.6810	18.8823	19.2040	19.6112	19.9222	20.0820	20.1162	20.1124	20.0042	19.5758	19.0530	18.6551	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6810	18.8823	19.2040	19.6112	19.9222	20.0820	20.1162	20.1124	20.0042	19.5758	19.0530	18.6551	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9924	0.9778	0.9303	0.8178	0.6266	0.4405	0.5019	0.7872	0.9629	0.9939	0.9980	(94)
Useful gains	562.9253	699.5686	833.7352	934.8773	902.2470	684.1789	459.4729	479.4361	666.9512	667.6278	566.0544	523.6764	(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													
	1960.9068	1901.9345	1723.9374	1437.2479	1100.9253	726.7754	466.1554	491.2614	785.7584	1201.8419	1607.3468	1952.4976	(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													
	1040.0982	807.9899	662.3105	361.7068	147.8166	0.0000	0.0000	0.0000	0.0000	397.4552	749.7305	1063.0429	(98)
Space heating												5230.1507	(98)
Space heating per m2											(98) / (4) =	51.4525	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1246.1961	981.0480	1005.7004	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8595	0.9181	0.8898	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1071.0862	900.6834	894.8736	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1382.0757	1322.7891	1221.9896	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	223.9125	314.0466	243.3743	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												781.3334	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   55.9781   78.5117   60.8436    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          195.3333 (107)
Space cooling per m2                                                                                                     1.9216 (108)
Energy for space heating                                                                                                51.4525 (99)
Energy for space cooling                                                                                                 1.9216 (108)
Total                                                                                                                   53.3742 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     61.4 (109)
```

Appendix C – Water Calculation for the New-Build Units

breglobal

Job no:	J2629
Date:	26/09/2022
Assessor name:	Ioannis Protonotarios
Registration no:	
Development name:	13 Netherhall Gardens - Phase 3

PRINTING: before printing please make sure that in "Page Setup" you have selected the page to be as "Landscape" and that the Scale has been set up to 70% (maximum)

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATOR)

	House Type:	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8		Type 9		Type 10	
	Description:	Flats																			
Installation Type	**Unit of measure**	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day
Is a dual or single flush WC specified?		Dual		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Click to Select		Click to Select		Click to Select	
WC	Full flush volume	6	8.76		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
	Part flush volume	3	8.88		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	3	6.32		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Are both a Bath & Shower Present?		Bath & Shower		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:	
Bath	Capacity to overflow	150	16.50		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Shower	Flow rate (litres / minute)	9	39.33		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Kitchen sink taps	Flow rate (litres / minute)	8	13.88		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a washing machine been specified?		Yes		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:	
Washing Machine	Litres / kg	8.17	17.16		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a dishwasher been specified?		Yes		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:	
Dishwasher	Litres / place setting	1.25	4.50		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a waste disposal unit been specified?		No	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00	Select option:	0.00
Water Softener	Litres / person / day		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
	Calculated Use		115.3		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
	Normalisation factor		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91
Code for Sustainable Homes	**Total Consumption**		**104.9**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**
	Mandatory level		**Level 3/4**		-		-		-		-		-		-		-		-		-
Building Regulations 17.K	External use		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0
	Total Consumption		**109.9**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**
	17.K Compliance?		Yes		-		-		-		-		-		-		-		-		-