



The PES

Energy & Sustainability Statement

20th October 2022

Lynton Grange
Fortis Green
N2 9EU

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Version Control

V1	20-10-21	

1.0 Executive Summary

The proposed development at the Lynton Grange has been designed to achieve the highest of environmental performance standards following the Energy Hierarchy as set down by the New London Plan and the London Borough of Haringey's relevant Policy documents.

The new development will provide five residential units with associated parking, cycle parking and refuse stores.

The report takes on board the latest GLA guidance on writing energy statements (June 2022) as well as taking into account matters raised within the London Plan 2021.

However, the very latest guidance from the GLA requires the on-going use of SAP2012 and the SAP10 emission conversion factors – and this report is informed accordingly.

The PES Ltd have been appointed to develop a strategy and advise how the proposed development of new build apartments and commercial will comply with these requirements.

A 'Lean, Clean, Green' has been adopted and the development achieves an improvement in build fabric at over **17%** at the "Be Lean" stage and an overall improvement (DER/TER) in regulated emissions at over **76%** above Part L 2013 standard (using SAP10 data), through the adoption of very high standards of insulation, heat pump driven heating and hot water systems and a roof mounted PV array.

The reduction in regulated emissions achieved through the use of renewable and energy generating technologies is over **59%**.

2.0 The Site & Proposal

The application site to the north side of Fortis Green is currently occupied by 2 rows of garage units.

The proposals involve the demolition of existing garages and redevelopment of the site to provide five residential units with associated parking, cycle parking and refuse stores.

2.1 Planning Policy

The site sits within the London Borough of Haringey

Haringey's Development Management DPD was adopted in July 2017

The key policy is Policy DM21: Sustainable Design, Layout and Construction

A All new development, including building and landscape works, will be expected to consider and implement sustainable design, layout and construction techniques.

Proposals should:

- a Apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements;
- b Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems;
- c Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls
- d Wherever possible, use building materials with high environmental performance ratings; and
- e Seek opportunities for locally sourced labour.

B The Council will support appropriate measures to sustainably retrofit existing homes and non-residential buildings.

C Proposals that fail to demonstrate adequate consideration for sustainable design, layout and construction techniques will be resisted.

D Consideration will be given to the use of carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals are unable to meet carbon dioxide emission reduction targets on-site.

2.2 The London Plan

Chapter 9 deals with Sustainable Infrastructure: -

Policy SI2 Minimising greenhouse gas emissions

A Major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

- 1) Be lean: use less energy and manage demand during construction and operation.
- 2) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.
- 3) Be green: generate, store and use renewable energy on-site.

B Major development should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and will be expected to monitor and report on energy performance.

C In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should aim to achieve 10 per cent, and non-residential development should aim to achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided:

- 1) through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or
- 2) off-site provided that an alternative proposal is identified, and delivery is certain.

Policy SI3 Energy infrastructure

D Major development proposals within Heat Network Priority Areas should have a communal heating system

1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

- a) connect to local existing or planned heat networks
- b) use available local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system)
- c) generate clean heat and/or power from zero-emission sources
- d) use fuel cells (if using natural gas in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
- e) use low emission combined heat and power (CHP) (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
- f) use ultra-low NOx gas boilers.

2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that there is no significant impact on local air quality.

3) Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

Policy SI4 Managing heat risk

A. Development proposals should minimise internal heat gain and the impacts of the urban heat island through design, layout, orientation and materials.

B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

- 1) minimise internal heat generation through energy efficient design
- 2) reduce the amount of heat entering a building through orientation, shading, albedo, fenestration, insulation and the provision of green roofs and walls
- 3) manage the heat within the building through exposed internal thermal mass and high ceilings
- 4) provide passive ventilation
- 5) provide mechanical ventilation
- 6) Provide active cooling systems.

Policy SI5 Water infrastructure

C. Development proposals should:

- 1) 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)
- 2) achieve at least the BREEAM excellent standard (commercial development)
- 3) be encouraged to 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.

The Lynton Grange project is non-major, but the design team will continue to take guidance and optimise the sustainability credentials of the proposed development by following the London Plan guidance.

3.0 Baseline energy results

The first stage of the Mayor's Energy Hierarchy is to consider the baseline energy model. The following section details the baseline energy requirements for the development – the starting point when considering the energy hierarchy.

3.1 New Build Dwellings

The baseline emission levels – the Target Emission Rate (TER) as required for Building regulations compliance - is obtained by applying the design to a reference 'notional' building the characteristics of which are set by regulations – SAP2012; The new Part L Building Regulations 2013 came into force in April 2014 and introduced a completely new notional dwelling as detailed below:-

Table 4 Summary of concurrent notional dwelling specification

Element or System	Values
Opening areas (windows and doors)	Same as actual dwelling up to a maximum proportion of 25% of total floor area [1]
External Walls (including opaque elements of curtain walls) [6]	0.18 W/m ² K
Party Walls	0.0 W/m ² K
Floor	0.13 W/m ² K
Roof	0.13 W/m ² K
Windows, roof windows, glazed rooflights and glazed doors	1.4 W/m ² K [2] (Whole window U-value) g-value = 0.63 [3]
Opaque doors	1.0 W/m ² K
Semi glazed doors	1.2 W/m ² K
Air tightness	5.0 m ³ /hr/m ²
Linear thermal transmittance	Standardised psi values – See SAP Appendix R, except use of $y=0.05$ W/m ² K if the default value of $y=0.15$ W/m ² K is used in the actual dwelling
Ventilation type	Natural (with extract fans) [4]
Air conditioning	None
Element or System	Values
Heating System	Mains gas If combi boiler in actual dwelling, combi boiler; otherwise regular boiler Radiators Room sealed Fan flue SEDBUK 2009 89.5% efficient
Controls	Time and temperature zone control [5] Weather compensation Modulating boiler with interlock
Hot water storage system	Heated by boiler (regular or combi as above) If cylinder specified in actual dwelling, volume of cylinder in actual dwelling. If combi boiler, no cylinder. Otherwise 150 litres. Located in heated space. Thermostat controlled Separate time control for space and water heating
Primary Pipework	Fully Insulated
Hot water cylinder loss factor (if specified)	Declared loss factor equal or better than $0.85 \times (0.2 + 0.051 V2/3)$ kWh/day
Secondary Space Heating	None
Low Energy Lighting	100% Low Energy Lighting
Thermal Mass Parameter	Medium (TMP=250)

SAP first creates the notional reference building, based upon the same shape and form as the proposed dwelling and applies the above the characteristics as defined in SAP2012.

Once all of the baseline emission rates have been calculated in line with the above Government approved methodologies, they are considered as stage 'zero' of the energy hierarchy as described earlier and Target Emission Rate sets the benchmark for the worst performing, but legally permissible, development.

3.2 Unregulated Energy Use

The baseline un-regulated energy use for cooking and appliances in the residential units have been calculated using the SAP Section 16 methodology; the same calculation used for Code for Sustainable Homes (CfSH) Ene 7.

$$\text{Appliances} = E_A = 207.8 \times (\text{TFA} \times N)^{0.4714}$$

$$\text{Cooking} = (119 + 24N)/\text{TFA}$$

N= no of occupant SAP table 1B

TFA – Total Floor Area

The unregulated energy use per sqm is summarised in Table 1 below and amended to reflect SAP10 emission values.

The full spreadsheet of all calculations for the project is attached at **Appendix D**.

Table 1 – Unregulated Energy Use

Unit	Unregulated Energy Use
	Kg/sqm
UNIT 01	6.81
UNIT 02	6.85
UNIT 03	6.85
UNIT 04	6.85
UNIT 05	6.85

The un-regulated emission rates are added to the baseline regulated emission rates (as calculated above) in order to set the total baseline emission rates before then applying the energy hierarchy in line with The London Plan and Local Plan policies: -

Table 2 – Baseline energy consumption and CO2 emissions

Unit	Target Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total baseline emissions Kg/sqm	Total baseline emissions Kg
UNIT 01	18.25	6.81	25.06	2313.90
UNIT 02	18.46	6.85	25.31	2086.13
UNIT 03	17.07	6.85	23.93	1972.15
UNIT 04	17.07	6.85	23.93	1972.15
UNIT 05	17.85	6.85	24.70	2036.23
Total				10,381

The baseline SAP TER outputs (which summarise the key data) are attached at **Appendix A**, with the SAP 10 calculations attached at **Appendix D**.

4.0 Design for energy efficiency

The first step in the Mayor's 'Energy Hierarchy' as laid out in Chapter 9 of The New London Plan, requests that buildings be designed to use improved energy efficiency measures – Be Lean. This will reduce demand for heating, cooling, and lighting, and therefore reduce operational costs while also minimizing associated carbon dioxide emissions.

This section sets out the measures included within the design of the development, to reduce the demand for energy, both gas and electricity (not including energy from renewable sources). The table at the end of this section details the amount of energy used and CO₂ produced by the building after the energy efficiency measures have been included. From these figures the overall reduction in CO₂ emissions, as a result of passive design measures, can be calculated. To achieve reductions in energy-demand the following measures have been included within the design and specification of the building:

4.1 Passive Design

The National Planning Policy Framework emphasises the need to take account of climate change over the longer term and plan new developments to avoid increased vulnerability to the range of impacts arising from climate change. The UK Climate Impacts Programme 2009 projections suggest that by the 2080's the UK is likely to experience summer temperatures that are up to 4.2°C higher than they are today.

In line with current GLA Guidance, the project at Lynton Grange has had been designed to ensure the building is not vulnerable to overheating; to instigate consideration of the risk of overheating with the proposed development, the design team have followed the guidance within the London Plan, which considers the control of overheating using the Cooling Hierarchy:-

1. minimise internal heat generation through energy efficient design

The project will be designed to best practice thermal insulation levels as noted, full details of which are noted under 4.3 below.

Not only does good insulation assist in reducing heat losses in the winter, but it also has a significant impact on preventing heat travelling through the build fabric during the summer.

2. reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and wall

The project is arranged around an east-west orientation

The surrounding context is of low rise 2-3 storey buildings and mature trees which offer a little by way of topographical shading.

The residential units have a design in such a way that all living areas have aspects within 20/30° of south, ensuring that all living areas enjoy adequate daylight and sunlight in line with BRE guidance

Additionally, the living areas incorporate large areas of glazing to maximise the levels of natural daylight and thereby reducing the requirements for artificial lighting and ensuring significant opportunity to harvest passive solar gain.

There is very little glazing to the northern aspect – removing the potential for heat losses to this aspect.

Given the above noted orientations and lack of topographical shading, the overheating risk has been considered as part of the scheme design; All glazing will achieve a g-value of 0.4 or better in order to offer a level of solar control during the peak summer months

3. manage the heat within the building through exposed internal thermal mass and high ceilings

All the dwelling have been designed with floor to ceiling heights at 2.5m to 2.8m.

The construction will be of traditional brick and block with slab floors – offering high thermal mass level able to assist in the regulation of internal temperatures; absorbing heat in the summer which can be vented overnight.

During winter months, the heat absorbed into the thermal mass is released back into the building during the night – reducing heating loads.

4. passive ventilation

All of the dwellings have been designed to offer the potential for cross ventilation and all glazing is designed to have opening areas to introduce high levels of natural levels of “purge” ventilation to further assist in the reduction of overheating risks during peak weather periods.

5. mechanical ventilation

Given the Lynton Grange location, away from traffic movements and the associated potential acoustic and air quality issues, the design team are proposing the use of low energy natural ventilation strategy.

4.2 Heating system

For the “notional” energy efficient model, the primary heating system for the dwellings will consist of high efficiency gas boilers providing instant hot water and LTHW heating.

- A Rated gas condensing boiler – (90% + SEDBUK seasonal efficiency)

To increase the efficiency in the use of the heating system, the following controls will be used in a 'boiler interlock' system to eliminate needless firing of the boiler.

- Time and temperature zone control
- Boiler fitted with a weather compensation system

4.4 Fabric heat loss

Fabric

Insulation measures will be utilised to ensure the calculated u values exceed the Building Regulations minima, with specific guidance taken from the design team: -

New wall constructions are yet to be specified, but the design team is targeting achieving a u-value of $0.15\text{W/m}^2\text{k}$ via a highly insulated rendered/clad construction within a steel frame utilising phenolic foam insulation.

The roof structures will be designed to meet a u-value of $0.12\text{W/m}^2\text{k}$

The exposed ground floors will target a u value at $0.14\text{W/m}^2\text{k}$ or better

Glazing

New glazing units for the residential spaces will be triple glazed with an area weighted average u-value of $1.2\text{W/m}^2\text{K}$ or better.

Air Tightness

The project will be tested for air tightness with a target value of $4\text{m}^3/\text{hr/m}^2$ in line with best practice for naturally ventilated buildings.

Construction Details

Heat loss via non-repeating thermal bridging will be minimised by the use of Accredited Construction Details for these new build units to ensure compliance with the minimum standards for dwelling fabric energy efficiency under SAP2012.

4.5 Ventilation

As noted above, the flats will be naturally ventilated, with background/trickly ventilation, opening windows for purge ventilation and wet room extraction.

4.6 Lighting

A 100% of internal light fittings throughout the development will be dedicated low-energy LED light fittings

To further reduce energy consumption, the developers will adopt Code for Sustainable Homes principles, providing high EU rated whites goods, ensuring all external lighting systems are high efficacy with appropriate daylight controls and providing smart metering to enable occupant to measure and manage their energy consumption.

4.7 Energy efficiency results

The following table shows a comparison between the baseline scheme assessed under the SAP methodology Part L minima and the scheme following the introduction of energy efficiency measures (not including energy from renewable sources), with the calculation data attached at **Appendix D**.

Table 3 – Energy consumption and CO2 reductions

Unit	Building Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total emissions Kg/sqm	Total emissions Kg
UNIT 01	15.54	6.81	22.34	2063.21
UNIT 02	15.25	6.85	22.10	1821.63
UNIT 03	14.08	6.85	20.93	1725.34
UNIT 04	14.08	6.85	20.93	1725.34
UNIT 05	14.48	6.85	21.33	1758.34
Total				9,094

The results show that, for the new development with the energy efficiency measures, the reduction in CO₂ emissions is **12.40%**.

The SAP Dwelling Emission Rates outputs are attached at **Appendix B**.

The energy demands of the proposed development are tabulated below.

Table 4 – Energy Demand, “Be-Lean”

Building	Energy demand following energy efficiency measures (Mwh/year)						
	Space Heating	Hot Water	Lighting	Cooling	Auxiliary	Unregulated electricity	Unregulated gas
Residential	22.10	4.92	1.92	N/A	0.375	2.89	N/A

Further reporting requirements are tabulated below.

The total Part L Fabric Energy Efficiency Standard (FEES) for the development – set out in Table 5 below:-

Table 5 – Residential FEES

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement (per cent)
Development Total	25.21	21.25	15.71

The Energy Use Intensity and space heating demand of the development – Table 6 below

Table 6 – Energy and Heat Demands

Building Type	Energy Use Intensity (kWh/m ² /year)	Space Heating (kWh/m ² /year)
Residential	69.43	52.35

5.0 Supplying Energy Efficiently

The second stage in the Mayor's 'Energy Hierarchy' is to ensure efficient and low carbon energy supply – Be Clean. In particular, this concerns provision of decentralised energy where practical and appropriate.

Haringey Local Plan policy - promotes zero carbon development by requiring all development to demonstrate it has minimised on-site CO₂ emissions and supports development of decentralised energy networks.

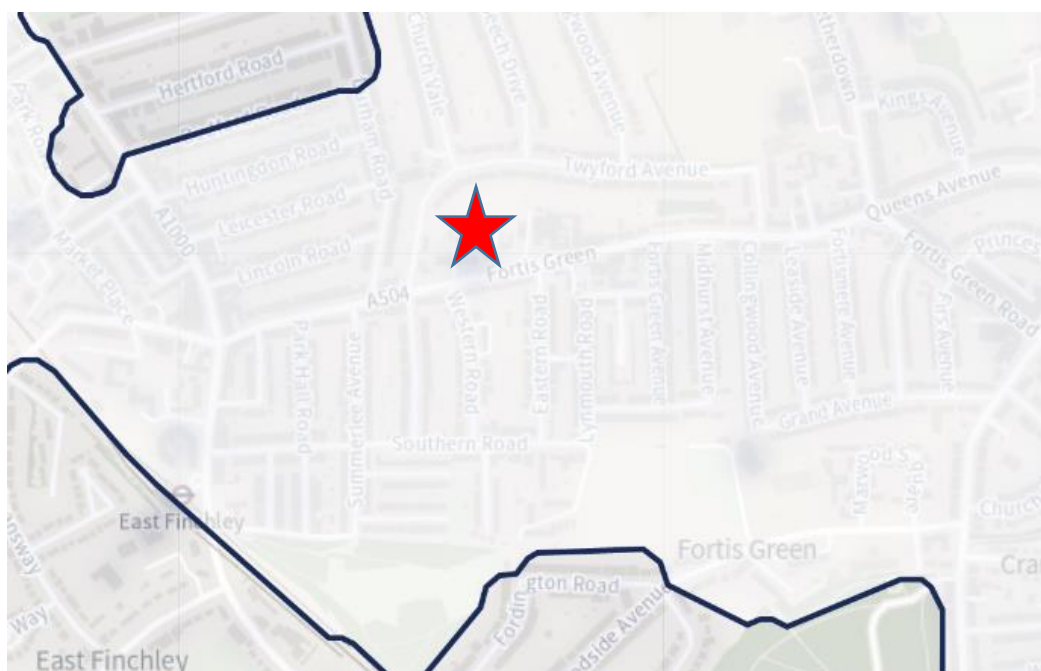
5.1 Community Heating/Combined Heat and Power (CHP)

The London Plan requires development to consider the availability of district energy networks (DENs) and the ability of new development to connect to any such network: -

Combined heat and power systems are essentially biomass or fossil fuel fired electricity generators that use the heat by-product to provide space and water heating. The electricity generated can be used directly within the host buildings or sold to electricity suppliers on the national grid. These systems can be employed on a large scale for community schemes or on a smaller scale for individual buildings.

Alternatively, larger scale systems operated as a standalone entity can be used to provide heat and power to the local neighbourhood a DEN

Therefore, this report must consider the availability – now or in the future – of heat networks in the Lynton Grange area. The extract from the London Heat Map (reproduced below) suggests that the project sits remote from any proposed DENs, but is within the Heat Network Priority Area.



Extract from London Heat map

Clearly there is some limited potential for the project site to connect to a DEN at some time in the future, however, as a non-major scheme set back from Fortis Green itself, the cost of any such connection is likely to be non-viable and the matter is not considered further.

However, it can be noted that the proposed LTHE heating and DHW system would be compatible with a connection should it become available at any point in the future.

6.0 Renewable Energy Options

The final element of the Mayor's 'Energy Hierarchy' requires development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible – Be Green.

This is further supported by Haringey's Local Plan policies

Renewable energy can be defined as energy taken from naturally occurring or renewable sources, such as sunlight, wind, wave's tides, geothermal etc. Harnessing these energy sources can involve a direct use of natural energy, such as solar water heating panels, or it can be a more indirect process, such as the use of Biofuels produced from plants, which have harnessed and embodied the sun's energy through photosynthesis.

The energy efficiency measures and the sourcing the energy efficiently outlined above have the most significant impact on the heating and hot water energy requirements for the development, and the associated reduction in gas consumption.

This section then sets out the feasibility of implementing different energy technologies in consideration of: -

- Potential for Carbon savings
- Capital costs
- Running costs
- Payback period as a result of energy saved/Government incentives
- Maturity/availability of technology
- Reliability of the technology and need for back up or alternative systems.

6.1 Government incentives

6.1.1 Smart Export Guarantee (SEG)

Introduced in 2020, the SEG will enable solar photovoltaic (PV), wind, hydro and anaerobic digestion (AD) installations up to 5MW and micro-combined heat and power (micro-CHP) up to 50kW will be able to receive an export tariff under the policy.

The SEG is a market-led initiative, requiring electricity supply licensees to offer export tariffs to eligible generators. Suppliers are free to set their own SEG compliant tariff price (provided it is above zero pence at all times) and decide how their tariffs work.

Installation owners are able to shop around and select the Licensee of their choice based upon an offer of the most appropriate tariff.

Payment are made against metered exports only.

6.1.1 Renewable Heat Incentive

The Renewable Heat Incentive (RHI) was formally withdrawn to all projects in March 2022.

6.2 Wind turbines

Wind turbines come in two main types'- horizontal axis and vertical axis. The more traditional horizontal axis systems rotate around the central pivot to face into the wind, whilst vertical axis systems work with wind from all directions.

The potential application of wind energy technologies at a particular site is dependent upon a variety of factors. But mainly these are: -

- Wind speed
- Wind turbulence
- Visual impact
- Noise impact
- Impact upon ecology

The availability and consistency of wind in urban environments is largely dependent upon the proximity, scale and orientation of surrounding obstructions. The site is surrounded by other properties of similar height in all directions. To overcome these obstructions and to receive practical amounts of non-turbulent wind, the blades of a wind turbine would need to be placed significantly above the roof level of the surrounding buildings and project site itself.

It is inconceivable that any wind turbines of this size would be considered acceptable in this location.

6.3 Solar Energy

The development at Lynton Grange has areas of low pitched roof that could accommodate solar panels.

In general, the roofs will have an unrestricted aspect, so there is scope therefore to site solar photovoltaic (PV) or water heating equipment at roof level.

6.3.1 Solar water heating

Solar water heating panels come in two main types: flat plate collectors and evacuated tubes. Flat plate collectors feed water, or other types of fluid used specifically to carry heat, through a roof mounted collector and into a hot water storage tank. Evacuated tube collectors are slightly more advanced as they employ sealed vacuum tubes, which capture and harness the heat more effectively.

Both collector types can capture heat whether the sky is overcast or clear. Depending on location, approximately 900–1100 kWh of solar energy falls on each m² of unshaded UK roof surface annually. The usable energy output per m² of solar panel as a result of this amount of insolation ranges from between 380 – 550 kWh/yr.

Solar hot water systems are of course, displacing high efficiency gas or heat pump systems, so it would require a very large system to compete with the off-setting of electricity use afforded by PV panels.

Accordingly, the use of solar thermal systems is dismissed.

6.3.2 Photovoltaics (PV)

A 1kWp (1 kilowatt peak) system in the UK could be expected to produce between 790-800kWh of electricity per year based upon a south east orientation according to SAP2005 methodology used by the Microgeneration Certification Scheme (MCS). The figure given in the London Renewables Toolkit is 783 kWh per year for a development in London.

Despite the withdrawal of the Feed in Tariff, the returns on PV installations can still achieve 7-9% via the reduction in electricity consumption and the associated high current costs of same.

Accordingly, the design team are proposing the installation of a 5 panel, 2.2Kwp PV array per dwelling, generating some 9,500kWh per annum across the scheme and reducing occupants running costs accordingly.

6.4 Biomass heating

Biomass is a term given to fuel derived directly from biological sources for example rapeseed oil, wood chip/pellets or gas from anaerobic digestion. It can only be considered as a renewable energy source if the carbon dioxide emitted from burning the fuel is later recaptured in reproducing the fuel source (i.e. trees that are grown to become wood fuel, capture carbon as they grow).

Biomass heating systems require space to site a boiler and fuel hopper along with a supply of fuel – which can be very bulky items. There also needs to be a local source of biomass fuel that can be delivered on a regular basis. There are also issues with fuel storage and delivery which mitigate against this technology. There is inadequate space at ground floor level for a fuel store and limited access for delivery lorries.

Additionally, a boiler of this type would replace the need for a conventional gas boiler and therefore offset all the gas energy typically used for space and water heating. However, biomass releases high levels of NO_x emissions, as well as other pollutants and would therefore have to be considered carefully against the high standard of air quality requirements in Haringey, as the whole borough has been designated as an Air Quality Management Area. Accordingly, the use of biomass is not considered appropriate for this project.

6.6 Ground source heat pump

All heat pump technologies utilise electricity as the primary fuel source – in this case displacing gas, as such, the overall reduction in emissions when using this technology can be less effective when opposed to a technology that is actually displacing electricity.

Ground source heating or cooling requires a source of consistent ground temperature, which could be a vertical borehole or a spread of pipework loops and a 'heat pump'. The system uses a loop of fluid to collect the more constant temperature in the ground and transport it to a heat pump. In a cooling system this principle works in reverse and the heat is distributed into the ground.

The heat pump then generates increased temperatures by 'condensing' the heat taken from the ground, producing hot water temperatures in the region of 45°C. This water can then be used as pre-heated water for a conventional boiler or to provide space heating with an under-floor heating system.

The use of a ground source heating/cooling system will therefore require:

- Vertical borehole or ground loop
- Use of under floor heating
- Space for heat pump unit

Clearly, there is insufficient land area to install bore holes or low-level collector loops; there is no scope for the locating of the ground collector devices and as such, ground source heating cannot be considered.

6.7 Air source heat pump

Air source heating or cooling also employs the principle of a heat pump. This time either, upgrading the ambient external air temperature to provide higher temperatures for water and space heating, or taking warmth from within the building and dissipating it to the outdoor air.

Air source heating or cooling also employs the principle of a heat pump. This time either, upgrading the ambient external air temperature to provide higher temperatures for water and space heating, or taking warmth from within the building and dissipating it to the outdoor air.

It must be remembered that heat pumps utilise grid-based electricity, so calculations base the benefits on SAP10 emissions data

Assuming a seasonal system efficiency of 320% (Coefficient of Performance of 3.2) and that the air source heat pump will replace 100% of the space heating/hot water demand, then the system would reduce the overall CO₂ emissions by approximately 60%. The table below demonstrates, on the assumption of a demand of 1000kWh/year for heating and hot water.

Table 7 – ASHP Performance

Type of Array	Energy Consumption (kWh/yr.)	Emission factor (kgCO ₂ /kWh)	Total CO ₂ emissions (kg/annum)
90% efficient gas boiler	11111	0.210	2333
320% efficient ASHP	2813	0.233	655
100% efficient immersion (back-up)	1000	0.233	233

A theoretical carbon saving of 60%

Overall system efficiency is conservatively expected to be around 320% based on the delivery of DHW at higher temperatures and allowing for distribution losses, so actual saving at 60% of emissions are not expected, but certainly it is expected that the heat pump systems will offer a significant carbon saving.

Accordingly, the design team are proposing the use of air to water heat pumps to service the heating and hot water requirements for the dwellings.

The formal design of the heat pump systems will be subject to detailed design at RIBA Stage 4, with these electrical only systems offering the significant advantage of generating zero local emissions.

6.8 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the use of air to water heat pumps to provide heating and hot water to the proposed dwellings along with the above noted roof mounted PV arrays to generate electricity on site and offset a further element of the buildings carbon emissions.

The final table – Table 8 – summarises the final SAP outputs; attached at **Appendix C** (with the SAP10 calculations attached at **Appendix D**).

Table 8 – “Be Green” emission levels

Unit	Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total emissions Kg/sqm	Total emissions Kg
UNIT 01	3.69	6.81	10.50	969.19
UNIT 02	4.39	6.85	11.24	926.39
UNIT 03	4.26	6.85	11.11	915.77
UNIT 04	4.26	6.85	11.11	915.77
UNIT 05	4.14	6.85	10.99	905.82
Total				4,633

The data at Table 5 confirms that overall emissions – including unregulated energy use - have been reduced by **55.37%** over and above the baseline model, with a **49.05%** reduction in emissions directly from the use of energy generating and renewable technologies, i.e. over and above the energy efficient model.

Excluding the un-regulated use, i.e. considering emissions controlled under AD Part L, then the reduction equates to **76.70%**.

8.0 Sustainable Design & Construction

8.1 Domestic Accommodation

The Code for Sustainable Homes (the Code) was the national standard for the sustainable design and construction of new homes.

This was formal withdrawn by DCLG, and planning authorities are no longer able to require developments to meet the technical guidance within the Code for Sustainable Homes

However, the applicants do acknowledge some requirements of the Code, and intend to incorporate the following measures in order to underline the suitability credentials of the proposed development

- Water use - Ensuring that internal wholesome water use will be limited to 105 litres/person/day.
- SuDs – the existing site is 100% building and hard standing, with the introduction of new SuDs strategies, surface water run-off will be reduced.
- NOx emissions – the heat pump driven heating and hot water systems will generate zero local harmful emissions – both NOx and PM
- Waste and recycling – appropriate internal and external storage space will be provided to ensure that residents can sort, store and dispose of waste and recyclable materials.
- The principle contractor will be required to produce a site waste management plan and sustainable procurement plan, to ensure the use of responsibly sourced materials and to ensure that construction waste sent to landfill is kept to a minimum.
- The contractor will also produce a construction-management-plan highlighting best practice construction site standard to avoid the potential for air (dust) pollution, ground water pollution or indeed, noise pollution.
- An energy display device will be provided for the flat. These would monitor the electrical consumption and heating fuel of the dwellings.
- Only appliances with a high EU rating to be installed - typically these would be a washer/dryer, a fridge/freezer and a dishwasher.

9.0 Conclusions

This report has detailed the baseline energy requirements for the proposed development, the reduction in energy demand as a result of energy efficiency measures and the potential to achieve further CO₂ reductions using renewable energy technologies.

The baseline results have shown that if the development was built to a standard to meet only the minimum requirements of current building regulations, including the use of communal heating systems, the total amount of CO₂ emissions would be **10,381Kg/year**.

Following the introduction of passive energy efficiency measures into the development, as detailed in section 4, the total amount of CO₂ emissions would be reduced to **9,094Kg/year**, a reduction of **12.40%**.

There is also a requirement to reduce CO₂ emissions across the development using renewable or low-carbon energy sources. Therefore, the report has considered the feasibility of the following technologies:

- Wind turbines
- Solar hot water
- Photovoltaic systems
- Biomass heating
- CHP (Combined heat and power)
- Ground & Air source heating

The results of the assessment of suitable technologies relative to the nature, locations and type of development suggest that the most suitable solution to meeting reduction in CO₂ emissions would be via the use of air to water heat pump technology for the generation of heating and hot water for the project, alongside a (total) 11kWp PV array.

This has been used in the final SAP models (reproduced at **Appendix C**) for the development which have also been detailed above in Table 8, which show a final gross emission level of **4,633Kg/year**, representing a total reduction in emission over the baseline model, taking into account unregulated energy, of **55.37%**.

In addition, the SAP outputs demonstrate that the building achieves an overall improvement in emissions over the Building Regulations Part L standards for regulated emissions of minimum of **76.70%**.

Tables 9 & 10 Demonstrate how the Lynton Grange project complies with the London Plan requirements and the new GLA guidance relating to zero carbon development.

Table 9 – Carbon Emission Reductions – Domestic Buildings

Key	Tonnes/annum
Baseline CO ₂ emissions (Part L 2013 of the Building Regulations Compliant Development)	7.49
CO ₂ emissions after energy demand reduction (be lean)	6.21
CO ₂ emissions after energy demand reduction (be lean) AND heat network (be clean)	6.21
CO ₂ emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	1.75

Table 10 – Regulated Emissions Savings – Domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO ₂ per annum)	%
Savings from energy demand reduction	1.28	17.09
Savings from heat network	0.00	0.00
Savings from renewable energy	4.46	59.55
Total Cumulative Savings	5.74	76.64
	(Tonnes CO ₂)	
Carbon Shortfall	1.75	
Cumulative savings for off-set payment	52.5	
Cash-in-lieu Contribution	£N/A	

Appendix A

Baseline/Un-regulated Energy Use:-

SAP Outputs & Target Emission Rates

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:51:46

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 92.34m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 01

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 20.16 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.37 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 65.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 56.6 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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 4.00 (design value)
Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Database: (rev 506, product index 018119):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC sustain 28
Model qualifier: VUW 286/7-2 (H-GB)
(Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%
 Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Medium **OK**

Based on:

Overshading: Average or unknown
 Windows facing: West 6.8m²
 Windows facing: South 3.3m²
 Windows facing: South West 8.04m²
 Windows facing: North 2.7m²
 Windows facing: North East 9.6m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 01

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	46.17	(1a) x	2.5	(2a) =	115.42
First floor	46.17	(1b) x	2.8	(2b) =	129.28
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.34	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			244.7

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							3	x 10 =	30
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.37
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.48	0.47	0.46	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.42	0.44
--	------	------	------	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.6 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1	= 1.78		(26)
Windows Type 1			4.76	x1/[1/(1.4)+ 0.04] =	6.31		(27)
Windows Type 2			2.31	x1/[1/(1.4)+ 0.04] =	3.06		(27)
Windows Type 3			5.63	x1/[1/(1.4)+ 0.04] =	7.46		(27)
Windows Type 4			1.89	x1/[1/(1.4)+ 0.04] =	2.51		(27)
Windows Type 5			6.72	x1/[1/(1.4)+ 0.04] =	8.91		(27)
Floor			46.17	x 0.13	= 6.0021		(28)
Walls	146.33	23.09	123.24	x 0.18	= 22.18		(29)
Roof	46.17	0	46.17	x 0.13	= 6		(30)
Total area of elements, m²			238.67				(31)
Internal wall **			164.09				(32c)
Internal floor			46.17				(32d)
Internal ceiling			46.17				(32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 64.22 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 15612.03 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

14.51 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

78.73 (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=	49.49	49.13	48.79	47.16	46.85	45.43	45.43	45.17	45.98	46.85	47.47	48.11

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	128.22	127.87	127.52	125.89	125.59	124.17	124.17	123.9	124.71	125.59	126.2	126.85
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Average = Sum(39)_{1...12} /12=

125.89 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.39	1.38	1.38	1.36	1.36	1.34	1.34	1.34	1.35	1.36	1.37	1.37
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Average = Sum(40)_{1...12} /12=

1.36 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.29

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.02	103.13	99.24	95.34	91.45	87.56	87.56	91.45	95.34	99.24	103.13	107.02
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Total = Sum(44)_{1...12} =

1167.48 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.71	138.81	143.23	124.88	119.82	103.4	95.81	109.95	111.26	129.66	141.54	153.7
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Total = Sum(45)_{1...12} =

1530.75 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.81	20.82	21.49	18.73	17.97	15.51	14.37	16.49	16.69	19.45	21.23	23.05
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(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0
0

(54)
 Enter (50) or (54) in (55) (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
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(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m

(61)m=

50.96	46.03	50.57	47.02	46.6	43.18	44.62	46.6	47.02	50.57	49.32	50.96
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(61)

Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

209.66	184.83	193.8	171.89	166.42	146.58	140.43	156.55	158.28	180.23	190.85	204.66
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(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63) (G2)

Output from water heater

(64)m=

209.66	184.83	193.8	171.89	166.42	146.58	140.43	156.55	158.28	180.23	190.85	204.66
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2104.19

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

65.51	57.66	60.27	53.28	51.49	45.17	43.01	48.21	48.75	55.75	59.39	63.84
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(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82

(66)

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

(67)m=

21.69	19.27	15.67	11.86	8.87	7.49	8.09	10.51	14.11	17.92	20.91	22.29
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

243.32	245.84	239.48	225.93	208.84	192.77	182.03	179.51	185.87	199.41	216.51	232.58
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

88.05	85.8	81.01	73.99	69.21	62.74	57.81	64.8	67.71	74.94	82.49	85.81
-------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

418.91	416.76	402	377.64	352.76	328.84	313.78	320.66	333.53	358.12	385.76	406.53
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(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
North	0.9x	0.77	x	1.89	x	10.63	x	0.63	x	0.7	=	6.14 (74)
North	0.9x	0.77	x	1.89	x	20.32	x	0.63	x	0.7	=	11.74 (74)
North	0.9x	0.77	x	1.89	x	34.53	x	0.63	x	0.7	=	19.94 (74)
North	0.9x	0.77	x	1.89	x	55.46	x	0.63	x	0.7	=	32.04 (74)
North	0.9x	0.77	x	1.89	x	74.72	x	0.63	x	0.7	=	43.16 (74)
North	0.9x	0.77	x	1.89	x	79.99	x	0.63	x	0.7	=	46.2 (74)
North	0.9x	0.77	x	1.89	x	74.68	x	0.63	x	0.7	=	43.13 (74)
North	0.9x	0.77	x	1.89	x	59.25	x	0.63	x	0.7	=	34.22 (74)
North	0.9x	0.77	x	1.89	x	41.52	x	0.63	x	0.7	=	23.98 (74)
North	0.9x	0.77	x	1.89	x	24.19	x	0.63	x	0.7	=	13.97 (74)
North	0.9x	0.77	x	1.89	x	13.12	x	0.63	x	0.7	=	7.58 (74)
North	0.9x	0.77	x	1.89	x	8.86	x	0.63	x	0.7	=	5.12 (74)
Northeast	0.9x	0.77	x	6.72	x	11.28	x	0.63	x	0.7	=	23.17 (75)
Northeast	0.9x	0.77	x	6.72	x	22.97	x	0.63	x	0.7	=	47.17 (75)
Northeast	0.9x	0.77	x	6.72	x	41.38	x	0.63	x	0.7	=	84.98 (75)
Northeast	0.9x	0.77	x	6.72	x	67.96	x	0.63	x	0.7	=	139.56 (75)
Northeast	0.9x	0.77	x	6.72	x	91.35	x	0.63	x	0.7	=	187.6 (75)
Northeast	0.9x	0.77	x	6.72	x	97.38	x	0.63	x	0.7	=	200 (75)
Northeast	0.9x	0.77	x	6.72	x	91.1	x	0.63	x	0.7	=	187.1 (75)
Northeast	0.9x	0.77	x	6.72	x	72.63	x	0.63	x	0.7	=	149.16 (75)
Northeast	0.9x	0.77	x	6.72	x	50.42	x	0.63	x	0.7	=	103.55 (75)
Northeast	0.9x	0.77	x	6.72	x	28.07	x	0.63	x	0.7	=	57.64 (75)
Northeast	0.9x	0.77	x	6.72	x	14.2	x	0.63	x	0.7	=	29.16 (75)
Northeast	0.9x	0.77	x	6.72	x	9.21	x	0.63	x	0.7	=	18.92 (75)
South	0.9x	0.77	x	2.31	x	46.75	x	0.63	x	0.7	=	33.01 (78)
South	0.9x	0.77	x	2.31	x	76.57	x	0.63	x	0.7	=	54.05 (78)
South	0.9x	0.77	x	2.31	x	97.53	x	0.63	x	0.7	=	68.86 (78)
South	0.9x	0.77	x	2.31	x	110.23	x	0.63	x	0.7	=	77.82 (78)
South	0.9x	0.77	x	2.31	x	114.87	x	0.63	x	0.7	=	81.1 (78)
South	0.9x	0.77	x	2.31	x	110.55	x	0.63	x	0.7	=	78.04 (78)
South	0.9x	0.77	x	2.31	x	108.01	x	0.63	x	0.7	=	76.25 (78)
South	0.9x	0.77	x	2.31	x	104.89	x	0.63	x	0.7	=	74.05 (78)
South	0.9x	0.77	x	2.31	x	101.89	x	0.63	x	0.7	=	71.93 (78)
South	0.9x	0.77	x	2.31	x	82.59	x	0.63	x	0.7	=	58.3 (78)
South	0.9x	0.77	x	2.31	x	55.42	x	0.63	x	0.7	=	39.12 (78)
South	0.9x	0.77	x	2.31	x	40.4	x	0.63	x	0.7	=	28.52 (78)

TER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	5.63	x	36.79		0.63	x	0.7	=	63.31	(79)
Southwest	0.9x	0.77	x	5.63	x	62.67		0.63	x	0.7	=	107.84	(79)
Southwest	0.9x	0.77	x	5.63	x	85.75		0.63	x	0.7	=	147.55	(79)
Southwest	0.9x	0.77	x	5.63	x	106.25		0.63	x	0.7	=	182.82	(79)
Southwest	0.9x	0.77	x	5.63	x	119.01		0.63	x	0.7	=	204.77	(79)
Southwest	0.9x	0.77	x	5.63	x	118.15		0.63	x	0.7	=	203.29	(79)
Southwest	0.9x	0.77	x	5.63	x	113.91		0.63	x	0.7	=	195.99	(79)
Southwest	0.9x	0.77	x	5.63	x	104.39		0.63	x	0.7	=	179.61	(79)
Southwest	0.9x	0.77	x	5.63	x	92.85		0.63	x	0.7	=	159.76	(79)
Southwest	0.9x	0.77	x	5.63	x	69.27		0.63	x	0.7	=	119.18	(79)
Southwest	0.9x	0.77	x	5.63	x	44.07		0.63	x	0.7	=	75.83	(79)
Southwest	0.9x	0.77	x	5.63	x	31.49		0.63	x	0.7	=	54.18	(79)
West	0.9x	0.77	x	4.76	x	19.64	x	0.63	x	0.7	=	28.57	(80)
West	0.9x	0.77	x	4.76	x	38.42	x	0.63	x	0.7	=	55.89	(80)
West	0.9x	0.77	x	4.76	x	63.27	x	0.63	x	0.7	=	92.04	(80)
West	0.9x	0.77	x	4.76	x	92.28	x	0.63	x	0.7	=	134.24	(80)
West	0.9x	0.77	x	4.76	x	113.09	x	0.63	x	0.7	=	164.52	(80)
West	0.9x	0.77	x	4.76	x	115.77	x	0.63	x	0.7	=	168.41	(80)
West	0.9x	0.77	x	4.76	x	110.22	x	0.63	x	0.7	=	160.34	(80)
West	0.9x	0.77	x	4.76	x	94.68	x	0.63	x	0.7	=	137.73	(80)
West	0.9x	0.77	x	4.76	x	73.59	x	0.63	x	0.7	=	107.05	(80)
West	0.9x	0.77	x	4.76	x	45.59	x	0.63	x	0.7	=	66.32	(80)
West	0.9x	0.77	x	4.76	x	24.49	x	0.63	x	0.7	=	35.62	(80)
West	0.9x	0.77	x	4.76	x	16.15	x	0.63	x	0.7	=	23.5	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	154.2	276.69	413.37	566.48	681.14	695.95	662.81	574.77	466.27	315.42	187.31	130.24	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	573.1	693.44	815.37	944.12	1033.9	1024.79	976.59	895.43	799.8	673.54	573.06	536.77	(84)
--------	-------	--------	--------	--------	--------	---------	--------	--------	-------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.54	0.6	0.84	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.47	19.66	19.98	20.39	20.73	20.92	20.98	20.97	20.82	20.36	19.84	19.44	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.77	19.78	19.78	19.79	19.79	19.81	19.81	19.81	19.8	19.79	19.79	19.78	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.81	0.6	0.4	0.46	0.76	0.96	0.99	1	(89)
--------	---	------	------	------	------	-----	-----	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

TER WorkSheet: New dwelling design stage

(90)m=	17.76	18.04	18.5	19.08	19.53	19.76	19.8	19.8	19.66	19.06	18.31	17.72	(90)
$fLA = \text{Living area} \div (4) =$												0.41	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.45	18.7	19.1	19.61	20.02	20.23	20.28	20.27	20.13	19.59	18.93	18.42	(92)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.45	18.7	19.1	19.61	20.02	20.23	20.28	20.27	20.13	19.59	18.93	18.42	(93)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, hm :

(94)m=	1	0.99	0.97	0.93	0.82	0.64	0.46	0.52	0.79	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=	570.44	686.11	793.83	874.99	846.99	652.88	448.52	465.65	631.71	643.8	567.75	534.88	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1814.72	1764.73	1606.75	1348.85	1044.86	699.36	456.99	480.02	752.08	1129.32	1493.33	1803.85	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	925.74	724.83	604.81	341.18	147.21	0	0	0	0	361.23	666.42	944.11	
$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} =$												4715.53	(98)

Space heating requirement in $kWh/m^2/year$

51.07	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) $(202) = 1 - (201) =$ 1 (202)

Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$ 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

925.74	724.83	604.81	341.18	147.21	0	0	0	0	361.23	666.42	944.11
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$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

991.15	776.05	647.55	365.29	157.61	0	0	0	0	386.75	713.51	1010.82
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$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} =$ 5048.74 (211)

Space heating fuel (secondary), $kWh/month$

$= \{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=	0	0	0	0	0	0	0	0	0	0	0		
$\text{Total (kWh/year)} = \text{Sum}(215)_{1..5,10..12} =$												0	(215)

Water heating

Output from water heater (calculated above)

209.66	184.83	193.8	171.89	166.42	146.58	140.43	156.55	158.28	180.23	190.85	204.66
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Efficiency of water heater 80.3 (216)

TER WorkSheet: New dwelling design stage

(217)m=

88.35	88.15	87.72	86.74	84.74	80.3	80.3	80.3	80.3	86.77	87.94	88.42
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 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

237.32	209.69	220.93	198.16	196.38	182.54	174.88	194.95	197.11	207.72	217.03	231.46
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Total = Sum(219a)_{1...12} =

2468.17

 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

5048.74

Water heating fuel used

2468.17

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

 (230c)

boiler with a fan-assisted flue

45

 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

 (231)

Electricity for lighting

383.09

 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

7975

 (238)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	1090.53 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	533.12 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1623.65 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	198.82 (268)
Total CO2, kg/year	sum of (265)...(271) =			1861.4 (272)

TER =

20.16

 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:51:44

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 02

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

20.5 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

17.24 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

62.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

52.2 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.15 (max. 0.30)

0.15 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

0.14 (max. 0.25)

0.14 (max. 0.70)

OK

Roof

0.12 (max. 0.20)

0.12 (max. 0.35)

OK

Openings

1.20 (max. 2.00)

1.20 (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

4.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Database: (rev 506, product index 018119):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Vaillant

Model: ecoTEC sustain 28

Model qualifier: VUW 286/7-2 (H-GB)

(Combi)

Efficiency 89.1 % SEDBUK2009

Minimum 88.0 %

OK

Secondary heating system:

None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**

Hot water controls: No cylinder thermostat

No cylinder

Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%

Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown

Windows facing: East 4.33m²

Windows facing: South 1.2m²

Windows facing: West 7.03m²

Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K

Party Walls U-value 0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 02

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	3.26	(2b) =	137.41
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	238.11

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							3	x 10 =	30
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.38	0.4	0.42	0.44
--	------	------	------	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6
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(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6
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(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1	= 1.78		(26)
Windows Type 1			4.33	x 1/[1/(1.4)+ 0.04]	= 5.74		(27)
Windows Type 2			1.2	x 1/[1/(1.4)+ 0.04]	= 1.59		(27)
Windows Type 3			7.03	x 1/[1/(1.4)+ 0.04]	= 9.32		(27)
Floor Type 1			40.28	x 0.13	= 5.2364		(28)
Floor Type 2			1.87	x 0.13	= 0.2431		(28)
Walls	102.34	14.34	88	x 0.18	= 15.84		(29)
Roof	46.34	0	46.34	x 0.13	= 6.02		(30)
Total area of elements, m²			190.83				(31)
Party wall			52.81	x 0	= 0		(32)
Internal wall **			124.99				(32c)
Internal floor			40.28				(32d)
Internal ceiling			40.28				(32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 45.78 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14754.18 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

12.17 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

57.94 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
48.32	47.97	47.62	46.01	45.71	44.3	44.3	44.04	44.84	45.71	46.32	46.96

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

106.26	105.91	105.56	103.95	103.65	102.24	102.24	101.98	102.78	103.65	104.26	104.9
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Average = Sum(39)_{1...12} / 12 =

103.95 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.29	1.28	1.28	1.26	1.26	1.24	1.24	1.24	1.25	1.26	1.26	1.27
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.26 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

50.96	45.74	48.73	45.31	44.91	41.61	43	44.91	45.31	48.73	49.01	50.96
-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS

0 0 0 0 0 0 0 0 0 0 0 0

(63) (G2)

Output from water heater

(64)m=

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2034.21

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

63.59	55.91	58.07	51.34	49.62	43.53	41.45	46.45	46.97	53.73	57.6	61.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=

21.08	18.73	15.23	11.53	8.62	7.28	7.86	10.22	13.72	17.42	20.33	21.67
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

85.47	83.2	78.06	71.3	66.69	60.46	55.71	62.44	65.24	72.21	80	83.31
-------	------	-------	------	-------	-------	-------	-------	-------	-------	----	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

394.61	392.31	377.8	354.85	331.56	309.16	295.09	301.85	314.02	337.18	363.65	383.13
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	25.99	(76)
East	0.9x	0.77	x	4.33	x	38.42	x	0.63	x	0.7	=	50.84	(76)
East	0.9x	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	83.73	(76)
East	0.9x	0.77	x	4.33	x	92.28	x	0.63	x	0.7	=	122.11	(76)
East	0.9x	0.77	x	4.33	x	113.09	x	0.63	x	0.7	=	149.66	(76)
East	0.9x	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	153.2	(76)
East	0.9x	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	145.85	(76)
East	0.9x	0.77	x	4.33	x	94.68	x	0.63	x	0.7	=	125.28	(76)
East	0.9x	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	97.38	(76)
East	0.9x	0.77	x	4.33	x	45.59	x	0.63	x	0.7	=	60.33	(76)
East	0.9x	0.77	x	4.33	x	24.49	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	0.77	x	4.33	x	16.15	x	0.63	x	0.7	=	21.37	(76)
South	0.9x	0.77	x	1.2	x	46.75	x	0.63	x	0.7	=	17.15	(78)
South	0.9x	0.77	x	1.2	x	76.57	x	0.63	x	0.7	=	28.08	(78)
South	0.9x	0.77	x	1.2	x	97.53	x	0.63	x	0.7	=	35.77	(78)
South	0.9x	0.77	x	1.2	x	110.23	x	0.63	x	0.7	=	40.43	(78)
South	0.9x	0.77	x	1.2	x	114.87	x	0.63	x	0.7	=	42.13	(78)
South	0.9x	0.77	x	1.2	x	110.55	x	0.63	x	0.7	=	40.54	(78)
South	0.9x	0.77	x	1.2	x	108.01	x	0.63	x	0.7	=	39.61	(78)
South	0.9x	0.77	x	1.2	x	104.89	x	0.63	x	0.7	=	38.47	(78)
South	0.9x	0.77	x	1.2	x	101.89	x	0.63	x	0.7	=	37.37	(78)
South	0.9x	0.77	x	1.2	x	82.59	x	0.63	x	0.7	=	30.29	(78)
South	0.9x	0.77	x	1.2	x	55.42	x	0.63	x	0.7	=	20.32	(78)
South	0.9x	0.77	x	1.2	x	40.4	x	0.63	x	0.7	=	14.82	(78)
West	0.9x	0.77	x	7.03	x	19.64	x	0.63	x	0.7	=	42.2	(80)
West	0.9x	0.77	x	7.03	x	38.42	x	0.63	x	0.7	=	82.54	(80)
West	0.9x	0.77	x	7.03	x	63.27	x	0.63	x	0.7	=	135.94	(80)
West	0.9x	0.77	x	7.03	x	92.28	x	0.63	x	0.7	=	198.26	(80)
West	0.9x	0.77	x	7.03	x	113.09	x	0.63	x	0.7	=	242.98	(80)
West	0.9x	0.77	x	7.03	x	115.77	x	0.63	x	0.7	=	248.73	(80)
West	0.9x	0.77	x	7.03	x	110.22	x	0.63	x	0.7	=	236.8	(80)
West	0.9x	0.77	x	7.03	x	94.68	x	0.63	x	0.7	=	203.41	(80)
West	0.9x	0.77	x	7.03	x	73.59	x	0.63	x	0.7	=	158.1	(80)
West	0.9x	0.77	x	7.03	x	45.59	x	0.63	x	0.7	=	97.95	(80)
West	0.9x	0.77	x	7.03	x	24.49	x	0.63	x	0.7	=	52.61	(80)
West	0.9x	0.77	x	7.03	x	16.15	x	0.63	x	0.7	=	34.7	(80)

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Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

85.33	161.47	255.44	360.8	434.76	442.47	422.26	367.16	292.85	188.56	105.34	70.89
-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

479.94	553.77	633.24	715.65	766.31	751.63	717.36	669.01	606.87	525.75	469	454.02
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.99	0.97	0.9	0.76	0.6	0.66	0.88	0.98	1	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

19.56	19.72	19.99	20.37	20.7	20.91	20.98	20.97	20.81	20.37	19.9	19.54
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.85	19.85	19.86	19.87	19.87	19.89	19.89	19.89	19.88	19.87	19.87	19.86
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

1	0.99	0.99	0.95	0.86	0.67	0.46	0.52	0.82	0.97	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

17.94	18.17	18.58	19.12	19.57	19.83	19.88	19.88	19.72	19.14	18.46	17.92
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.43

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

18.64	18.84	19.19	19.67	20.06	20.3	20.36	20.35	20.19	19.67	19.09	18.63
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

18.64	18.84	19.19	19.67	20.06	20.3	20.36	20.35	20.19	19.67	19.09	18.63
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=

1	0.99	0.98	0.95	0.87	0.71	0.52	0.58	0.84	0.97	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

478.3	549.97	622.57	680.93	667.11	531.45	374.59	387.57	508.33	509.94	465.94	452.83
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=

1524.22	1476.7	1339.88	1119.01	866.48	582.53	384.15	402.86	626.19	940.56	1249.58	1513.17
---------	--------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

778.16	622.76	533.68	315.42	148.33	0	0	0	0	320.38	564.22	788.9
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	-------

 Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

4071.85

 (98)

Space heating requirement in kWh/m²/year

49.4

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
778.16	622.76	533.68	315.42	148.33	0	0	0	0	320.38	564.22	788.9	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												
833.15	666.77	571.39	337.71	158.81	0	0	0	0	343.02	604.09	844.64	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												4359.58
(211)												

Space heating fuel (secondary), kWh/month												
= {[[(98)m x (201)] } x 100 ÷ (208)												
(215)m=	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =												0
(215)												

Water heating

Output from water heater (calculated above)												
	203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
Efficiency of water heater												80.3
(217)m=	88.1	87.93	87.55	86.65	84.86	80.3	80.3	80.3	80.3	86.57	87.67	88.17
(217)												
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	231.43	204.14	213.32	191.16	188.99	175.89	168.52	187.86	189.94	200.61	211.46	225.78
Total = Sum(219a) _{1..12} =												2389.11
(219)												

Annual totals

Space heating fuel used, main system 1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 941.67
Space heating (secondary)	(215) x	0.519	= 0
Water heating	(219) x	0.216	= 516.05
Space and water heating	(261) + (262) + (263) + (264) =		1457.72
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93

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Electricity for lighting	(232)	x	0.519	=	193.24	(268)
Total CO2, kg/year			sum of (265)...(271)	=	1689.88	(272)
TER	=				20.5	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:51:43

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 03

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.11 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.06 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 55.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 46.8 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 506, product index 018119): Boiler systems with radiators or underfloor heating - mains gas Brand name: Vaillant Model: ecoTEC sustain 28 Model qualifier: VUW 286/7-2 (H-GB) (Combi) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%
 Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: East 4.33m²
 Windows facing: West 7.03m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K
 Party Walls U-value 0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham **Stroma Number:** STRO010943
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.57

Property Address: UNIT 03

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	3.26	(2b) =	137.41
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			238.11

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0
Number of open flues	0	0	0	0	0
Number of intermittent fans				3	30
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.38	0.4	0.42	0.44
--	------	------	------	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6
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(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6
--------	------	------	------	------	------	------	------	------	------	------	------	-----

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1	= 1.78		(26)
Windows Type 1			4.33	x 1/[1/(1.4)+0.04]	= 5.74		(27)
Windows Type 2			7.03	x 1/[1/(1.4)+0.04]	= 9.32		(27)
Floor Type 1			40.28	x 0.13	= 5.2364		(28)
Floor Type 2			1.87	x 0.13	= 0.2431		(28)
Walls	49.67	13.14	36.53	x 0.18	= 6.58		(29)
Roof	46.34	0	46.34	x 0.13	= 6.02		(30)
Total area of elements, m²			138.16				(31)
Party wall			105.48	x 0	= 0		(32)
Internal wall **			124.99				(32c)
Internal floor			40.28				(32d)
Internal ceiling			40.28				(32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.92 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14036.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

11.78 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

46.7 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
48.32	47.97	47.62	46.01	45.71	44.3	44.3	44.04	44.84	45.71	46.32	46.96

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

95.02	94.67	94.32	92.71	92.41	91	91	90.74	91.54	92.41	93.02	93.66
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Average = Sum(39)_{1...12} / 12 =

92.71 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.15	1.15	1.14	1.12	1.12	1.1	1.1	1.1	1.11	1.12	1.13	1.14
------	------	------	------	------	-----	-----	-----	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.12 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
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(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

50.96	45.74	48.73	45.31	44.91	41.61	43	44.91	45.31	48.73	49.01	50.96
-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS

0 0 0 0 0 0 0 0 0 0 0 0

(63) (G2)

Output from water heater

(64)m=

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2034.21

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

63.59	55.91	58.07	51.34	49.62	43.53	41.45	46.45	46.97	53.73	57.6	61.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=

21.54	19.13	15.56	11.78	8.81	7.43	8.03	10.44	14.01	17.79	20.77	22.14
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

85.47	83.2	78.06	71.3	66.69	60.46	55.71	62.44	65.24	72.21	80	83.31
-------	------	-------	------	-------	-------	-------	-------	-------	-------	----	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

395.06	392.71	378.13	355.1	331.74	309.32	295.26	302.07	314.32	337.56	364.09	383.6
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------

(73)

TER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m ²	Flux Table 6a			g_ Table 6b	FF Table 6c			Gains (W)	
East	0.9x	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	25.99	(76)
East	0.9x	0.77	x	4.33	x	38.42	x	0.63	x	0.7	=	50.84	(76)
East	0.9x	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	83.73	(76)
East	0.9x	0.77	x	4.33	x	92.28	x	0.63	x	0.7	=	122.11	(76)
East	0.9x	0.77	x	4.33	x	113.09	x	0.63	x	0.7	=	149.66	(76)
East	0.9x	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	153.2	(76)
East	0.9x	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	145.85	(76)
East	0.9x	0.77	x	4.33	x	94.68	x	0.63	x	0.7	=	125.28	(76)
East	0.9x	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	97.38	(76)
East	0.9x	0.77	x	4.33	x	45.59	x	0.63	x	0.7	=	60.33	(76)
East	0.9x	0.77	x	4.33	x	24.49	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	0.77	x	4.33	x	16.15	x	0.63	x	0.7	=	21.37	(76)
West	0.9x	0.77	x	7.03	x	19.64	x	0.63	x	0.7	=	42.2	(80)
West	0.9x	0.77	x	7.03	x	38.42	x	0.63	x	0.7	=	82.54	(80)
West	0.9x	0.77	x	7.03	x	63.27	x	0.63	x	0.7	=	135.94	(80)
West	0.9x	0.77	x	7.03	x	92.28	x	0.63	x	0.7	=	198.26	(80)
West	0.9x	0.77	x	7.03	x	113.09	x	0.63	x	0.7	=	242.98	(80)
West	0.9x	0.77	x	7.03	x	115.77	x	0.63	x	0.7	=	248.73	(80)
West	0.9x	0.77	x	7.03	x	110.22	x	0.63	x	0.7	=	236.8	(80)
West	0.9x	0.77	x	7.03	x	94.68	x	0.63	x	0.7	=	203.41	(80)
West	0.9x	0.77	x	7.03	x	73.59	x	0.63	x	0.7	=	158.1	(80)
West	0.9x	0.77	x	7.03	x	45.59	x	0.63	x	0.7	=	97.95	(80)
West	0.9x	0.77	x	7.03	x	24.49	x	0.63	x	0.7	=	52.61	(80)
West	0.9x	0.77	x	7.03	x	16.15	x	0.63	x	0.7	=	34.7	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ... (82)m

(83)m= 68.19 133.39 219.67 320.37 392.63 401.93 382.65 328.69 255.48 158.27 85.02 56.07 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 463.25 526.1 597.8 675.48 724.37 711.24 677.91 630.76 569.8 495.84 449.12 439.68 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	1	0.99	0.97	0.9	0.74	0.57	0.63	0.88	0.98	1	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 19.72 19.86 20.12 20.47 20.76 20.94 20.99 20.98 20.85 20.46 20.03 19.7 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m= 19.96 19.96 19.96 19.98 19.98 20 20 20 19.99 19.98 19.98 19.97 (88)

TER WorkSheet: New dwelling design stage

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.86	0.66	0.45	0.51	0.81	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.25	18.46	18.83	19.34	19.74	19.96	19.99	19.99	19.87	19.34	18.72	18.23	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.43 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.89	19.07	19.39	19.83	20.19	20.38	20.43	20.42	20.29	19.83	19.29	18.87	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.89	19.07	19.39	19.83	20.19	20.38	20.43	20.42	20.29	19.83	19.29	18.87	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.99	0.95	0.87	0.69	0.51	0.56	0.84	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	461.99	523.2	589.23	644.62	628.89	492.43	342.71	355.67	476.23	482.49	446.7	438.75	(95)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1386.12	1341.16	1215.77	1013.35	784.21	526.34	348.11	364.89	566.95	852.57	1134.02	1374.33	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	687.56	549.66	466.15	265.49	115.56	0	0	0	0	275.34	494.87	696.07	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3550.7 (98)

Space heating requirement in kWh/m²/year

43.08 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

687.56	549.66	466.15	265.49	115.56	0	0	0	0	275.34	494.87	696.07
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

736.15	588.5	499.09	284.25	123.73	0	0	0	0	294.8	529.84	745.26
--------	-------	--------	--------	--------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 3801.6 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	(215)
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Total (kWh/year) =Sum(215)_{1...5,10...12}= 0 (215)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

80.3 (216)

(217)m= 87.87 87.69 87.26 86.23 84.24 80.3 80.3 80.3 80.3 86.21 87.4 87.94 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

232.03	204.7	214.02	192.08	190.37	175.89	168.52	187.86	189.94	201.46	212.11	226.36
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} =

2395.34 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3801.6

Water heating fuel used

2395.34

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

380.41

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

6652.35

(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	821.15	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	517.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1338.54	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.43	(268)
Total CO2, kg/year		sum of (265)...(271) =		1574.9	(272)

TER =

19.11 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:51:41

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 04

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.11 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.06 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 55.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 46.8 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 506, product index 018119): Boiler systems with radiators or underfloor heating - mains gas Brand name: Vaillant Model: ecoTEC sustain 28 Model qualifier: VUW 286/7-2 (H-GB) (Combi) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%
 Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: East 4.33m²
 Windows facing: West 7.03m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K
 Party Walls U-value 0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham **Stroma Number:** STRO010943
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.57

Property Address: UNIT 04

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28 (1a)	x	2.5 (2a)	=	100.7 (3a)
First floor	42.15 (1b)	x	3.26 (2b)	=	137.41 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	238.11 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.38	0.4	0.42	0.44
--	------	------	------	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

(23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.61 0.61 0.61 0.59 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.6 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.61 0.61 0.61 0.59 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1	= 1.78		(26)
Windows Type 1			4.33	x 1/[1/(1.4)+0.04]	= 5.74		(27)
Windows Type 2			7.03	x 1/[1/(1.4)+0.04]	= 9.32		(27)
Floor Type 1			40.28	x 0.13	= 5.2364		(28)
Floor Type 2			1.87	x 0.13	= 0.2431		(28)
Walls	49.67	13.14	36.53	x 0.18	= 6.58		(29)
Roof	46.34	0	46.34	x 0.13	= 6.02		(30)
Total area of elements, m²			138.16				(31)
Party wall			105.48	x 0	= 0		(32)
Internal wall **			124.99				(32c)
Internal floor			40.28				(32d)
Internal ceiling			40.28				(32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.92 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14036.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

11.78 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

46.7 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
48.32	47.97	47.62	46.01	45.71	44.3	44.3	44.04	44.84	45.71	46.32	46.96

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

95.02	94.67	94.32	92.71	92.41	91	91	90.74	91.54	92.41	93.02	93.66
-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	-------

Average = Sum(39)_{1...12} / 12 =

92.71 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.15	1.15	1.14	1.12	1.12	1.1	1.1	1.1	1.11	1.12	1.13	1.14
------	------	------	------	------	-----	-----	-----	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.12 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0
0

(54)
 Enter (50) or (54) in (55) (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m

(61)m=

50.96	45.74	48.73	45.31	44.91	41.61	43	44.91	45.31	48.73	49.01	50.96
-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63) (G2)

Output from water heater

(64)m=

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2034.21

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

63.59	55.91	58.07	51.34	49.62	43.53	41.45	46.45	46.97	53.73	57.6	61.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=

21.54	19.13	15.56	11.78	8.81	7.43	8.03	10.44	14.01	17.79	20.77	22.14
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

85.47	83.2	78.06	71.3	66.69	60.46	55.71	62.44	65.24	72.21	80	83.31
-------	------	-------	------	-------	-------	-------	-------	-------	-------	----	-------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

395.06	392.71	378.13	355.1	331.74	309.32	295.26	302.07	314.32	337.56	364.09	383.6
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------

(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m ²	Flux Table 6a			g_ Table 6b	FF Table 6c			Gains (W)	
East	0.9x	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	25.99	(76)
East	0.9x	0.77	x	4.33	x	38.42	x	0.63	x	0.7	=	50.84	(76)
East	0.9x	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	83.73	(76)
East	0.9x	0.77	x	4.33	x	92.28	x	0.63	x	0.7	=	122.11	(76)
East	0.9x	0.77	x	4.33	x	113.09	x	0.63	x	0.7	=	149.66	(76)
East	0.9x	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	153.2	(76)
East	0.9x	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	145.85	(76)
East	0.9x	0.77	x	4.33	x	94.68	x	0.63	x	0.7	=	125.28	(76)
East	0.9x	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	97.38	(76)
East	0.9x	0.77	x	4.33	x	45.59	x	0.63	x	0.7	=	60.33	(76)
East	0.9x	0.77	x	4.33	x	24.49	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	0.77	x	4.33	x	16.15	x	0.63	x	0.7	=	21.37	(76)
West	0.9x	0.77	x	7.03	x	19.64	x	0.63	x	0.7	=	42.2	(80)
West	0.9x	0.77	x	7.03	x	38.42	x	0.63	x	0.7	=	82.54	(80)
West	0.9x	0.77	x	7.03	x	63.27	x	0.63	x	0.7	=	135.94	(80)
West	0.9x	0.77	x	7.03	x	92.28	x	0.63	x	0.7	=	198.26	(80)
West	0.9x	0.77	x	7.03	x	113.09	x	0.63	x	0.7	=	242.98	(80)
West	0.9x	0.77	x	7.03	x	115.77	x	0.63	x	0.7	=	248.73	(80)
West	0.9x	0.77	x	7.03	x	110.22	x	0.63	x	0.7	=	236.8	(80)
West	0.9x	0.77	x	7.03	x	94.68	x	0.63	x	0.7	=	203.41	(80)
West	0.9x	0.77	x	7.03	x	73.59	x	0.63	x	0.7	=	158.1	(80)
West	0.9x	0.77	x	7.03	x	45.59	x	0.63	x	0.7	=	97.95	(80)
West	0.9x	0.77	x	7.03	x	24.49	x	0.63	x	0.7	=	52.61	(80)
West	0.9x	0.77	x	7.03	x	16.15	x	0.63	x	0.7	=	34.7	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ... (82)m

(83)m= 68.19 133.39 219.67 320.37 392.63 401.93 382.65 328.69 255.48 158.27 85.02 56.07 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 463.25 526.1 597.8 675.48 724.37 711.24 677.91 630.76 569.8 495.84 449.12 439.68 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	1	0.99	0.97	0.9	0.74	0.57	0.63	0.88	0.98	1	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 19.72 19.86 20.12 20.47 20.76 20.94 20.99 20.98 20.85 20.46 20.03 19.7 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m= 19.96 19.96 19.96 19.98 19.98 20 20 20 19.99 19.98 19.98 19.97 (88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.86	0.66	0.45	0.51	0.81	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.25	18.46	18.83	19.34	19.74	19.96	19.99	19.99	19.87	19.34	18.72	18.23	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.43 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.89	19.07	19.39	19.83	20.19	20.38	20.43	20.42	20.29	19.83	19.29	18.87	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.89	19.07	19.39	19.83	20.19	20.38	20.43	20.42	20.29	19.83	19.29	18.87	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.99	0.95	0.87	0.69	0.51	0.56	0.84	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	461.99	523.2	589.23	644.62	628.89	492.43	342.71	355.67	476.23	482.49	446.7	438.75	(95)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1386.12	1341.16	1215.77	1013.35	784.21	526.34	348.11	364.89	566.95	852.57	1134.02	1374.33	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	687.56	549.66	466.15	265.49	115.56	0	0	0	0	275.34	494.87	696.07	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3550.7 (98)

Space heating requirement in kWh/m²/year

43.08 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

687.56	549.66	466.15	265.49	115.56	0	0	0	0	275.34	494.87	696.07
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

736.15	588.5	499.09	284.25	123.73	0	0	0	0	294.8	529.84	745.26
--------	-------	--------	--------	--------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 3801.6 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	(215)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

Total (kWh/year) =Sum(215)_{1...5,10...12}= 0

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Water heating

Output from water heater (calculated above)

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

80.3 (216)

(217)m= 87.87 87.69 87.26 86.23 84.24 80.3 80.3 80.3 80.3 86.21 87.4 87.94 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.03	204.7	214.02	192.08	190.37	175.89	168.52	187.86	189.94	201.46	212.11	226.36
---------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} =

2395.34 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3801.6

Water heating fuel used

2395.34

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

380.41

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

6652.35

(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	821.15	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	517.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1338.54	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.43	(268)
Total CO2, kg/year		sum of (265)...(271) =		1574.9	(272)

TER =

19.11

(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:51:40

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 05

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.83 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.39 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 49.3 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 506, product index 018119): Boiler systems with radiators or underfloor heating - mains gas Brand name: Vaillant Model: ecoTEC sustain 28 Model qualifier: VUW 286/7-2 (H-GB) (Combi) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%
 Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: East 4.33m²
 Windows facing: West 6.1m²
 Roof windows facing: North 4.32m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K
 Party Walls U-value 0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 05

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	2.82	(2b) =	118.86
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			219.56

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							3	x 10 =	30
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.39
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.39

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.43	0.45
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1	= 1.78		(26)
Windows Type 1			4.33	x1/[1/(1.4)+0.04]	= 5.74		(27)
Windows Type 2			6.1	x1/[1/(1.4)+0.04]	= 8.09		(27)
Rooflights			4.32	x1/[1/(1.7)+0.04]	= 7.344		(27b)
Floor Type 1			40.28	x 0.13	= 5.2364		(28)
Floor Type 2			1.87	x 0.13	= 0.2431		(28)
Walls	80.97	12.21	68.76	x 0.18	= 12.38		(29)
Roof	58.5	4.32	54.18	x 0.13	= 7.04		(30)
Total area of elements, m²			181.62				(31)
Party wall			52.67	x 0	= 0		(32)
Internal wall **			124.99				(32c)
Internal floor			40.28				(32d)
Internal ceiling			40.28				(32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 47.38 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13664.04 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

11.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

59.34 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
45.03	44.69	44.35	42.78	42.49	41.12	41.12	40.86	41.64	42.49	43.08	43.7

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

104.37	104.03	103.69	102.12	101.82	100.45	100.45	100.2	100.98	101.82	102.42	103.04
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Average = Sum(39)_{1...12} / 12 =

102.12 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.27	1.26	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.24	1.25
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.24 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

50.96	45.74	48.73	45.31	44.91	41.61	43	44.91	45.31	48.73	49.01	50.96
-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS

0 0 0 0 0 0 0 0 0 0 0 0

(63) (G2)

Output from water heater

(64)m=

203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2034.21

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

63.59	55.91	58.07	51.34	49.62	43.53	41.45	46.45	46.97	53.73	57.6	61.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=

20.28	18.01	14.65	11.09	8.29	7	7.56	9.83	13.19	16.75	19.55	20.84
-------	-------	-------	-------	------	---	------	------	-------	-------	-------	-------

(67)

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

(68)m=

224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

85.47	83.2	78.06	71.3	66.69	60.46	55.71	62.44	65.24	72.21	80	83.31
-------	------	-------	------	-------	-------	-------	-------	-------	-------	----	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

393.8	391.59	377.22	354.41	331.23	308.88	294.79	301.46	313.5	336.52	362.88	382.31
-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)
East	0.9x	0.77	x	4.33	x	19.64	x	0.63	x	0.7	= 25.99 (76)
East	0.9x	0.77	x	4.33	x	38.42	x	0.63	x	0.7	= 50.84 (76)
East	0.9x	0.77	x	4.33	x	63.27	x	0.63	x	0.7	= 83.73 (76)
East	0.9x	0.77	x	4.33	x	92.28	x	0.63	x	0.7	= 122.11 (76)
East	0.9x	0.77	x	4.33	x	113.09	x	0.63	x	0.7	= 149.66 (76)
East	0.9x	0.77	x	4.33	x	115.77	x	0.63	x	0.7	= 153.2 (76)
East	0.9x	0.77	x	4.33	x	110.22	x	0.63	x	0.7	= 145.85 (76)
East	0.9x	0.77	x	4.33	x	94.68	x	0.63	x	0.7	= 125.28 (76)
East	0.9x	0.77	x	4.33	x	73.59	x	0.63	x	0.7	= 97.38 (76)
East	0.9x	0.77	x	4.33	x	45.59	x	0.63	x	0.7	= 60.33 (76)
East	0.9x	0.77	x	4.33	x	24.49	x	0.63	x	0.7	= 32.41 (76)
East	0.9x	0.77	x	4.33	x	16.15	x	0.63	x	0.7	= 21.37 (76)
West	0.9x	0.77	x	6.1	x	19.64	x	0.63	x	0.7	= 36.61 (80)
West	0.9x	0.77	x	6.1	x	38.42	x	0.63	x	0.7	= 71.63 (80)
West	0.9x	0.77	x	6.1	x	63.27	x	0.63	x	0.7	= 117.96 (80)
West	0.9x	0.77	x	6.1	x	92.28	x	0.63	x	0.7	= 172.03 (80)
West	0.9x	0.77	x	6.1	x	113.09	x	0.63	x	0.7	= 210.83 (80)
West	0.9x	0.77	x	6.1	x	115.77	x	0.63	x	0.7	= 215.82 (80)
West	0.9x	0.77	x	6.1	x	110.22	x	0.63	x	0.7	= 205.47 (80)
West	0.9x	0.77	x	6.1	x	94.68	x	0.63	x	0.7	= 176.5 (80)
West	0.9x	0.77	x	6.1	x	73.59	x	0.63	x	0.7	= 137.19 (80)
West	0.9x	0.77	x	6.1	x	45.59	x	0.63	x	0.7	= 84.99 (80)
West	0.9x	0.77	x	6.1	x	24.49	x	0.63	x	0.7	= 45.65 (80)
West	0.9x	0.77	x	6.1	x	16.15	x	0.63	x	0.7	= 30.11 (80)
Rooflights	0.9x	1	x	4.32	x	14.95	x	0.63	x	0.7	= 25.64 (82)
Rooflights	0.9x	1	x	4.32	x	27.7	x	0.63	x	0.7	= 47.49 (82)
Rooflights	0.9x	1	x	4.32	x	48.05	x	0.63	x	0.7	= 82.39 (82)
Rooflights	0.9x	1	x	4.32	x	83.46	x	0.63	x	0.7	= 143.1 (82)
Rooflights	0.9x	1	x	4.32	x	120.31	x	0.63	x	0.7	= 206.29 (82)
Rooflights	0.9x	1	x	4.32	x	132.58	x	0.63	x	0.7	= 227.32 (82)
Rooflights	0.9x	1	x	4.32	x	122.25	x	0.63	x	0.7	= 209.62 (82)
Rooflights	0.9x	1	x	4.32	x	91.87	x	0.63	x	0.7	= 157.52 (82)
Rooflights	0.9x	1	x	4.32	x	59.39	x	0.63	x	0.7	= 101.83 (82)
Rooflights	0.9x	1	x	4.32	x	32.94	x	0.63	x	0.7	= 56.48 (82)
Rooflights	0.9x	1	x	4.32	x	18.21	x	0.63	x	0.7	= 31.23 (82)
Rooflights	0.9x	1	x	4.32	x	12.66	x	0.63	x	0.7	= 21.7 (82)

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Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

88.24	169.96	284.07	437.24	566.77	596.34	560.94	459.3	336.4	201.8	109.29	73.18
-------	--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	-------

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

482.05	561.55	661.29	791.65	898	905.23	855.74	760.76	649.9	538.32	472.17	455.49
--------	--------	--------	--------	-----	--------	--------	--------	-------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.99	0.95	0.85	0.66	0.51	0.58	0.85	0.98	1	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

19.59	19.75	20.05	20.46	20.79	20.95	20.99	20.98	20.84	20.4	19.93	19.57
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.87	19.87	19.87	19.89	19.89	19.91	19.91	19.91	19.9	19.89	19.89	19.88
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

1	0.99	0.98	0.93	0.79	0.57	0.39	0.46	0.78	0.97	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

18	18.24	18.67	19.26	19.69	19.88	19.9	19.9	19.77	19.19	18.51	17.98
----	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.43

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

18.69	18.9	19.27	19.78	20.17	20.34	20.37	20.37	20.24	19.72	19.13	18.67
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

18.69	18.9	19.27	19.78	20.17	20.34	20.37	20.37	20.24	19.72	19.13	18.67
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=

1	0.99	0.98	0.93	0.81	0.61	0.44	0.51	0.81	0.97	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

480.4	557.5	648.2	738.38	726.45	550.99	374.9	389.18	524.28	520.56	469.02	454.29
-------	-------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=

1502.02	1456.08	1324.09	1111.34	862.52	577	379.19	397.78	619.7	928.67	1231.83	1491.11
---------	---------	---------	---------	--------	-----	--------	--------	-------	--------	---------	---------

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

760.09	603.84	502.87	268.53	101.24	0	0	0	0	303.64	549.22	771.39
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3860.83

 (98)

Space heating requirement in kWh/m²/year

46.84

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

TER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
760.09	603.84	502.87	268.53	101.24	0	0	0	0	303.64	549.22	771.39	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												
813.8	646.51	538.4	287.51	108.39	0	0	0	0	325.1	588.03	825.9	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												4133.65

Space heating fuel (secondary), kWh/month												
= {[(98)m × (201)] } × 100 ÷ (208)												
(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =												0

Water heating

Output from water heater (calculated above)	203.89	179.49	186.75	165.64	160.37	141.24	135.32	150.85	152.52	173.67	185.39	199.06
Efficiency of water heater												80.3
(217)m =	88.06	87.87	87.42	86.26	83.93	80.3	80.3	80.3	80.3	86.44	87.62	88.13
Fuel for water heating, kWh/month												
(219)m = (64)m × 100 ÷ (217)m												
(219)m =	231.54	204.28	213.62	192.02	191.08	175.89	168.52	187.86	189.94	200.91	211.59	225.89
Total = Sum(219a) _{1..12} =												2393.13

Annual totals

												kWh/year
Space heating fuel used, main system 1												4133.65
Water heating fuel used												2393.13
Electricity for pumps, fans and electric keep-hot												
central heating pump:												30
boiler with a fan-assisted flue												45
Total electricity for the above, kWh/year	sum of (230a)...(230g) =											75
Electricity for lighting												358.14
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =												6959.91

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.216	= 892.87
Space heating (secondary)	(215) ×	0.519	= 0
Water heating	(219) ×	0.216	= 516.92
Space and water heating	(261) + (262) + (263) + (264) =		1409.78
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	= 38.93

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Electricity for lighting	(232)	x	0.519	=	185.87	(268)
Total CO2, kg/year			sum of (265)...(271)	=	1634.58	(272)
TER	=				19.83	(273)

Appendix B

Energy Efficient Design:-

SAP Outputs & Dwelling Emission Rates

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:52:06

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 92.34m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 01

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 20.16 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.37 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 65.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 56.6 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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 4.00 (design value)
Maximum 10.0

OK

4 Heating efficiency

Main Heating system: Database: (rev 506, product index 018119):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC sustain 28
Model qualifier: VUW 286/7-2 (H-GB)
(Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 %

OK

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%
 Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Medium **OK**

Based on:

Overshading: Average or unknown
 Windows facing: West 6.8m²
 Windows facing: South 3.3m²
 Windows facing: South West 8.04m²
 Windows facing: North 2.7m²
 Windows facing: North East 9.6m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 01

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	46.17	(1a) x	2.5	(2a) =	115.42
First floor	46.17	(1b) x	2.8	(2b) =	129.28
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.34	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			244.7

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	+	0
Number of open flues	0	+	0	+	0
Number of intermittent fans				4	40
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.36
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.36

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.46	0.45	0.45	0.4	0.39	0.35	0.35	0.34	0.36	0.39	0.41	0.43
--	------	------	------	-----	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.61 0.6 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.58 0.59 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.61 0.6 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.58 0.59 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			6.8	x1/[1/(1.2)+ 0.04] =	7.79		(27)
Windows Type 2			3.3	x1/[1/(1.2)+ 0.04] =	3.78		(27)
Windows Type 3			8.04	x1/[1/(1.2)+ 0.04] =	9.21		(27)
Windows Type 4			2.7	x1/[1/(1.2)+ 0.04] =	3.09		(27)
Windows Type 5			9.6	x1/[1/(1.2)+ 0.04] =	10.99		(27)
Floor			46.17	x 0.14	= 6.4638	110	5078.7 (28)
Walls	146.33	32.22	114.11	x 0.15	= 17.12	60	6846.6 (29)
Roof	46.17	0	46.17	x 0.12	= 5.54	9	415.53 (30)
Total area of elements, m²			238.67				(31)
Internal wall **			164.09			9	1476.81 (32c)
Internal floor			46.17			18	831.0599 (32d)
Internal ceiling			46.17			9	415.53 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 66.11 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 15064.23 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.14 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

DER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

20.89

(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

87

(37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
49.05	48.71	48.38	46.83	46.54	45.19	45.19	44.94	45.71	46.54	47.13	47.74

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

136.04	135.71	135.38	133.83	133.54	132.19	132.19	131.94	132.71	133.54	134.12	134.74
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Average = Sum(39)_{1...12} /12=

133.83

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.47	1.47	1.47	1.45	1.45	1.43	1.43	1.43	1.44	1.45	1.45	1.46
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} /12=

1.45

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.29

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

107.02	103.13	99.24	95.34	91.45	87.56	87.56	91.45	95.34	99.24	103.13	107.02
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Total = Sum(44)_{1...12} =

1167.48

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

158.71	138.81	143.23	124.88	119.82	103.4	95.81	109.95	111.26	129.66	141.54	153.7
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	-------

Total = Sum(45)_{1...12} =

1530.75

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.81	20.82	21.49	18.73	17.97	15.51	14.37	16.49	16.69	19.45	21.23	23.05
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

17.19	15.52	17.19	16.63	17.19	16.63	17.19	17.19	16.63	17.19	16.63	17.19
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

175.89	154.33	160.42	141.51	137.01	120.03	113	127.13	127.89	146.85	158.17	170.89
--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS

120.44	108.69	108.38	97.57	73.51	3.58	3.37	3.74	3.76	99.72	108.94	118.83
--------	--------	--------	-------	-------	------	------	------	------	-------	--------	--------

(63) (G2)

Output from water heater

(64)m=

55.46	45.64	52.04	43.94	63.5	116.45	109.63	123.4	124.13	47.13	49.23	52.06
-------	-------	-------	-------	------	--------	--------	-------	--------	-------	-------	-------

Output from water heater (annual)^{1...12}

882.59

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

57.07	50.03	51.92	45.68	44.14	38.54	36.15	40.85	41.15	47.41	51.22	55.4
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82

(66)

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

(67)m=

21.69	19.27	15.67	11.86	8.87	7.49	8.09	10.51	14.11	17.92	20.91	22.29
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

243.32	245.84	239.48	225.93	208.84	192.77	182.03	179.51	185.87	199.41	216.51	232.58
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

76.7	74.46	69.79	63.44	59.32	53.52	48.59	54.91	57.16	63.72	71.14	74.46
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

407.56	405.41	390.78	367.09	342.87	319.62	304.56	310.78	322.98	346.9	374.41	395.19
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
North	0.9x	0.77	x	2.7	x	10.63	x	0.57	x	0.7	=	7.94 (74)
North	0.9x	0.77	x	2.7	x	20.32	x	0.57	x	0.7	=	15.17 (74)
North	0.9x	0.77	x	2.7	x	34.53	x	0.57	x	0.7	=	25.78 (74)
North	0.9x	0.77	x	2.7	x	55.46	x	0.57	x	0.7	=	41.41 (74)
North	0.9x	0.77	x	2.7	x	74.72	x	0.57	x	0.7	=	55.78 (74)
North	0.9x	0.77	x	2.7	x	79.99	x	0.57	x	0.7	=	59.71 (74)
North	0.9x	0.77	x	2.7	x	74.68	x	0.57	x	0.7	=	55.75 (74)
North	0.9x	0.77	x	2.7	x	59.25	x	0.57	x	0.7	=	44.23 (74)
North	0.9x	0.77	x	2.7	x	41.52	x	0.57	x	0.7	=	30.99 (74)
North	0.9x	0.77	x	2.7	x	24.19	x	0.57	x	0.7	=	18.06 (74)
North	0.9x	0.77	x	2.7	x	13.12	x	0.57	x	0.7	=	9.79 (74)
North	0.9x	0.77	x	2.7	x	8.86	x	0.57	x	0.7	=	6.62 (74)
Northeast	0.9x	0.77	x	9.6	x	11.28	x	0.57	x	0.7	=	29.95 (75)
Northeast	0.9x	0.77	x	9.6	x	22.97	x	0.57	x	0.7	=	60.96 (75)
Northeast	0.9x	0.77	x	9.6	x	41.38	x	0.57	x	0.7	=	109.84 (75)
Northeast	0.9x	0.77	x	9.6	x	67.96	x	0.57	x	0.7	=	180.39 (75)
Northeast	0.9x	0.77	x	9.6	x	91.35	x	0.57	x	0.7	=	242.47 (75)
Northeast	0.9x	0.77	x	9.6	x	97.38	x	0.57	x	0.7	=	258.5 (75)
Northeast	0.9x	0.77	x	9.6	x	91.1	x	0.57	x	0.7	=	241.83 (75)
Northeast	0.9x	0.77	x	9.6	x	72.63	x	0.57	x	0.7	=	192.79 (75)
Northeast	0.9x	0.77	x	9.6	x	50.42	x	0.57	x	0.7	=	133.84 (75)
Northeast	0.9x	0.77	x	9.6	x	28.07	x	0.57	x	0.7	=	74.5 (75)
Northeast	0.9x	0.77	x	9.6	x	14.2	x	0.57	x	0.7	=	37.69 (75)
Northeast	0.9x	0.77	x	9.6	x	9.21	x	0.57	x	0.7	=	24.46 (75)
South	0.9x	0.77	x	3.3	x	46.75	x	0.57	x	0.7	=	42.66 (78)
South	0.9x	0.77	x	3.3	x	76.57	x	0.57	x	0.7	=	69.87 (78)
South	0.9x	0.77	x	3.3	x	97.53	x	0.57	x	0.7	=	89 (78)
South	0.9x	0.77	x	3.3	x	110.23	x	0.57	x	0.7	=	100.59 (78)
South	0.9x	0.77	x	3.3	x	114.87	x	0.57	x	0.7	=	104.82 (78)
South	0.9x	0.77	x	3.3	x	110.55	x	0.57	x	0.7	=	100.87 (78)
South	0.9x	0.77	x	3.3	x	108.01	x	0.57	x	0.7	=	98.56 (78)
South	0.9x	0.77	x	3.3	x	104.89	x	0.57	x	0.7	=	95.71 (78)
South	0.9x	0.77	x	3.3	x	101.89	x	0.57	x	0.7	=	92.97 (78)
South	0.9x	0.77	x	3.3	x	82.59	x	0.57	x	0.7	=	75.36 (78)
South	0.9x	0.77	x	3.3	x	55.42	x	0.57	x	0.7	=	50.57 (78)
South	0.9x	0.77	x	3.3	x	40.4	x	0.57	x	0.7	=	36.86 (78)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	8.04	x	36.79		0.57	x	0.7	=	81.8	(79)
Southwest	0.9x	0.77	x	8.04	x	62.67		0.57	x	0.7	=	139.33	(79)
Southwest	0.9x	0.77	x	8.04	x	85.75		0.57	x	0.7	=	190.64	(79)
Southwest	0.9x	0.77	x	8.04	x	106.25		0.57	x	0.7	=	236.21	(79)
Southwest	0.9x	0.77	x	8.04	x	119.01		0.57	x	0.7	=	264.57	(79)
Southwest	0.9x	0.77	x	8.04	x	118.15		0.57	x	0.7	=	262.66	(79)
Southwest	0.9x	0.77	x	8.04	x	113.91		0.57	x	0.7	=	253.23	(79)
Southwest	0.9x	0.77	x	8.04	x	104.39		0.57	x	0.7	=	232.07	(79)
Southwest	0.9x	0.77	x	8.04	x	92.85		0.57	x	0.7	=	206.42	(79)
Southwest	0.9x	0.77	x	8.04	x	69.27		0.57	x	0.7	=	153.99	(79)
Southwest	0.9x	0.77	x	8.04	x	44.07		0.57	x	0.7	=	97.97	(79)
Southwest	0.9x	0.77	x	8.04	x	31.49		0.57	x	0.7	=	70	(79)
West	0.9x	0.77	x	6.8	x	19.64	x	0.57	x	0.7	=	36.93	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.57	x	0.7	=	72.24	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.57	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.57	x	0.7	=	173.51	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.57	x	0.7	=	212.64	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.57	x	0.7	=	217.68	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.57	x	0.7	=	207.24	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.57	x	0.7	=	178.01	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.57	x	0.7	=	138.37	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.57	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	6.8	x	24.49	x	0.57	x	0.7	=	46.05	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.57	x	0.7	=	30.37	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

199.27	357.57	534.22	732.1	880.29	899.43	856.61	742.82	602.59	407.63	242.06	168.31
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

606.83	762.98	925	1099.19	1223.16	1219.05	1161.17	1053.59	925.57	754.53	616.47	563.5
--------	--------	-----	---------	---------	---------	---------	---------	--------	--------	--------	-------

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.97	0.94	0.88	0.76	0.61	0.47	0.53	0.75	0.92	0.98	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

19.28	19.51	19.85	20.27	20.61	20.81	20.88	20.86	20.7	20.24	19.68	19.25
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.71	19.71	19.71	19.73	19.73	19.74	19.74	19.74	19.73	19.73	19.72	19.72
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.98	0.97	0.93	0.85	0.7	0.51	0.35	0.4	0.67	0.9	0.97	0.99
------	------	------	------	-----	------	------	-----	------	-----	------	------

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

DER WorkSheet: New dwelling design stage

(90)m=	17.44	17.77	18.26	18.86	19.3	19.54	19.6	19.59	19.43	18.83	18.03	17.4	(90)
$fLA = \text{Living area} \div (4) =$													(91)
												0.41	

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.19	18.48	18.91	19.43	19.83	20.05	20.12	20.11	19.94	19.4	18.7	18.15	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.04	18.33	18.76	19.28	19.68	19.9	19.97	19.96	19.79	19.25	18.55	18	(93)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	----	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm :

(94)m=	0.98	0.96	0.92	0.84	0.7	0.53	0.37	0.42	0.67	0.89	0.96	0.98	(94)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=	593.45	731.02	849.53	918.28	857.66	641.62	431.02	447.62	624.67	669.38	593.74	553.37	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1869.51	1821.98	1659.41	1389.54	1065.74	701.03	445.21	469.38	755.51	1155.04	1535.76	1859.29	(97)
--------	---------	---------	---------	---------	---------	--------	--------	--------	--------	---------	---------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	949.39	733.13	602.55	339.31	154.81	0	0	0	0	361.33	678.26	971.61	
$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} =$													(98)
												4790.39	

Space heating requirement in $kWh/m^2/year$

51.88	(99)
-------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
---	-------

Fraction of space heat from main system(s)

$$(202) = 1 - (201) =$$

1	(202)
---	-------

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] =$$

1	(204)
---	-------

Efficiency of main space heating system 1

90	(206)
----	-------

Efficiency of secondary/supplementary heating system, %

0	(208)
---	-------

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

949.39	733.13	602.55	339.31	154.81	0	0	0	0	361.33	678.26	971.61
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$$

1054.88	814.59	669.5	377.01	172.01	0	0	0	0	401.48	753.62	1079.57
---------	--------	-------	--------	--------	---	---	---	---	--------	--------	---------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} =$$

5322.66	(211)
---------	-------

Space heating fuel (secondary), $kWh/month$

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

(215)m=	0	0	0	0	0	0	0	0	0	0	0	
---------	---	---	---	---	---	---	---	---	---	---	---	--

$$\text{Total (kWh/year)} = \text{Sum}(215)_{1..5,10..12} =$$

0	(215)
---	-------

Water heating

Output from water heater (calculated above)

55.46	45.64	52.04	43.94	63.5	116.45	109.63	123.4	124.13	47.13	49.23	52.06
-------	-------	-------	-------	------	--------	--------	-------	--------	-------	-------	-------

Efficiency of water heater

87	(216)
----	-------

DER WorkSheet: New dwelling design stage

(217)m=

89.83	89.82	89.75	89.65	89.11	87	87	87	87	89.64	89.79	89.84
-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

61.74	50.81	57.98	49.01	71.26	133.85	126.01	141.84	142.68	52.57	54.83	57.95
-------	-------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Total = Sum(219a)_{1...12} =

1000.52

 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

 (230c)

boiler with a fan-assisted flue

45

 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

 (231)

Electricity for lighting

383.09

 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

6781.26

 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	1149.69 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	216.11 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1365.81 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	198.82 (268)
Total CO2, kg/year	sum of (265)...(271) =			1603.55 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			17.37 (273)
El rating (section 14)				84 (274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:52:04

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 02

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

20.5 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

17.24 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

62.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

52.2 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.15 (max. 0.30)

0.15 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

0.14 (max. 0.25)

0.14 (max. 0.70)

OK

Roof

0.12 (max. 0.20)

0.12 (max. 0.35)

OK

Openings

1.20 (max. 2.00)

1.20 (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

4.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Database: (rev 506, product index 018119):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Vaillant

Model: ecoTEC sustain 28

Model qualifier: VUW 286/7-2 (H-GB)

(Combi)

Efficiency 89.1 % SEDBUK2009

Minimum 88.0 %

OK

Secondary heating system:

None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**

Hot water controls: No cylinder thermostat

No cylinder

Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%

Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown

Windows facing: East 4.33m²

Windows facing: South 1.2m²

Windows facing: West 7.03m²

Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K

Party Walls U-value 0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 02

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	3.26	(2b) =	137.41
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	238.11

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.17
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.37
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43
--	------	------	------	-----	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			4.33	x1/[1/(1.2)+ 0.04] =	4.96		(27)
Windows Type 2			1.2	x1/[1/(1.2)+ 0.04] =	1.37		(27)
Windows Type 3			7.03	x1/[1/(1.2)+ 0.04] =	8.05		(27)
Floor Type 1			40.28	x 0.14	= 5.6392	110	4430.8 (28)
Floor Type 2			1.87	x 0.14	= 0.2618	20	37.4 (28)
Walls	102.34	14.34	88	x 0.15	= 13.2	60	5280 (29)
Roof	46.34	0	46.34	x 0.12	= 5.56	9	417.06 (30)
Total area of elements, m²			190.83				(31)
Party wall			52.81	x 0	= 0	45	2376.45 (32)
Internal wall **			124.99			9	1124.91 (32c)
Internal floor			40.28			18	725.04 (32d)
Internal ceiling			40.28			9	362.52 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.18 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14754.18 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 178.99 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

15.62 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

56.8 (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=	47.94	47.6	47.27	45.73	45.44	44.09	44.09	43.84	44.61	45.44	46.02	46.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	104.74	104.4	104.07	102.53	102.24	100.89	100.89	100.64	101.41	102.24	102.82	103.44
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Average = Sum(39)_{1...12} / 12 =

102.53 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.27	1.27	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.25	1.25
--------	------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.24 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

17.19	15.52	17.19	16.63	17.19	16.63	17.19	17.19	16.63	17.19	16.63	17.19
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

170.12	149.28	155.21	136.96	132.65	116.27	109.51	123.13	123.84	142.13	153.02	165.29
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS 114.77 104.88 105.37 95.57 77.71 3.48 3.26 3.64 3.67 97.37 105.05 113.1

(63) (G2)

Output from water heater

(64)m=

55.35	44.4	49.84	41.39	54.94	112.79	106.25	119.49	120.17	44.76	47.97	52.19
-------	------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Output from water heater (annual)^{1...12}

849.55

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

55.15	48.35	50.19	44.17	42.69	37.29	35	39.52	39.81	45.84	49.51	53.54
-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=

21.7	19.27	15.67	11.87	8.87	7.49	8.09	10.52	14.12	17.92	20.92	22.3
------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

(67)

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

(68)m=

224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

74.12	71.96	67.46	61.35	57.38	51.79	47.04	53.12	55.29	61.61	68.76	71.97
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

383.87	381.61	367.65	345.23	322.49	300.7	286.65	292.83	304.46	327.09	353.01	372.42
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(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	4.33	x	19.64	x	0.57	x	0.7	=	23.51 (76)
East	0.9x	0.77	x	4.33	x	38.42	x	0.57	x	0.7	=	46 (76)
East	0.9x	0.77	x	4.33	x	63.27	x	0.57	x	0.7	=	75.76 (76)
East	0.9x	0.77	x	4.33	x	92.28	x	0.57	x	0.7	=	110.48 (76)
East	0.9x	0.77	x	4.33	x	113.09	x	0.57	x	0.7	=	135.4 (76)
East	0.9x	0.77	x	4.33	x	115.77	x	0.57	x	0.7	=	138.61 (76)
East	0.9x	0.77	x	4.33	x	110.22	x	0.57	x	0.7	=	131.96 (76)
East	0.9x	0.77	x	4.33	x	94.68	x	0.57	x	0.7	=	113.35 (76)
East	0.9x	0.77	x	4.33	x	73.59	x	0.57	x	0.7	=	88.11 (76)
East	0.9x	0.77	x	4.33	x	45.59	x	0.57	x	0.7	=	54.58 (76)
East	0.9x	0.77	x	4.33	x	24.49	x	0.57	x	0.7	=	29.32 (76)
East	0.9x	0.77	x	4.33	x	16.15	x	0.57	x	0.7	=	19.34 (76)
South	0.9x	0.77	x	1.2	x	46.75	x	0.57	x	0.7	=	15.51 (78)
South	0.9x	0.77	x	1.2	x	76.57	x	0.57	x	0.7	=	25.41 (78)
South	0.9x	0.77	x	1.2	x	97.53	x	0.57	x	0.7	=	32.36 (78)
South	0.9x	0.77	x	1.2	x	110.23	x	0.57	x	0.7	=	36.58 (78)
South	0.9x	0.77	x	1.2	x	114.87	x	0.57	x	0.7	=	38.12 (78)
South	0.9x	0.77	x	1.2	x	110.55	x	0.57	x	0.7	=	36.68 (78)
South	0.9x	0.77	x	1.2	x	108.01	x	0.57	x	0.7	=	35.84 (78)
South	0.9x	0.77	x	1.2	x	104.89	x	0.57	x	0.7	=	34.8 (78)
South	0.9x	0.77	x	1.2	x	101.89	x	0.57	x	0.7	=	33.81 (78)
South	0.9x	0.77	x	1.2	x	82.59	x	0.57	x	0.7	=	27.4 (78)
South	0.9x	0.77	x	1.2	x	55.42	x	0.57	x	0.7	=	18.39 (78)
South	0.9x	0.77	x	1.2	x	40.4	x	0.57	x	0.7	=	13.4 (78)
West	0.9x	0.77	x	7.03	x	19.64	x	0.57	x	0.7	=	38.18 (80)
West	0.9x	0.77	x	7.03	x	38.42	x	0.57	x	0.7	=	74.68 (80)
West	0.9x	0.77	x	7.03	x	63.27	x	0.57	x	0.7	=	122.99 (80)
West	0.9x	0.77	x	7.03	x	92.28	x	0.57	x	0.7	=	179.38 (80)
West	0.9x	0.77	x	7.03	x	113.09	x	0.57	x	0.7	=	219.83 (80)
West	0.9x	0.77	x	7.03	x	115.77	x	0.57	x	0.7	=	225.04 (80)
West	0.9x	0.77	x	7.03	x	110.22	x	0.57	x	0.7	=	214.25 (80)
West	0.9x	0.77	x	7.03	x	94.68	x	0.57	x	0.7	=	184.04 (80)
West	0.9x	0.77	x	7.03	x	73.59	x	0.57	x	0.7	=	143.05 (80)
West	0.9x	0.77	x	7.03	x	45.59	x	0.57	x	0.7	=	88.62 (80)
West	0.9x	0.77	x	7.03	x	24.49	x	0.57	x	0.7	=	47.6 (80)
West	0.9x	0.77	x	7.03	x	16.15	x	0.57	x	0.7	=	31.4 (80)

DER WorkSheet: New dwelling design stage

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

77.21	146.09	231.11	326.44	393.35	400.33	382.05	332.19	264.96	170.6	95.31	64.14
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 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

461.08	527.7	598.76	671.67	715.85	701.03	668.7	625.03	569.42	497.7	448.32	436.55
--------	-------	--------	--------	--------	--------	-------	--------	--------	-------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.99	0.98	0.95	0.88	0.75	0.61	0.66	0.86	0.97	0.99	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

19.54	19.68	19.93	20.28	20.58	20.8	20.89	20.87	20.7	20.3	19.86	19.52
-------	-------	-------	-------	-------	------	-------	-------	------	------	-------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.86	19.87	19.87	19.89	19.89	19.9	19.9	19.9	19.9	19.89	19.88	19.88
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.99	0.97	0.93	0.84	0.67	0.48	0.53	0.8	0.95	0.99	0.99
------	------	------	------	------	------	------	------	-----	------	------	------

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

17.91	18.12	18.49	18.99	19.41	19.69	19.77	19.77	19.58	19.03	18.4	17.9
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

 (90)

fLA = Living area ÷ (4) =

0.43

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

18.62	18.8	19.12	19.55	19.92	20.17	20.26	20.25	20.07	19.58	19.04	18.6
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

18.47	18.65	18.97	19.4	19.77	20.02	20.11	20.1	19.92	19.43	18.89	18.45
-------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	-------

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=

0.99	0.98	0.97	0.92	0.84	0.68	0.5	0.56	0.8	0.95	0.98	0.99
------	------	------	------	------	------	-----	------	-----	------	------	------

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

456.38	518.67	578.66	621.23	599.84	477.62	337.29	348.02	455.88	470.98	440.8	432.89
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=

1484.38	1435.58	1297.57	1076.38	825.05	547.23	353.85	372.01	589.82	902.89	1211.9	1474.46
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

764.83	616.16	534.87	327.71	167.56	0	0	0	0	321.34	555.19	774.93
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

 Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

4062.57

 (98)

Space heating requirement in kWh/m²/year

49.29

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

DER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

764.83	616.16	534.87	327.71	167.56	0	0	0	0	321.34	555.19	774.93
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m × (204)] } × 100 ÷ (206)

(211)

849.81	684.62	594.3	364.12	186.17	0	0	0	0	357.04	616.88	861.03
--------	--------	-------	--------	--------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1..5,10...12} =

4513.97 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

Total (kWh/year) = Sum(215)_{1..5,10...12} =

0 (215)

Water heating

Output from water heater (calculated above)

55.35	44.4	49.84	41.39	54.94	112.79	106.25	119.49	120.17	44.76	47.97	52.19
-------	------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Efficiency of water heater

87 (216)

89.79	89.79	89.74	89.65	89.24	87	87	87	87	89.62	89.75	89.8
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(217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

61.64	49.45	55.54	46.17	61.57	129.64	122.13	137.35	138.13	49.94	53.45	58.11
-------	-------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Total = Sum(219a)_{1..12} =

963.12 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

4513.97

Water heating fuel used

963.12

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75 (231)

Electricity for lighting

383.18 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

5935.27 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.216	= 975.02 (261)
Space heating (secondary)	(215) ×	0.519	= 0 (263)
Water heating	(219) ×	0.216	= 208.03 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1183.05 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	= 38.93 (267)

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	198.87	(268)
Total CO2, kg/year		sum of (265)...(271) =			1420.85 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			17.24 (273)
EI rating (section 14)				85	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:52:01

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 03

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.11 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.06 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 55.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 46.8 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 506, product index 018119): Boiler systems with radiators or underfloor heating - mains gas Brand name: Vaillant Model: ecoTEC sustain 28 Model qualifier: VUW 286/7-2 (H-GB) (Combi) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%
 Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: East 4.33m²
 Windows facing: West 7.03m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K
 Party Walls U-value 0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 03

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	3.26	(2b) =	137.41
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			238.11
					(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.17	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.37	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43
--	------	------	------	-----	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			4.33	x 1/[1/(1.2)+0.04]	= 4.96		(27)
Windows Type 2			7.03	x 1/[1/(1.2)+0.04]	= 8.05		(27)
Floor Type 1			40.28	x 0.14	= 5.6392	110	4430.8 (28)
Floor Type 2			1.87	x 0.14	= 0.2618	20	37.4 (28)
Walls	49.67	13.14	36.53	x 0.15	= 5.48	60	2191.8 (29)
Roof	46.34	0	46.34	x 0.12	= 5.56	9	417.06 (30)
Total area of elements, m²			138.16				(31)
Party wall			105.48	x 0	= 0	45	4746.6 (32)
Internal wall **			124.99			9	1124.91 (32c)
Internal floor			40.28			18	725.04 (32d)
Internal ceiling			40.28			9	362.52 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.08 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14036.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 170.28 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

DER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

15.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

47.36 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
47.94	47.6	47.27	45.73	45.44	44.09	44.09	43.84	44.61	45.44	46.02	46.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

95.29	94.96	94.63	93.08	92.79	91.45	91.45	91.2	91.96	92.79	93.38	93.99
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Average = Sum(39)_{1...12} / 12 =

93.08 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.16	1.15	1.15	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.14
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.13 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
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(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

17.19	15.52	17.19	16.63	17.19	16.63	17.19	17.19	16.63	17.19	16.63	17.19
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

170.12	149.28	155.21	136.96	132.65	116.27	109.51	123.13	123.84	142.13	153.02	165.29
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS

113.35	103.98	104.52	95.1	66.92	3.48	3.26	3.64	3.67	96.91	104.17	111.72
--------	--------	--------	------	-------	------	------	------	------	-------	--------	--------

(63) (G2)

Output from water heater

(64)m=

56.77	45.3	50.69	41.86	65.73	112.79	106.25	119.49	120.17	45.22	48.85	53.57
-------	------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Output from water heater (annual)^{1...12}

866.7

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

55.15	48.35	50.19	44.17	42.69	37.29	35	39.52	39.81	45.84	49.51	53.54
-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=

22.19	19.71	16.03	12.13	9.07	7.66	8.27	10.75	14.43	18.33	21.39	22.8
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

(67)

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

(68)m=

224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

74.12	71.96	67.46	61.35	57.38	51.79	47.04	53.12	55.29	61.61	68.76	71.97
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

384.36	382.04	368	345.5	322.69	300.87	286.83	293.07	304.78	327.5	353.48	372.92
--------	--------	-----	-------	--------	--------	--------	--------	--------	-------	--------	--------

(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m ²	Flux Table 6a			g_ Table 6b	FF Table 6c			Gains (W)	
East	0.9x	0.77	x	4.33	x	19.64	x	0.57	x	0.7	=	23.51	(76)
East	0.9x	0.77	x	4.33	x	38.42	x	0.57	x	0.7	=	46	(76)
East	0.9x	0.77	x	4.33	x	63.27	x	0.57	x	0.7	=	75.76	(76)
East	0.9x	0.77	x	4.33	x	92.28	x	0.57	x	0.7	=	110.48	(76)
East	0.9x	0.77	x	4.33	x	113.09	x	0.57	x	0.7	=	135.4	(76)
East	0.9x	0.77	x	4.33	x	115.77	x	0.57	x	0.7	=	138.61	(76)
East	0.9x	0.77	x	4.33	x	110.22	x	0.57	x	0.7	=	131.96	(76)
East	0.9x	0.77	x	4.33	x	94.68	x	0.57	x	0.7	=	113.35	(76)
East	0.9x	0.77	x	4.33	x	73.59	x	0.57	x	0.7	=	88.11	(76)
East	0.9x	0.77	x	4.33	x	45.59	x	0.57	x	0.7	=	54.58	(76)
East	0.9x	0.77	x	4.33	x	24.49	x	0.57	x	0.7	=	29.32	(76)
East	0.9x	0.77	x	4.33	x	16.15	x	0.57	x	0.7	=	19.34	(76)
West	0.9x	0.77	x	7.03	x	19.64	x	0.57	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	7.03	x	38.42	x	0.57	x	0.7	=	74.68	(80)
West	0.9x	0.77	x	7.03	x	63.27	x	0.57	x	0.7	=	122.99	(80)
West	0.9x	0.77	x	7.03	x	92.28	x	0.57	x	0.7	=	179.38	(80)
West	0.9x	0.77	x	7.03	x	113.09	x	0.57	x	0.7	=	219.83	(80)
West	0.9x	0.77	x	7.03	x	115.77	x	0.57	x	0.7	=	225.04	(80)
West	0.9x	0.77	x	7.03	x	110.22	x	0.57	x	0.7	=	214.25	(80)
West	0.9x	0.77	x	7.03	x	94.68	x	0.57	x	0.7	=	184.04	(80)
West	0.9x	0.77	x	7.03	x	73.59	x	0.57	x	0.7	=	143.05	(80)
West	0.9x	0.77	x	7.03	x	45.59	x	0.57	x	0.7	=	88.62	(80)
West	0.9x	0.77	x	7.03	x	24.49	x	0.57	x	0.7	=	47.6	(80)
West	0.9x	0.77	x	7.03	x	16.15	x	0.57	x	0.7	=	31.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ... (82)m

(83)m=	61.69	120.68	198.75	289.86	355.24	363.65	346.21	297.39	231.15	143.2	76.92	50.73	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	446.05	502.73	566.75	635.36	677.93	664.52	633.04	590.46	535.93	470.7	430.4	423.65	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.95	0.88	0.74	0.59	0.64	0.85	0.97	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.75	19.99	20.33	20.62	20.82	20.9	20.88	20.73	20.34	19.93	19.6	(87)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.96	19.98	19.98	19.99	19.99	20	19.99	19.98	19.97	19.97	(88)
--------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	------

DER WorkSheet: New dwelling design stage

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.93	0.84	0.66	0.47	0.53	0.8	0.95	0.99	0.99	(89)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.1	18.29	18.65	19.13	19.54	19.8	19.87	19.87	19.69	19.17	18.56	18.08	(90)
--------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.43 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.76	18.93	19.23	19.65	20.01	20.24	20.32	20.31	20.14	19.68	19.16	18.74	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.61	18.78	19.08	19.5	19.86	20.09	20.17	20.16	19.99	19.53	19.01	18.59	(93)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.97	0.92	0.83	0.67	0.49	0.55	0.8	0.95	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	441.37	494.15	547.79	586.89	564.73	446.04	313.34	323.66	427.19	445.31	423.05	419.96	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m – (96)m]

(97)m=	1363.42	1317.56	1190.62	986.93	757.06	502.48	326.25	342.74	541.78	828.39	1111.82	1352.87	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	686.01	553.33	478.27	288.03	143.09	0	0	0	0	285.01	495.92	694.09	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3623.74 (98)

Space heating requirement in kWh/m²/year

43.96 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

90 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

686.01	553.33	478.27	288.03	143.09	0	0	0	0	285.01	495.92	694.09
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

762.23	614.81	531.41	320.03	158.99	0	0	0	0	316.68	551.02	771.21
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 4026.38 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	(215)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

Total (kWh/year) =Sum(215)_{1...5,10...12} =

0 (215)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

56.77	45.3	50.69	41.86	65.73	112.79	106.25	119.49	120.17	45.22	48.85	53.57
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Efficiency of water heater

87

(216)

(217)m=	89.76	89.77	89.7	89.61	89.03	87	87	87	87	89.58	89.72	89.78
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(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	63.25	50.46	56.51	46.72	73.83	129.64	122.13	137.35	138.13	50.48	54.44	59.67
---------	-------	-------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Total = Sum(219a)_{1...12} =

982.61

(219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

4026.38

Water heating fuel used

982.61

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

391.81

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

5475.79

(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	869.7	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	212.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1081.94	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	203.35	(268)
Total CO2, kg/year		sum of (265)...(271) =		1324.21	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		16.06	(273)
EI rating (section 14)				86	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:51:59

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 04

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.11 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.06 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 55.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 46.8 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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 4.00 (design value)
Maximum 10.0

OK

4 Heating efficiency

Main Heating system: Database: (rev 506, product index 018119):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC sustain 28
Model qualifier: VUW 286/7-2 (H-GB)
(Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 %

OK

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%
 Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: East 4.33m²
 Windows facing: West 7.03m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K
 Party Walls U-value 0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 04

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	3.26	(2b) =	137.41
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			238.11
					(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.17	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.37	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			4.33	x1/[1/(1.2)+ 0.04] =	4.96		(27)
Windows Type 2			7.03	x1/[1/(1.2)+ 0.04] =	8.05		(27)
Floor Type 1			40.28	x 0.14	= 5.6392	110	4430.8 (28)
Floor Type 2			1.87	x 0.14	= 0.2618	20	37.4 (28)
Walls	49.67	13.14	36.53	x 0.15	= 5.48	60	2191.8 (29)
Roof	46.34	0	46.34	x 0.12	= 5.56	9	417.06 (30)
Total area of elements, m²			138.16				(31)
Party wall			105.48	x 0	= 0	45	4746.6 (32)
Internal wall **			124.99			9	1124.91 (32c)
Internal floor			40.28			18	725.04 (32d)
Internal ceiling			40.28			9	362.52 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.08 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14036.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 170.28 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

DER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

15.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

47.36 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
47.94	47.6	47.27	45.73	45.44	44.09	44.09	43.84	44.61	45.44	46.02	46.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

95.29	94.96	94.63	93.08	92.79	91.45	91.45	91.2	91.96	92.79	93.38	93.99
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Average = Sum(39)_{1...12} / 12 =

93.08 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.16	1.15	1.15	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.14
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.13 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

17.19	15.52	17.19	16.63	17.19	16.63	17.19	17.19	16.63	17.19	16.63	17.19
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

170.12	149.28	155.21	136.96	132.65	116.27	109.51	123.13	123.84	142.13	153.02	165.29
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS 113.35 103.98 104.52 95.1 66.92 3.48 3.26 3.64 3.67 96.91 104.17 111.72

(63) (G2)

Output from water heater

(64)m=

56.77	45.3	50.69	41.86	65.73	112.79	106.25	119.49	120.17	45.22	48.85	53.57
-------	------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Output from water heater (annual)^{1...12}

866.7

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

55.15	48.35	50.19	44.17	42.69	37.29	35	39.52	39.81	45.84	49.51	53.54
-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=

22.19	19.71	16.03	12.13	9.07	7.66	8.27	10.75	14.43	18.33	21.39	22.8
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

(67)

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

(68)m=

224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

74.12	71.96	67.46	61.35	57.38	51.79	47.04	53.12	55.29	61.61	68.76	71.97
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

384.36	382.04	368	345.5	322.69	300.87	286.83	293.07	304.78	327.5	353.48	372.92
--------	--------	-----	-------	--------	--------	--------	--------	--------	-------	--------	--------

(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	4.33	x	19.64	x	0.57	x	0.7	=	23.51 (76)
East	0.9x	0.77	x	4.33	x	38.42	x	0.57	x	0.7	=	46 (76)
East	0.9x	0.77	x	4.33	x	63.27	x	0.57	x	0.7	=	75.76 (76)
East	0.9x	0.77	x	4.33	x	92.28	x	0.57	x	0.7	=	110.48 (76)
East	0.9x	0.77	x	4.33	x	113.09	x	0.57	x	0.7	=	135.4 (76)
East	0.9x	0.77	x	4.33	x	115.77	x	0.57	x	0.7	=	138.61 (76)
East	0.9x	0.77	x	4.33	x	110.22	x	0.57	x	0.7	=	131.96 (76)
East	0.9x	0.77	x	4.33	x	94.68	x	0.57	x	0.7	=	113.35 (76)
East	0.9x	0.77	x	4.33	x	73.59	x	0.57	x	0.7	=	88.11 (76)
East	0.9x	0.77	x	4.33	x	45.59	x	0.57	x	0.7	=	54.58 (76)
East	0.9x	0.77	x	4.33	x	24.49	x	0.57	x	0.7	=	29.32 (76)
East	0.9x	0.77	x	4.33	x	16.15	x	0.57	x	0.7	=	19.34 (76)
West	0.9x	0.77	x	7.03	x	19.64	x	0.57	x	0.7	=	38.18 (80)
West	0.9x	0.77	x	7.03	x	38.42	x	0.57	x	0.7	=	74.68 (80)
West	0.9x	0.77	x	7.03	x	63.27	x	0.57	x	0.7	=	122.99 (80)
West	0.9x	0.77	x	7.03	x	92.28	x	0.57	x	0.7	=	179.38 (80)
West	0.9x	0.77	x	7.03	x	113.09	x	0.57	x	0.7	=	219.83 (80)
West	0.9x	0.77	x	7.03	x	115.77	x	0.57	x	0.7	=	225.04 (80)
West	0.9x	0.77	x	7.03	x	110.22	x	0.57	x	0.7	=	214.25 (80)
West	0.9x	0.77	x	7.03	x	94.68	x	0.57	x	0.7	=	184.04 (80)
West	0.9x	0.77	x	7.03	x	73.59	x	0.57	x	0.7	=	143.05 (80)
West	0.9x	0.77	x	7.03	x	45.59	x	0.57	x	0.7	=	88.62 (80)
West	0.9x	0.77	x	7.03	x	24.49	x	0.57	x	0.7	=	47.6 (80)
West	0.9x	0.77	x	7.03	x	16.15	x	0.57	x	0.7	=	31.4 (80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ... (82)m

(83)m= 61.69 120.68 198.75 289.86 355.24 363.65 346.21 297.39 231.15 143.2 76.92 50.73 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 446.05 502.73 566.75 635.36 677.93 664.52 633.04 590.46 535.93 470.7 430.4 423.65 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.99	0.98	0.95	0.88	0.74	0.59	0.64	0.85	0.97	0.99	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 19.62 19.75 19.99 20.33 20.62 20.82 20.9 20.88 20.73 20.34 19.93 19.6 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m= 19.96 19.96 19.96 19.98 19.98 19.99 19.99 20 19.99 19.98 19.97 19.97 (88)

DER WorkSheet: New dwelling design stage

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.93	0.84	0.66	0.47	0.53	0.8	0.95	0.99	0.99	(89)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.1	18.29	18.65	19.13	19.54	19.8	19.87	19.87	19.69	19.17	18.56	18.08	(90)
--------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.43 \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.76	18.93	19.23	19.65	20.01	20.24	20.32	20.31	20.14	19.68	19.16	18.74	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.61	18.78	19.08	19.5	19.86	20.09	20.17	20.16	19.99	19.53	19.01	18.59	(93)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.97	0.92	0.83	0.67	0.49	0.55	0.8	0.95	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	441.37	494.15	547.79	586.89	564.73	446.04	313.34	323.66	427.19	445.31	423.05	419.96	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1363.42	1317.56	1190.62	986.93	757.06	502.48	326.25	342.74	541.78	828.39	1111.82	1352.87	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	686.01	553.33	478.27	288.03	143.09	0	0	0	0	285.01	495.92	694.09	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 3623.74 \quad (98)$$

Space heating requirement in kWh/m²/year

$$43.96 \quad (99)$$

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

Space heating:

Fraction of space heat from secondary/supplementary system

$$0 \quad (201)$$

Fraction of space heat from main system(s)

$$(202) = 1 - (201) = 1 \quad (202)$$

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] = 1 \quad (204)$$

Efficiency of main space heating system 1

$$90 \quad (206)$$

Efficiency of secondary/supplementary heating system, %

$$0 \quad (208)$$

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

686.01	553.33	478.27	288.03	143.09	0	0	0	0	285.01	495.92	694.09
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206) \quad (211)$$

762.23	614.81	531.41	320.03	158.99	0	0	0	0	316.68	551.02	771.21
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 4026.38 \quad (211)$$

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

(215)m=	0	0	0	0	0	0	0	0	0	0	0	(215)
---------	---	---	---	---	---	---	---	---	---	---	---	-------

$$\text{Total (kWh/year)} = \text{Sum}(215)_{1..5,10..12} = 0 \quad (215)$$

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

56.77	45.3	50.69	41.86	65.73	112.79	106.25	119.49	120.17	45.22	48.85	53.57
-------	------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Efficiency of water heater

87

(216)

(217)m=	89.76	89.77	89.7	89.61	89.03	87	87	87	87	89.58	89.72	89.78
---------	-------	-------	------	-------	-------	----	----	----	----	-------	-------	-------

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	63.25	50.46	56.51	46.72	73.83	129.64	122.13	137.35	138.13	50.48	54.44	59.67
---------	-------	-------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Total = Sum(219a)_{1...12} =

982.61

(219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

4026.38

Water heating fuel used

982.61

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

391.81

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

5475.79

(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	869.7	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	212.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1081.94	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	203.35	(268)
Total CO2, kg/year		sum of (265)...(271) =		1324.21	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		16.06	(273)
EI rating (section 14)				86	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:51:58

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange LEAN

Plot Reference: UNIT 05

Address :

Client Details:

Name:

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.83 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.39 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 49.3 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 506, product index 018119): Boiler systems with radiators or underfloor heating - mains gas Brand name: Vaillant Model: ecoTEC sustain 28 Model qualifier: VUW 286/7-2 (H-GB) (Combi) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%
 Minimum 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: East 4.33m²
 Windows facing: West 6.1m²
 Roof windows facing: North 4.32m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K
 Party Walls U-value 0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 05

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	2.82	(2b) =	118.86
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			219.56

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0
Number of open flues	0	+	0	=	0
Number of intermittent fans				4	40
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.18
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			4.33	x1/[1/(1.2)+ 0.04]	= 4.96		(27)
Windows Type 2			6.1	x1/[1/(1.2)+ 0.04]	= 6.98		(27)
Rooflights			4.32	x1/[1/(1.2) + 0.04]	= 5.184		(27b)
Floor Type 1			40.28	x 0.14	= 5.6392	110	4430.8 (28)
Floor Type 2			1.87	x 0.14	= 0.2618	20	37.4 (28)
Walls	80.97	12.21	68.76	x 0.15	= 10.31	60	4125.6 (29)
Roof	58.5	4.32	54.18	x 0.12	= 6.5	9	487.62 (30)
Total area of elements, m²			181.62				(31)
Party wall			52.67	x 0	= 0	45	2370.15 (32)
Internal wall **			124.99			9	1124.91 (32c)
Internal floor			40.28			18	725.04 (32d)
Internal ceiling			40.28			9	362.52 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.74 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13664.04 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.77 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

15.12 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

56.87 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
44.83	44.5	44.17	42.63	42.34	41	41	40.76	41.52	42.34	42.92	43.53

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

101.7	101.36	101.03	99.5	99.21	97.87	97.87	97.62	98.39	99.21	99.79	100.4
-------	--------	--------	------	-------	-------	-------	-------	-------	-------	-------	-------

Average = Sum(39)_{1...12} /12=

99.5 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.23	1.23	1.23	1.21	1.2	1.19	1.19	1.18	1.19	1.2	1.21	1.22
------	------	------	------	-----	------	------	------	------	-----	------	------

Average = Sum(40)_{1...12} /12=

1.21 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

17.19	15.52	17.19	16.63	17.19	16.63	17.19	17.19	16.63	17.19	16.63	17.19
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

170.12	149.28	155.21	136.96	132.65	116.27	109.51	123.13	123.84	142.13	153.02	165.29
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

FHRS

114.15	104.43	104.78	95.03	59.02	3.48	3.26	3.64	3.67	97.09	104.65	112.52
--------	--------	--------	-------	-------	------	------	------	------	-------	--------	--------

(63) (G2)

Output from water heater

(64)m=

55.97	44.85	50.43	41.94	73.63	112.79	106.25	119.49	120.17	45.04	48.37	52.77
-------	-------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Output from water heater (annual)^{1...12}

871.71

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

55.15	48.35	50.19	44.17	42.69	37.29	35	39.52	39.81	45.84	49.51	53.54
-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=

20.73	18.41	14.97	11.34	8.47	7.15	7.73	10.05	13.49	17.12	19.98	21.3
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

(67)

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

(68)m=

224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

74.12	71.96	67.46	61.35	57.38	51.79	47.04	53.12	55.29	61.61	68.76	71.97
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

382.9	380.75	366.95	344.7	322.1	300.36	286.29	292.36	303.83	326.29	352.07	371.42
-------	--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	--------

(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	4.33	x	19.64	x	0.57	x	0.7	=	23.51 (76)
East	0.9x	0.77	x	4.33	x	38.42	x	0.57	x	0.7	=	46 (76)
East	0.9x	0.77	x	4.33	x	63.27	x	0.57	x	0.7	=	75.76 (76)
East	0.9x	0.77	x	4.33	x	92.28	x	0.57	x	0.7	=	110.48 (76)
East	0.9x	0.77	x	4.33	x	113.09	x	0.57	x	0.7	=	135.4 (76)
East	0.9x	0.77	x	4.33	x	115.77	x	0.57	x	0.7	=	138.61 (76)
East	0.9x	0.77	x	4.33	x	110.22	x	0.57	x	0.7	=	131.96 (76)
East	0.9x	0.77	x	4.33	x	94.68	x	0.57	x	0.7	=	113.35 (76)
East	0.9x	0.77	x	4.33	x	73.59	x	0.57	x	0.7	=	88.11 (76)
East	0.9x	0.77	x	4.33	x	45.59	x	0.57	x	0.7	=	54.58 (76)
East	0.9x	0.77	x	4.33	x	24.49	x	0.57	x	0.7	=	29.32 (76)
East	0.9x	0.77	x	4.33	x	16.15	x	0.57	x	0.7	=	19.34 (76)
West	0.9x	0.77	x	6.1	x	19.64	x	0.57	x	0.7	=	33.13 (80)
West	0.9x	0.77	x	6.1	x	38.42	x	0.57	x	0.7	=	64.8 (80)
West	0.9x	0.77	x	6.1	x	63.27	x	0.57	x	0.7	=	106.72 (80)
West	0.9x	0.77	x	6.1	x	92.28	x	0.57	x	0.7	=	155.65 (80)
West	0.9x	0.77	x	6.1	x	113.09	x	0.57	x	0.7	=	190.75 (80)
West	0.9x	0.77	x	6.1	x	115.77	x	0.57	x	0.7	=	195.27 (80)
West	0.9x	0.77	x	6.1	x	110.22	x	0.57	x	0.7	=	185.9 (80)
West	0.9x	0.77	x	6.1	x	94.68	x	0.57	x	0.7	=	159.69 (80)
West	0.9x	0.77	x	6.1	x	73.59	x	0.57	x	0.7	=	124.12 (80)
West	0.9x	0.77	x	6.1	x	45.59	x	0.57	x	0.7	=	76.89 (80)
West	0.9x	0.77	x	6.1	x	24.49	x	0.57	x	0.7	=	41.31 (80)
West	0.9x	0.77	x	6.1	x	16.15	x	0.57	x	0.7	=	27.24 (80)
Rooflights	0.9x	1	x	4.32	x	14.95	x	0.57	x	0.7	=	23.2 (82)
Rooflights	0.9x	1	x	4.32	x	27.7	x	0.57	x	0.7	=	42.97 (82)
Rooflights	0.9x	1	x	4.32	x	48.05	x	0.57	x	0.7	=	74.54 (82)
Rooflights	0.9x	1	x	4.32	x	83.46	x	0.57	x	0.7	=	129.47 (82)
Rooflights	0.9x	1	x	4.32	x	120.31	x	0.57	x	0.7	=	186.64 (82)
Rooflights	0.9x	1	x	4.32	x	132.58	x	0.57	x	0.7	=	205.67 (82)
Rooflights	0.9x	1	x	4.32	x	122.25	x	0.57	x	0.7	=	189.65 (82)
Rooflights	0.9x	1	x	4.32	x	91.87	x	0.57	x	0.7	=	142.52 (82)
Rooflights	0.9x	1	x	4.32	x	59.39	x	0.57	x	0.7	=	92.13 (82)
Rooflights	0.9x	1	x	4.32	x	32.94	x	0.57	x	0.7	=	51.1 (82)
Rooflights	0.9x	1	x	4.32	x	18.21	x	0.57	x	0.7	=	28.25 (82)
Rooflights	0.9x	1	x	4.32	x	12.66	x	0.57	x	0.7	=	19.63 (82)

DER WorkSheet: New dwelling design stage

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

79.84	153.77	257.02	395.6	512.8	539.55	507.52	415.56	304.36	182.58	98.88	66.21
-------	--------	--------	-------	-------	--------	--------	--------	--------	--------	-------	-------

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

462.74	534.52	623.96	740.3	834.89	839.91	793.81	707.92	608.19	508.87	450.95	437.63
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.99	0.97	0.92	0.82	0.66	0.51	0.58	0.82	0.96	0.99	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

19.51	19.66	19.94	20.33	20.65	20.84	20.9	20.88	20.72	20.3	19.84	19.49
-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.89	19.9	19.9	19.91	19.92	19.93	19.93	19.93	19.93	19.92	19.91	19.91
-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.98	0.96	0.9	0.77	0.57	0.4	0.47	0.76	0.94	0.98	0.99
------	------	------	-----	------	------	-----	------	------	------	------	------

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

17.9	18.12	18.53	19.08	19.52	19.75	19.81	19.8	19.62	19.06	18.4	17.88
------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------

 (90)

fLA = Living area ÷ (4) =

0.43

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

18.6	18.79	19.14	19.62	20.01	20.22	20.28	20.27	20.1	19.6	19.03	18.58
------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

18.45	18.64	18.99	19.47	19.86	20.07	20.13	20.12	19.95	19.45	18.88	18.43
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=

0.99	0.98	0.96	0.89	0.77	0.59	0.42	0.49	0.76	0.93	0.98	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

456.7	522.79	596.07	661.11	641.2	491.41	335.46	346.31	461.78	475.18	441.43	432.89
-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=

1438.71	1392.71	1262.05	1052.06	809.43	535.75	345.58	363.18	575.59	877.66	1175.1	1428.48
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

730.61	584.59	495.49	281.49	125.16	0	0	0	0	299.44	528.24	740.71
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

 Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3785.73

 (98)

Space heating requirement in kWh/m²/year

45.93

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

DER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

730.61	584.59	495.49	281.49	125.16	0	0	0	0	299.44	528.24	740.71
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[[(98)m x (204)] } x 100 ÷ (206)

(211)

811.79	649.54	550.54	312.76	139.06	0	0	0	0	332.72	586.94	823.02
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1...5,10...12} =

4206.37 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

(215)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

Total (kWh/year) = Sum(215)_{1...5,10...12} =

0 (215)

Water heating

Output from water heater (calculated above)

55.97	44.85	50.43	41.94	73.63	112.79	106.25	119.49	120.17	45.04	48.37	52.77
-------	-------	-------	-------	-------	--------	--------	--------	--------	-------	-------	-------

Efficiency of water heater

87 (216)

(217)m=

89.78	89.78	89.71	89.6	88.86	87	87	87	87	89.6	89.74	89.79
-------	-------	-------	------	-------	----	----	----	----	------	-------	-------

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

62.34	49.96	56.22	46.81	82.86	129.64	122.13	137.35	138.13	50.27	53.9	58.77
-------	-------	-------	-------	-------	--------	--------	--------	--------	-------	------	-------

Total = Sum(219a)_{1...12} =

988.36 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

4206.37

Water heating fuel used

988.36

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75 (231)

Electricity for lighting

366.07 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

5635.8 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	908.58 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	213.49 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1122.06 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	189.99	(268)
Total CO2, kg/year		sum of (265)...(271) =			1350.98 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			16.39 (273)
EI rating (section 14)				86	(274)

Appendix C

Generating energy on-site:-

Final SAP Outputs & Dwelling Emission Rates

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:52:53

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 92.34m²

Site Reference : Lynton Grange GREEN

Plot Reference: UNIT 01

Address :

Client Details:

Name:

Address :

**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 system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 29.39 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 8.22 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 65.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 56.6 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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 4.00 (design value)
Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Mitsubishi ECODAN 8.5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.57 kWh/day
Permitted by DBSCG: 2.30 kWh/day **OK**
Primary pipework insulated: Yes **OK**

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Medium	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: West	6.8m ²	
Windows facing: South	3.3m ²	
Windows facing: South West	8.04m ²	
Windows facing: North	2.7m ²	
Windows facing: North East	9.6m ²	
Ventilation rate:	4.00	

10 Key features

Roofs U-value	0.12 W/m ² K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 01

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	46.17	(1a) x	2.5	(2a) =	115.42
First floor	46.17	(1b) x	2.8	(2b) =	129.28
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.34	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			244.7

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.36
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.36

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.46	0.45	0.45	0.4	0.39	0.35	0.35	0.34	0.36	0.39	0.41	0.43
--	------	------	------	-----	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.61 0.6 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.58 0.59 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.61 0.6 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.58 0.59 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			6.8	x1/[1/(1.2)+ 0.04] =	7.79		(27)
Windows Type 2			3.3	x1/[1/(1.2)+ 0.04] =	3.78		(27)
Windows Type 3			8.04	x1/[1/(1.2)+ 0.04] =	9.21		(27)
Windows Type 4			2.7	x1/[1/(1.2)+ 0.04] =	3.09		(27)
Windows Type 5			9.6	x1/[1/(1.2)+ 0.04] =	10.99		(27)
Floor			46.17	x 0.14	= 6.4638	110	5078.7 (28)
Walls	146.33	32.22	114.11	x 0.15	= 17.12	60	6846.6 (29)
Roof	46.17	0	46.17	x 0.12	= 5.54	9	415.53 (30)
Total area of elements, m²			238.67				(31)
Internal wall **			164.09			9	1476.81 (32c)
Internal floor			46.17			18	831.0599 (32d)
Internal ceiling			46.17			9	415.53 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 66.11 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 15064.23 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.14 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

DER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

20.89

(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

87

(37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
49.05	48.71	48.38	46.83	46.54	45.19	45.19	44.94	45.71	46.54	47.13	47.74

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

136.04	135.71	135.38	133.83	133.54	132.19	132.19	131.94	132.71	133.54	134.12	134.74
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Average = Sum(39)_{1...12} /12=

133.83

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.47	1.47	1.47	1.45	1.45	1.43	1.43	1.43	1.44	1.45	1.45	1.46
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} /12=

1.45

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.29

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

107.02	103.13	99.24	95.34	91.45	87.56	87.56	91.45	95.34	99.24	103.13	107.02
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Total = Sum(44)_{1...12} =

1167.48

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

158.71	138.81	143.23	124.88	119.82	103.4	95.81	109.95	111.26	129.66	141.54	153.7
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	-------

Total = Sum(45)_{1...12} =

1530.75

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.81	20.82	21.49	18.73	17.97	15.51	14.37	16.49	16.69	19.45	21.23	23.05
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

210

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

1.57

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) =

0
0.85

(54)
 Enter (50) or (54) in (55) (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

208.25	183.55	192.78	172.82	169.36	151.34	145.36	159.49	159.2	179.21	189.48	203.24
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

208.25	183.55	192.78	172.82	169.36	151.34	145.36	159.49	159.2	179.21	189.48	203.24
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

(64)
Output from water heater (annual)_{1...12}

2114.09

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

92.41	81.95	87.26	79.88	79.48	72.74	71.49	76.19	75.35	82.75	85.42	90.74
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82	132.82

(66)

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

(67)m=

21.69	19.27	15.67	11.86	8.87	7.49	8.09	10.51	14.11	17.92	20.91	22.29
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

243.32	245.84	239.48	225.93	208.84	192.77	182.03	179.51	185.87	199.41	216.51	232.58
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28	36.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26	-106.26
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

124.2	121.95	117.29	110.94	106.82	101.02	96.09	102.41	104.65	111.22	118.64	121.96
-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

452.06	449.91	435.28	411.58	387.37	364.12	349.06	355.27	367.48	391.4	418.91	439.68
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(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.7	x	10.63	x	0.57	x	0.7	=	7.94 (74)
North	0.9x	0.77	x	2.7	x	20.32	x	0.57	x	0.7	=	15.17 (74)
North	0.9x	0.77	x	2.7	x	34.53	x	0.57	x	0.7	=	25.78 (74)
North	0.9x	0.77	x	2.7	x	55.46	x	0.57	x	0.7	=	41.41 (74)
North	0.9x	0.77	x	2.7	x	74.72	x	0.57	x	0.7	=	55.78 (74)
North	0.9x	0.77	x	2.7	x	79.99	x	0.57	x	0.7	=	59.71 (74)
North	0.9x	0.77	x	2.7	x	74.68	x	0.57	x	0.7	=	55.75 (74)
North	0.9x	0.77	x	2.7	x	59.25	x	0.57	x	0.7	=	44.23 (74)
North	0.9x	0.77	x	2.7	x	41.52	x	0.57	x	0.7	=	30.99 (74)
North	0.9x	0.77	x	2.7	x	24.19	x	0.57	x	0.7	=	18.06 (74)
North	0.9x	0.77	x	2.7	x	13.12	x	0.57	x	0.7	=	9.79 (74)
North	0.9x	0.77	x	2.7	x	8.86	x	0.57	x	0.7	=	6.62 (74)
Northeast	0.9x	0.77	x	9.6	x	11.28	x	0.57	x	0.7	=	29.95 (75)
Northeast	0.9x	0.77	x	9.6	x	22.97	x	0.57	x	0.7	=	60.96 (75)
Northeast	0.9x	0.77	x	9.6	x	41.38	x	0.57	x	0.7	=	109.84 (75)
Northeast	0.9x	0.77	x	9.6	x	67.96	x	0.57	x	0.7	=	180.39 (75)
Northeast	0.9x	0.77	x	9.6	x	91.35	x	0.57	x	0.7	=	242.47 (75)
Northeast	0.9x	0.77	x	9.6	x	97.38	x	0.57	x	0.7	=	258.5 (75)
Northeast	0.9x	0.77	x	9.6	x	91.1	x	0.57	x	0.7	=	241.83 (75)
Northeast	0.9x	0.77	x	9.6	x	72.63	x	0.57	x	0.7	=	192.79 (75)
Northeast	0.9x	0.77	x	9.6	x	50.42	x	0.57	x	0.7	=	133.84 (75)
Northeast	0.9x	0.77	x	9.6	x	28.07	x	0.57	x	0.7	=	74.5 (75)
Northeast	0.9x	0.77	x	9.6	x	14.2	x	0.57	x	0.7	=	37.69 (75)
Northeast	0.9x	0.77	x	9.6	x	9.21	x	0.57	x	0.7	=	24.46 (75)
South	0.9x	0.77	x	3.3	x	46.75	x	0.57	x	0.7	=	42.66 (78)
South	0.9x	0.77	x	3.3	x	76.57	x	0.57	x	0.7	=	69.87 (78)
South	0.9x	0.77	x	3.3	x	97.53	x	0.57	x	0.7	=	89 (78)
South	0.9x	0.77	x	3.3	x	110.23	x	0.57	x	0.7	=	100.59 (78)
South	0.9x	0.77	x	3.3	x	114.87	x	0.57	x	0.7	=	104.82 (78)
South	0.9x	0.77	x	3.3	x	110.55	x	0.57	x	0.7	=	100.87 (78)
South	0.9x	0.77	x	3.3	x	108.01	x	0.57	x	0.7	=	98.56 (78)
South	0.9x	0.77	x	3.3	x	104.89	x	0.57	x	0.7	=	95.71 (78)
South	0.9x	0.77	x	3.3	x	101.89	x	0.57	x	0.7	=	92.97 (78)
South	0.9x	0.77	x	3.3	x	82.59	x	0.57	x	0.7	=	75.36 (78)
South	0.9x	0.77	x	3.3	x	55.42	x	0.57	x	0.7	=	50.57 (78)
South	0.9x	0.77	x	3.3	x	40.4	x	0.57	x	0.7	=	36.86 (78)
Southwest	0.9x	0.77	x	8.04	x	36.79		0.57	x	0.7	=	81.8 (79)
Southwest	0.9x	0.77	x	8.04	x	62.67		0.57	x	0.7	=	139.33 (79)
Southwest	0.9x	0.77	x	8.04	x	85.75		0.57	x	0.7	=	190.64 (79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	8.04	x	106.25		0.57	x	0.7	=	236.21	(79)
Southwest	0.9x	0.77	x	8.04	x	119.01		0.57	x	0.7	=	264.57	(79)
Southwest	0.9x	0.77	x	8.04	x	118.15		0.57	x	0.7	=	262.66	(79)
Southwest	0.9x	0.77	x	8.04	x	113.91		0.57	x	0.7	=	253.23	(79)
Southwest	0.9x	0.77	x	8.04	x	104.39		0.57	x	0.7	=	232.07	(79)
Southwest	0.9x	0.77	x	8.04	x	92.85		0.57	x	0.7	=	206.42	(79)
Southwest	0.9x	0.77	x	8.04	x	69.27		0.57	x	0.7	=	153.99	(79)
Southwest	0.9x	0.77	x	8.04	x	44.07		0.57	x	0.7	=	97.97	(79)
Southwest	0.9x	0.77	x	8.04	x	31.49		0.57	x	0.7	=	70	(79)
West	0.9x	0.77	x	6.8	x	19.64	x	0.57	x	0.7	=	36.93	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.57	x	0.7	=	72.24	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.57	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.57	x	0.7	=	173.51	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.57	x	0.7	=	212.64	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.57	x	0.7	=	217.68	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.57	x	0.7	=	207.24	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.57	x	0.7	=	178.01	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.57	x	0.7	=	138.37	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.57	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	6.8	x	24.49	x	0.57	x	0.7	=	46.05	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.57	x	0.7	=	30.37	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 199.27 357.57 534.22 732.1 880.29 899.43 856.61 742.82 602.59 407.63 242.06 168.31 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 651.33 807.48 969.5 1143.68 1267.66 1263.55 1205.66 1098.09 970.07 799.03 660.97 607.99 (84)

7. Mean internal temperature (heating season)

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

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.98	0.97	0.94	0.87	0.75	0.59	0.46	0.51	0.73	0.91	0.97	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21
--------	----	----	----	----	----	----	----	----	----	----	----

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.71	19.71	19.71	19.73	19.73	19.74	19.74	19.74	19.73	19.73	19.72	19.72
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.96	0.92	0.84	0.69	0.5	0.34	0.39	0.65	0.89	0.97	0.98
--------	------	------	------	------	------	-----	------	------	------	------	------	------

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.71	19.71	19.71	19.73	19.73	19.74	19.74	19.74	19.73	19.73	19.72	19.72
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(90)

fLA = Living area ÷ (4) =

0.41

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=

20.23	20.24	20.24	20.24	20.25	20.25	20.25	20.25	20.25	20.25	20.24	20.24
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

20.23	20.24	20.24	20.24	20.25	20.25	20.25	20.25	20.25	20.25	20.24	20.24
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm :

(94)m=

0.98	0.97	0.93	0.85	0.71	0.54	0.39	0.44	0.69	0.9	0.97	0.99
------	------	------	------	------	------	------	------	------	-----	------	------

 (94)

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=

639.61	779.49	901.46	971.92	905.62	679.81	465.58	482.51	666.89	718.15	640.46	599.04
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=

2167.65	2081.08	1859.64	1518.16	1141.16	747.15	482.77	508.41	816.11	1288.05	1762.76	2161.16
---------	---------	---------	---------	---------	--------	--------	--------	--------	---------	---------	---------

 (97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=

1136.86	874.67	712.88	393.3	175.24	0	0	0	0	424.01	808.06	1162.21
---------	--------	--------	-------	--------	---	---	---	---	--------	--------	---------

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$

5687.24

 (98)

Space heating requirement in $kWh/m^2/year$

61.59

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

Fraction of space heat from main system(s) (202) = $1 - (201) =$

1

 (202)

Fraction of total heating from main system 1 (204) = $(202) \times [1 - (203)] =$

1

 (204)

Efficiency of main space heating system 1

305.8

 (206)

Efficiency of secondary/supplementary heating system, %

0

 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	$kWh/year$
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------------

Space heating requirement (calculated above)

1136.86	874.67	712.88	393.3	175.24	0	0	0	0	424.01	808.06	1162.21
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(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

371.76	286.02	233.12	128.61	57.31	0	0	0	0	138.65	264.24	380.05
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1..5,10..12} =$

1859.76

 (211)

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=

0	0	0	0	0	0	0	0	0	0	0	0
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Total ($kWh/year$) = $Sum(215)_{1..5,10..12} =$

0

 (215)

Water heating

Output from water heater (calculated above)

208.25	183.55	192.78	172.82	169.36	151.34	145.36	159.49	159.2	179.21	189.48	203.24
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Efficiency of water heater

188.96

 (216)

(217)m=

188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=

110.21	97.14	102.02	91.46	89.63	80.09	76.93	84.41	84.26	94.84	100.28	107.56
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Total = $Sum(219a)_{1..12} =$

1118.83

 (219)

DER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		1859.76
Water heating fuel used		1118.83
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0 (231)
Electricity for lighting		383.09 (232)
Electricity generated by PVs		-1899.96 (233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1461.72 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	=	965.22 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.519	=	580.67 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1545.89 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0 (267)
Electricity for lighting	(232) x	0.519	=	198.82 (268)
Energy saving/generation technologies Item 1		0.519	=	-986.08 (269)
Total CO2, kg/year		sum of (265)...(271) =		758.63 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		8.22 (273)
El rating (section 14)				93 (274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:52:52

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange GREEN

Plot Reference: UNIT 02

Address :

Client Details:

Name:

Address :

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 system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 29.76 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.77 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 52.2 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Mitsubishi ECODAN 8.5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.57 kWh/day Permitted by DBSCG: 2.30 kWh/day	OK
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Regulations Compliance Report

Primary pipework insulated: Yes

OK

6 Controls

Space heating controls TTZC by plumbing and electrical services

OK

Hot water controls: Cylinderstat

OK

Independent timer for DHW

OK

Boiler interlock: Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%

Minimum 75.0%

OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight

OK

Based on:

Overshading: Average or unknown

Windows facing: East 4.33m²

Windows facing: South 1.2m²

Windows facing: West 7.03m²

Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K

Party Walls U-value 0 W/m²K

Photovoltaic array

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 02

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	3.26	(2b) =	137.41
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			238.11
					(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.17	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.37	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43
--	------	------	------	-----	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			4.33	x1/[1/(1.2)+ 0.04] =	4.96		(27)
Windows Type 2			1.2	x1/[1/(1.2)+ 0.04] =	1.37		(27)
Windows Type 3			7.03	x1/[1/(1.2)+ 0.04] =	8.05		(27)
Floor Type 1			40.28	x 0.14	= 5.6392	110	4430.8 (28)
Floor Type 2			1.87	x 0.14	= 0.2618	20	37.4 (28)
Walls	102.34	14.34	88	x 0.15	= 13.2	60	5280 (29)
Roof	46.34	0	46.34	x 0.12	= 5.56	9	417.06 (30)
Total area of elements, m²			190.83				(31)
Party wall			52.81	x 0	= 0	45	2376.45 (32)
Internal wall **			124.99			9	1124.91 (32c)
Internal floor			40.28			18	725.04 (32d)
Internal ceiling			40.28			9	362.52 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.18 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14754.18 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 178.99 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

15.62 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

56.8 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
47.94	47.6	47.27	45.73	45.44	44.09	44.09	43.84	44.61	45.44	46.02	46.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

104.74	104.4	104.07	102.53	102.24	100.89	100.89	100.64	101.41	102.24	102.82	103.44
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Average = Sum(39)_{1...12} /12=

102.53 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.27	1.27	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.25	1.25
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} /12=

1.24 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

210

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

1.57

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0.85

(54)

Enter (50) or (54) in (55)

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2058.39 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	90.48	80.27	85.53	78.37	78.03	71.49	70.33	74.86	74	81.18	83.7	88.88
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=	21.7	19.27	15.67	11.87	8.87	7.49	8.09	10.52	14.12	17.92	20.92	22.3
--------	------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

(67)

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

(68)m=	224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	121.62	119.45	114.96	108.84	104.87	99.28	94.53	100.62	102.78	109.11	116.26	119.46
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	428.37	426.11	412.14	389.73	366.99	345.2	331.15	337.33	348.96	371.59	397.5	416.91
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
East	0.9x	4.33	19.64	0.57	0.7	23.51 (76)
East	0.9x	4.33	38.42	0.57	0.7	46 (76)
East	0.9x	4.33	63.27	0.57	0.7	75.76 (76)
East	0.9x	4.33	92.28	0.57	0.7	110.48 (76)
East	0.9x	4.33	113.09	0.57	0.7	135.4 (76)
East	0.9x	4.33	115.77	0.57	0.7	138.61 (76)
East	0.9x	4.33	110.22	0.57	0.7	131.96 (76)
East	0.9x	4.33	94.68	0.57	0.7	113.35 (76)
East	0.9x	4.33	73.59	0.57	0.7	88.11 (76)
East	0.9x	4.33	45.59	0.57	0.7	54.58 (76)
East	0.9x	4.33	24.49	0.57	0.7	29.32 (76)
East	0.9x	4.33	16.15	0.57	0.7	19.34 (76)
South	0.9x	1.2	46.75	0.57	0.7	15.51 (78)
South	0.9x	1.2	76.57	0.57	0.7	25.41 (78)
South	0.9x	1.2	97.53	0.57	0.7	32.36 (78)
South	0.9x	1.2	110.23	0.57	0.7	36.58 (78)
South	0.9x	1.2	114.87	0.57	0.7	38.12 (78)
South	0.9x	1.2	110.55	0.57	0.7	36.68 (78)
South	0.9x	1.2	108.01	0.57	0.7	35.84 (78)
South	0.9x	1.2	104.89	0.57	0.7	34.8 (78)
South	0.9x	1.2	101.89	0.57	0.7	33.81 (78)
South	0.9x	1.2	82.59	0.57	0.7	27.4 (78)
South	0.9x	1.2	55.42	0.57	0.7	18.39 (78)
South	0.9x	1.2	40.4	0.57	0.7	13.4 (78)
West	0.9x	7.03	19.64	0.57	0.7	38.18 (80)
West	0.9x	7.03	38.42	0.57	0.7	74.68 (80)
West	0.9x	7.03	63.27	0.57	0.7	122.99 (80)
West	0.9x	7.03	92.28	0.57	0.7	179.38 (80)
West	0.9x	7.03	113.09	0.57	0.7	219.83 (80)
West	0.9x	7.03	115.77	0.57	0.7	225.04 (80)
West	0.9x	7.03	110.22	0.57	0.7	214.25 (80)
West	0.9x	7.03	94.68	0.57	0.7	184.04 (80)
West	0.9x	7.03	73.59	0.57	0.7	143.05 (80)
West	0.9x	7.03	45.59	0.57	0.7	88.62 (80)
West	0.9x	7.03	24.49	0.57	0.7	47.6 (80)
West	0.9x	7.03	16.15	0.57	0.7	31.4 (80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 77.21 | 146.09 | 231.11 | 326.44 | 393.35 | 400.33 | 382.05 | 332.19 | 264.96 | 170.6 | 95.31 | 64.14 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 505.58 | 572.2 | 643.25 | 716.17 | 760.34 | 745.53 | 713.19 | 669.52 | 613.92 | 542.19 | 492.81 | 481.05 (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 (86)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.94	0.86	0.73	0.58	0.63	0.84	0.96	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)
--------	----	----	----	----	----	----	----	----	----	----	----	----	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.86	19.87	19.87	19.89	19.89	19.9	19.9	19.9	19.9	19.89	19.88	19.88	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.97	0.92	0.82	0.64	0.45	0.5	0.77	0.94	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.86	19.87	19.87	19.89	19.89	19.9	19.9	19.9	19.9	19.89	19.88	19.88	(90)
--------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.43 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.36	20.36	20.36	20.37	20.37	20.38	20.38	20.38	20.38	20.37	20.37	20.37	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.36	20.36	20.36	20.37	20.37	20.38	20.38	20.38	20.38	20.37	20.37	20.37	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.97	0.93	0.84	0.68	0.51	0.56	0.8	0.95	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	500.94	563.45	623.72	665.7	640.08	508.57	362.9	374.39	491.71	514.31	485.15	477.37	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1681.92	1614.07	1442.65	1176	886.58	583.05	381.26	400.59	636.47	999.04	1364.32	1672.06	(97)
--------	---------	---------	---------	------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	878.65	706.02	609.28	367.42	183.39	0	0	0	0	360.64	633	888.85	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												4627.24	(98)

Space heating requirement in kWh/m²/year

56.14 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 233.72 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	878.65	706.02	609.28	367.42	183.39	0	0	0	0	360.64	633	888.85	
(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$													(211)
	375.94	302.08	260.69	157.21	78.47	0	0	0	0	154.3	270.84	380.31	
Total (kWh/year) = $\text{Sum}(211)_{1..5,10..12} =$													1979.84 (211)
Space heating fuel (secondary), kWh/month													
= $\{[(98)m \times (201)]\} \times 100 \div (208)$													
(215)m =	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = $\text{Sum}(215)_{1..5,10..12} =$													0 (215)
Water heating													
Output from water heater (calculated above)													
	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65	
Efficiency of water heater													188.96 (216)
(217)m =	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	(217)
Fuel for water heating, kWh/month													
(219)m = $(64)m \times 100 \div (217)m$													
(219)m =	107.16	94.47	99.27	89.06	87.32	78.1	75.08	82.29	82.11	92.34	97.55	104.6	
Total = $\text{Sum}(219a)_{1..12} =$													1089.35 (219)
Annual totals													
													kWh/year
Space heating fuel used, main system 1													1979.84
Water heating fuel used													1089.35
Electricity for pumps, fans and electric keep-hot													
Total electricity for the above, kWh/year													0 (231)
Electricity for lighting													383.18 (232)
Electricity generated by PVs													-1899.96 (233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =													1552.42 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	=	1027.54 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.519	=	565.37 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1592.91 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0 (267)
Electricity for lighting	(232) x	0.519	=	198.87 (268)
Energy saving/generation technologies				
Item 1		0.519	=	-986.08 (269)
Total CO2, kg/year			sum of (265)...(271) =	805.7 (272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =	9.77 (273)

DER WorkSheet: New dwelling design stage

EI rating (section 14)

92

(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:52:51

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange GREEN

Plot Reference: UNIT 03

Address :

Client Details:

Name:

Address :

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 system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 27.57 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.49 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 55.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 46.8 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Mitsubishi ECODAN 8.5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.57 kWh/day Permitted by DBSCG: 2.30 kWh/day	OK
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Regulations Compliance Report

Primary pipework insulated: Yes

OK

6 Controls

Space heating controls: TTZC by plumbing and electrical services
 Hot water controls: Cylinderstat
 Independent timer for DHW
 Boiler interlock: Yes

OK
 OK
 OK
 OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100.0%
 Minimum: 75.0%

OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight OK
 Based on:
 Overshading: Average or unknown
 Windows facing: East 4.33m²
 Windows facing: West 7.03m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value: 0.12 W/m²K
 Party Walls U-value: 0 W/m²K
 Photovoltaic array

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 03

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	3.26	(2b) =	137.41
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			238.11
					(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.17	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.37	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43
--	------	------	------	-----	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			4.33	x1/[1/(1.2)+ 0.04]	= 4.96		(27)
Windows Type 2			7.03	x1/[1/(1.2)+ 0.04]	= 8.05		(27)
Floor Type 1			40.28	x 0.14	= 5.6392	110	4430.8 (28)
Floor Type 2			1.87	x 0.14	= 0.2618	20	37.4 (28)
Walls	49.67	13.14	36.53	x 0.15	= 5.48	60	2191.8 (29)
Roof	46.34	0	46.34	x 0.12	= 5.56	9	417.06 (30)
Total area of elements, m²			138.16				(31)
Party wall			105.48	x 0	= 0	45	4746.6 (32)
Internal wall **			124.99			9	1124.91 (32c)
Internal floor			40.28			18	725.04 (32d)
Internal ceiling			40.28			9	362.52 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.08 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14036.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 170.28 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

DER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

15.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

47.36 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
47.94	47.6	47.27	45.73	45.44	44.09	44.09	43.84	44.61	45.44	46.02	46.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

95.29	94.96	94.63	93.08	92.79	91.45	91.45	91.2	91.96	92.79	93.38	93.99
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

Average = Sum(39)_{1...12} / 12 =

93.08 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.16	1.15	1.15	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.14
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.13 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
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(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

210

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

1.57

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0.85

(54)

Enter (50) or (54) in (55)

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
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(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2058.39

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	90.48	80.27	85.53	78.37	78.03	71.49	70.33	74.86	74	81.18	83.7	88.88
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=	22.19	19.71	16.03	12.13	9.07	7.66	8.27	10.75	14.43	18.33	21.39	22.8
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

(67)

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

(68)m=	224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	121.62	119.45	114.96	108.84	104.87	99.28	94.53	100.62	102.78	109.11	116.26	119.46
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	428.86	426.54	412.5	389.99	367.19	345.37	331.33	337.57	349.28	371.99	397.97	417.42
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(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
East	0.9x	4.33	19.64	0.57	0.7	23.51 (76)
East	0.9x	4.33	38.42	0.57	0.7	46 (76)
East	0.9x	4.33	63.27	0.57	0.7	75.76 (76)
East	0.9x	4.33	92.28	0.57	0.7	110.48 (76)
East	0.9x	4.33	113.09	0.57	0.7	135.4 (76)
East	0.9x	4.33	115.77	0.57	0.7	138.61 (76)
East	0.9x	4.33	110.22	0.57	0.7	131.96 (76)
East	0.9x	4.33	94.68	0.57	0.7	113.35 (76)
East	0.9x	4.33	73.59	0.57	0.7	88.11 (76)
East	0.9x	4.33	45.59	0.57	0.7	54.58 (76)
East	0.9x	4.33	24.49	0.57	0.7	29.32 (76)
East	0.9x	4.33	16.15	0.57	0.7	19.34 (76)
West	0.9x	7.03	19.64	0.57	0.7	38.18 (80)
West	0.9x	7.03	38.42	0.57	0.7	74.68 (80)
West	0.9x	7.03	63.27	0.57	0.7	122.99 (80)
West	0.9x	7.03	92.28	0.57	0.7	179.38 (80)
West	0.9x	7.03	113.09	0.57	0.7	219.83 (80)
West	0.9x	7.03	115.77	0.57	0.7	225.04 (80)
West	0.9x	7.03	110.22	0.57	0.7	214.25 (80)
West	0.9x	7.03	94.68	0.57	0.7	184.04 (80)
West	0.9x	7.03	73.59	0.57	0.7	143.05 (80)
West	0.9x	7.03	45.59	0.57	0.7	88.62 (80)
West	0.9x	7.03	24.49	0.57	0.7	47.6 (80)
West	0.9x	7.03	16.15	0.57	0.7	31.4 (80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

61.69	120.68	198.75	289.86	355.24	363.65	346.21	297.39	231.15	143.2	76.92	50.73
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 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

490.55	547.23	611.24	679.86	722.43	709.01	677.54	634.95	580.43	515.19	474.9	468.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (84)

7. Mean internal temperature (heating season)

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

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.99	0.97	0.94	0.86	0.71	0.56	0.61	0.83	0.95	0.99	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

21	21	21	21	21	21	21	21	21	21	21	21
----	----	----	----	----	----	----	----	----	----	----	----

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.96	19.96	19.96	19.98	19.98	19.99	19.99	20	19.99	19.98	19.97	19.97
-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.98	0.97	0.92	0.82	0.63	0.45	0.5	0.76	0.94	0.98	0.99
------	------	------	------	------	------	------	-----	------	------	------	------

 (89)

DER WorkSheet: New dwelling design stage

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.96	19.96	19.96	19.98	19.98	19.99	19.99	20	19.99	19.98	19.97	19.97	(90)
--------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = \boxed{0.43} \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	20.41	20.41	20.41	20.42	20.42	20.43	20.43	20.43	20.42	20.42	20.42	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.41	20.41	20.41	20.42	20.42	20.43	20.43	20.43	20.43	20.42	20.42	20.42	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm :

(94)m=	0.99	0.98	0.97	0.93	0.83	0.67	0.5	0.55	0.79	0.95	0.98	0.99	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=	485.78	538.65	592.27	630.08	602.65	474.11	336.34	347.41	460.78	487.82	467.14	464.33	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1535.13	1472.92	1316.58	1072.48	809.48	533.22	350.33	367.74	581.96	911.55	1243.81	1524.21	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	780.72	627.83	538.89	318.53	153.88	0	0	0	0	315.25	559.21	788.55	
Total per year ($kWh/year$) = $\text{Sum}(98)_{1..5,9..12} =$												4082.85	(98)

Space heating requirement in $kWh/m^2/year$

49.53	(99)
-------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system $\boxed{0}$ (201)

Fraction of space heat from main system(s) (202) = $1 - (201) =$ 1 (202)

Fraction of total heating from main system 1 (204) = $(202) \times [1 - (203)] =$ 1 (204)

Efficiency of main space heating system 1 $\boxed{212.03}$ (206)

Efficiency of secondary/supplementary heating system, % $\boxed{0}$ (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	$kWh/year$
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------------

Space heating requirement (calculated above)

780.72	627.83	538.89	318.53	153.88	0	0	0	0	315.25	559.21	788.55
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

368.22	296.11	254.16	150.23	72.58	0	0	0	0	148.68	263.74	371.91
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

$$\text{Total } (kWh/year) = \text{Sum}(211)_{1..5,10..12} = \boxed{1925.63} \quad (211)$$

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215) _{1..5,10..12} =												0	(215)

Water heating

Output from water heater (calculated above)

202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
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Efficiency of water heater $\boxed{188.96}$ (216)

DER WorkSheet: New dwelling design stage

(217)m=	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	(217)
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	107.16	94.47	99.27	89.06	87.32	78.1	75.08	82.29	82.11	92.34	97.55	104.6	
Total = Sum(219a) _{1...12} =												1089.35	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		1925.63
Water heating fuel used		1089.35
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0
Electricity for lighting		391.81
Electricity generated by PVs		-1899.96
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1506.83

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	999.4
Space heating (secondary)	(215) x	0.519	0
Water heating	(219) x	0.519	565.37
Space and water heating	(261) + (262) + (263) + (264) =		1564.78
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0
Electricity for lighting	(232) x	0.519	203.35
Energy saving/generation technologies Item 1		0.519	-986.08
Total CO2, kg/year	sum of (265)...(271) =		782.04
Dwelling CO2 Emission Rate	(272) ÷ (4) =		9.49
EI rating (section 14)			92

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:52:51

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange GREEN

Plot Reference: UNIT 04

Address :

Client Details:

Name:

Address :

**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 system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 27.57 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.49 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 55.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 46.8 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Mitsubishi ECODAN 8.5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.57 kWh/day Permitted by DBSCG: 2.30 kWh/day	OK
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Regulations Compliance Report

Primary pipework insulated: Yes

OK

6 Controls

Space heating controls TTZC by plumbing and electrical services

OK

Hot water controls: Cylinderstat

OK

Independent timer for DHW

OK

Boiler interlock: Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%

Minimum 75.0%

OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley): Slight

OK

Based on:

Overshading: Average or unknown

Windows facing: East 4.33m²

Windows facing: West 7.03m²

Ventilation rate: 4.00

10 Key features

Roofs U-value 0.12 W/m²K

Party Walls U-value 0 W/m²K

Photovoltaic array

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 04

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	3.26	(2b) =	137.41
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			238.11
					(5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	+	0
Number of open flues	0	+	0	+	0
Number of intermittent fans				4	40
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.17
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.37
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43
--	------	------	------	-----	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59
---------	------	------	-----	------	------	------	------	------	------	------	------	------

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59
--------	------	------	-----	------	------	------	------	------	------	------	------	------

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			4.33	x 1/[1/(1.2) + 0.04]	= 4.96		(27)
Windows Type 2			7.03	x 1/[1/(1.2) + 0.04]	= 8.05		(27)
Floor Type 1			40.28	x 0.14	= 5.6392	110	4430.8 (28)
Floor Type 2			1.87	x 0.14	= 0.2618	20	37.4 (28)
Walls	49.67	13.14	36.53	x 0.15	= 5.48	60	2191.8 (29)
Roof	46.34	0	46.34	x 0.12	= 5.56	9	417.06 (30)
Total area of elements, m²			138.16				(31)
Party wall			105.48	x 0	= 0	45	4746.6 (32)
Internal wall **			124.99			9	1124.91 (32c)
Internal floor			40.28			18	725.04 (32d)
Internal ceiling			40.28			9	362.52 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.08 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14036.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 170.28 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

15.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

47.36 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
47.94	47.6	47.27	45.73	45.44	44.09	44.09	43.84	44.61	45.44	46.02	46.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

95.29	94.96	94.63	93.08	92.79	91.45	91.45	91.2	91.96	92.79	93.38	93.99
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

Average = Sum(39)_{1...12} / 12 =

93.08 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.16	1.15	1.15	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.14
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.13 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
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(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

210

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

1.57

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0.85

(54)

Enter (50) or (54) in (55)

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
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(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2058.39

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	90.48	80.27	85.53	78.37	78.03	71.49	70.33	74.86	74	81.18	83.7	88.88
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(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=	22.19	19.71	16.03	12.13	9.07	7.66	8.27	10.75	14.43	18.33	21.39	22.8
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(67)

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

(68)m=	224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
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(71)

Water heating gains (Table 5)

(72)m=	121.62	119.45	114.96	108.84	104.87	99.28	94.53	100.62	102.78	109.11	116.26	119.46
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	428.86	426.54	412.5	389.99	367.19	345.37	331.33	337.57	349.28	371.99	397.97	417.42
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(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
East	0.9x	4.33	19.64	0.57	0.7	23.51 (76)
East	0.9x	4.33	38.42	0.57	0.7	46 (76)
East	0.9x	4.33	63.27	0.57	0.7	75.76 (76)
East	0.9x	4.33	92.28	0.57	0.7	110.48 (76)
East	0.9x	4.33	113.09	0.57	0.7	135.4 (76)
East	0.9x	4.33	115.77	0.57	0.7	138.61 (76)
East	0.9x	4.33	110.22	0.57	0.7	131.96 (76)
East	0.9x	4.33	94.68	0.57	0.7	113.35 (76)
East	0.9x	4.33	73.59	0.57	0.7	88.11 (76)
East	0.9x	4.33	45.59	0.57	0.7	54.58 (76)
East	0.9x	4.33	24.49	0.57	0.7	29.32 (76)
East	0.9x	4.33	16.15	0.57	0.7	19.34 (76)
West	0.9x	7.03	19.64	0.57	0.7	38.18 (80)
West	0.9x	7.03	38.42	0.57	0.7	74.68 (80)
West	0.9x	7.03	63.27	0.57	0.7	122.99 (80)
West	0.9x	7.03	92.28	0.57	0.7	179.38 (80)
West	0.9x	7.03	113.09	0.57	0.7	219.83 (80)
West	0.9x	7.03	115.77	0.57	0.7	225.04 (80)
West	0.9x	7.03	110.22	0.57	0.7	214.25 (80)
West	0.9x	7.03	94.68	0.57	0.7	184.04 (80)
West	0.9x	7.03	73.59	0.57	0.7	143.05 (80)
West	0.9x	7.03	45.59	0.57	0.7	88.62 (80)
West	0.9x	7.03	24.49	0.57	0.7	47.6 (80)
West	0.9x	7.03	16.15	0.57	0.7	31.4 (80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

61.69	120.68	198.75	289.86	355.24	363.65	346.21	297.39	231.15	143.2	76.92	50.73
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 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

490.55	547.23	611.24	679.86	722.43	709.01	677.54	634.95	580.43	515.19	474.9	468.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (84)

7. Mean internal temperature (heating season)

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

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.99	0.97	0.94	0.86	0.71	0.56	0.61	0.83	0.95	0.99	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

21	21	21	21	21	21	21	21	21	21	21	21
----	----	----	----	----	----	----	----	----	----	----	----

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.96	19.96	19.96	19.98	19.98	19.99	19.99	20	19.99	19.98	19.97	19.97
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 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.98	0.97	0.92	0.82	0.63	0.45	0.5	0.76	0.94	0.98	0.99
------	------	------	------	------	------	------	-----	------	------	------	------

 (89)

DER WorkSheet: New dwelling design stage

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.96	19.96	19.96	19.98	19.98	19.99	19.99	20	19.99	19.98	19.97	19.97	(90)
--------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = \boxed{0.43} \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	20.41	20.41	20.41	20.42	20.42	20.43	20.43	20.43	20.42	20.42	20.42	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.41	20.41	20.41	20.42	20.42	20.43	20.43	20.43	20.43	20.42	20.42	20.42	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, hm :

(94)m=	0.99	0.98	0.97	0.93	0.83	0.67	0.5	0.55	0.79	0.95	0.98	0.99	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=	485.78	538.65	592.27	630.08	602.65	474.11	336.34	347.41	460.78	487.82	467.14	464.33	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1535.13	1472.92	1316.58	1072.48	809.48	533.22	350.33	367.74	581.96	911.55	1243.81	1524.21	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	780.72	627.83	538.89	318.53	153.88	0	0	0	0	315.25	559.21	788.55	
Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$												4082.85	(98)

Space heating requirement in $kWh/m^2/year$

49.53	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system $\boxed{0}$ (201)

Fraction of space heat from main system(s) (202) = $1 - (201) =$ 1 (202)

Fraction of total heating from main system 1 (204) = $(202) \times [1 - (203)] =$ 1 (204)

Efficiency of main space heating system 1 $\boxed{212.03}$ (206)

Efficiency of secondary/supplementary heating system, % $\boxed{0}$ (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	$kWh/year$
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------------

Space heating requirement (calculated above)

780.72	627.83	538.89	318.53	153.88	0	0	0	0	315.25	559.21	788.55
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(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

368.22	296.11	254.16	150.23	72.58	0	0	0	0	148.68	263.74	371.91
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$$\text{Total } (kWh/year) = Sum(211)_{1..5,10..12} = \boxed{1925.63} \quad (211)$$

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215) _{1..5,10..12} =												0	(215)

Water heating

Output from water heater (calculated above)

202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
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Efficiency of water heater $\boxed{188.96}$ (216)

DER WorkSheet: New dwelling design stage

(217)m=	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	107.16	94.47	99.27	89.06	87.32	78.1	75.08	82.29	82.11	92.34	97.55	104.6	
Total = Sum(219a) _{1...12} =												1089.35	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		1925.63
Water heating fuel used		1089.35
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0
Electricity for lighting		391.81
Electricity generated by PVs		-1899.96
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1506.83

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	999.4
Space heating (secondary)	(215) x	0.519	0
Water heating	(219) x	0.519	565.37
Space and water heating	(261) + (262) + (263) + (264) =		1564.78
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	0
Electricity for lighting	(232) x	0.519	203.35
Energy saving/generation technologies Item 1		0.519	-986.08
Total CO2, kg/year	sum of (265)...(271) =		782.04
Dwelling CO2 Emission Rate	(272) ÷ (4) =		9.49
EI rating (section 14)			92

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.57
Printed on 13 October 2022 at 09:52:50

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 82.43m²

Site Reference : Lynton Grange GREEN

Plot Reference: UNIT 05

Address :

Client Details:

Name:

Address :

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 system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 28.8 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.22 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 49.3 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (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	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Mitsubishi ECODAN 8.5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.57 kWh/day Permitted by DBSCG: 2.30 kWh/day	OK
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Regulations Compliance Report

Primary pipework insulated: Yes OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: East	4.33m ²
Windows facing: West	6.1m ²
Roof windows facing: North	4.32m ²
Ventilation rate:	4.00

10 Key features

Roofs U-value	0.12 W/m ² K
Party Walls U-value	0 W/m ² K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.57

Property Address: UNIT 05

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.28	(1a) x	2.5	(2a) =	100.7
First floor	42.15	(1b) x	2.82	(2b) =	118.86
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.43	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			219.56

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	+	0
Number of open flues	0	+	0	+	0
Number of intermittent fans				4	40
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.18
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.78	x 1.2	= 2.136		(26)
Windows Type 1			4.33	x1/[1/(1.2)+ 0.04]	= 4.96		(27)
Windows Type 2			6.1	x1/[1/(1.2)+ 0.04]	= 6.98		(27)
Rooflights			4.32	x1/[1/(1.2) + 0.04]	= 5.184		(27b)
Floor Type 1			40.28	x 0.14	= 5.6392	110	4430.8 (28)
Floor Type 2			1.87	x 0.14	= 0.2618	20	37.4 (28)
Walls	80.97	12.21	68.76	x 0.15	= 10.31	60	4125.6 (29)
Roof	58.5	4.32	54.18	x 0.12	= 6.5	9	487.62 (30)
Total area of elements, m²			181.62				(31)
Party wall			52.67	x 0	= 0	45	2370.15 (32)
Internal wall **			124.99			9	1124.91 (32c)
Internal floor			40.28			18	725.04 (32d)
Internal ceiling			40.28			9	362.52 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.74 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13664.04 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.77 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

15.12 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

56.87 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
44.83	44.5	44.17	42.63	42.34	41	41	40.76	41.52	42.34	42.92	43.53

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

101.7	101.36	101.03	99.5	99.21	97.87	97.87	97.62	98.39	99.21	99.79	100.4
-------	--------	--------	------	-------	-------	-------	-------	-------	-------	-------	-------

Average = Sum(39)_{1...12} /12=

99.5 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.23	1.23	1.23	1.21	1.2	1.19	1.19	1.18	1.19	1.2	1.21	1.22
------	------	------	------	-----	------	------	------	------	-----	------	------

Average = Sum(40)_{1...12} /12=

1.21 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.75

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

103.12	99.37	95.62	91.87	88.12	84.37	84.37	88.12	91.87	95.62	99.37	103.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(44)_{1...12} =

1125 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

152.93	133.75	138.02	120.33	115.46	99.63	92.33	105.94	107.21	124.94	136.39	148.11
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1475.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.94	20.06	20.7	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

210

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

1.57

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0.85

(54)

Enter (50) or (54) in (55)

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65
--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2058.39 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	90.48	80.27	85.53	78.37	78.03	71.49	70.33	74.86	74	81.18	83.7	88.88
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37	125.37

(66)

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

(67)m=	20.73	18.41	14.97	11.34	8.47	7.15	7.73	10.05	13.49	17.12	19.98	21.3
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

(67)

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

(68)m=	224.44	226.77	220.9	208.41	192.64	177.81	167.91	165.58	171.45	183.95	199.72	214.54
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29	-100.29
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	121.62	119.45	114.96	108.84	104.87	99.28	94.53	100.62	102.78	109.11	116.26	119.46
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	427.4	425.25	411.44	389.2	366.59	344.86	330.78	336.86	348.33	370.79	396.57	415.92
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	4.33	x	19.64	x	0.57	x	0.7	=	23.51 (76)
East	0.9x	0.77	x	4.33	x	38.42	x	0.57	x	0.7	=	46 (76)
East	0.9x	0.77	x	4.33	x	63.27	x	0.57	x	0.7	=	75.76 (76)
East	0.9x	0.77	x	4.33	x	92.28	x	0.57	x	0.7	=	110.48 (76)
East	0.9x	0.77	x	4.33	x	113.09	x	0.57	x	0.7	=	135.4 (76)
East	0.9x	0.77	x	4.33	x	115.77	x	0.57	x	0.7	=	138.61 (76)
East	0.9x	0.77	x	4.33	x	110.22	x	0.57	x	0.7	=	131.96 (76)
East	0.9x	0.77	x	4.33	x	94.68	x	0.57	x	0.7	=	113.35 (76)
East	0.9x	0.77	x	4.33	x	73.59	x	0.57	x	0.7	=	88.11 (76)
East	0.9x	0.77	x	4.33	x	45.59	x	0.57	x	0.7	=	54.58 (76)
East	0.9x	0.77	x	4.33	x	24.49	x	0.57	x	0.7	=	29.32 (76)
East	0.9x	0.77	x	4.33	x	16.15	x	0.57	x	0.7	=	19.34 (76)
West	0.9x	0.77	x	6.1	x	19.64	x	0.57	x	0.7	=	33.13 (80)
West	0.9x	0.77	x	6.1	x	38.42	x	0.57	x	0.7	=	64.8 (80)
West	0.9x	0.77	x	6.1	x	63.27	x	0.57	x	0.7	=	106.72 (80)
West	0.9x	0.77	x	6.1	x	92.28	x	0.57	x	0.7	=	155.65 (80)
West	0.9x	0.77	x	6.1	x	113.09	x	0.57	x	0.7	=	190.75 (80)
West	0.9x	0.77	x	6.1	x	115.77	x	0.57	x	0.7	=	195.27 (80)
West	0.9x	0.77	x	6.1	x	110.22	x	0.57	x	0.7	=	185.9 (80)
West	0.9x	0.77	x	6.1	x	94.68	x	0.57	x	0.7	=	159.69 (80)
West	0.9x	0.77	x	6.1	x	73.59	x	0.57	x	0.7	=	124.12 (80)
West	0.9x	0.77	x	6.1	x	45.59	x	0.57	x	0.7	=	76.89 (80)
West	0.9x	0.77	x	6.1	x	24.49	x	0.57	x	0.7	=	41.31 (80)
West	0.9x	0.77	x	6.1	x	16.15	x	0.57	x	0.7	=	27.24 (80)
Rooflights	0.9x	1	x	4.32	x	14.95	x	0.57	x	0.7	=	23.2 (82)
Rooflights	0.9x	1	x	4.32	x	27.7	x	0.57	x	0.7	=	42.97 (82)
Rooflights	0.9x	1	x	4.32	x	48.05	x	0.57	x	0.7	=	74.54 (82)
Rooflights	0.9x	1	x	4.32	x	83.46	x	0.57	x	0.7	=	129.47 (82)
Rooflights	0.9x	1	x	4.32	x	120.31	x	0.57	x	0.7	=	186.64 (82)
Rooflights	0.9x	1	x	4.32	x	132.58	x	0.57	x	0.7	=	205.67 (82)
Rooflights	0.9x	1	x	4.32	x	122.25	x	0.57	x	0.7	=	189.65 (82)
Rooflights	0.9x	1	x	4.32	x	91.87	x	0.57	x	0.7	=	142.52 (82)
Rooflights	0.9x	1	x	4.32	x	59.39	x	0.57	x	0.7	=	92.13 (82)
Rooflights	0.9x	1	x	4.32	x	32.94	x	0.57	x	0.7	=	51.1 (82)
Rooflights	0.9x	1	x	4.32	x	18.21	x	0.57	x	0.7	=	28.25 (82)
Rooflights	0.9x	1	x	4.32	x	12.66	x	0.57	x	0.7	=	19.63 (82)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

79.84	153.77	257.02	395.6	512.8	539.55	507.52	415.56	304.36	182.58	98.88	66.21
-------	--------	--------	-------	-------	--------	--------	--------	--------	--------	-------	-------

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

507.24	579.02	668.46	784.8	879.39	884.41	838.31	752.42	652.69	553.37	495.45	482.13
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

DER WorkSheet: New dwelling design stage

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (86)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.63	0.49	0.56	0.8	0.95	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)
--------	----	----	----	----	----	----	----	----	----	----	----	----	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.9	19.9	19.91	19.92	19.93	19.93	19.93	19.93	19.92	19.91	19.91	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.75	0.55	0.38	0.44	0.73	0.93	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.89	19.9	19.9	19.91	19.92	19.93	19.93	19.93	19.93	19.92	19.91	19.91	(90)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.43 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.37	20.38	20.38	20.39	20.39	20.4	20.4	20.4	20.39	20.39	20.38	20.38	(92)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.37	20.38	20.38	20.39	20.39	20.4	20.4	20.4	20.39	20.39	20.38	20.38	(93)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.9	0.77	0.59	0.43	0.49	0.76	0.94	0.98	0.99	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	501.31	567.69	641.42	705.51	679.21	519.62	360.01	371.5	496.17	518.34	485.78	477.4	(95)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1634.72	1568.72	1402.17	1142.87	861.94	567.2	371.46	390.18	619.1	971.07	1325.72	1624.63	(97)
--------	---------	---------	---------	---------	--------	-------	--------	--------	-------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	843.26	672.69	566	314.9	135.95	0	0	0	0	336.83	604.76	853.54	(98)
--------	--------	--------	-----	-------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 4327.93 (98)

Space heating requirement in kWh/m²/year

52.5 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 226.75 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

DER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	843.26	672.69	566	314.9	135.95	0	0	0	0	336.83	604.76	853.54	
(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$													(211)
	371.88	296.66	249.61	138.87	59.96	0	0	0	0	148.54	266.7	376.42	
Total (kWh/year) = $\text{Sum}(211)_{1..5,10..12} =$													1908.65 (211)
Space heating fuel (secondary), kWh/month = $\{[(98)m \times (201)]\} \times 100 \div (208)$													
(215)m =	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = $\text{Sum}(215)_{1..5,10..12} =$													0 (215)
Water heating													
Output from water heater (calculated above)	202.47	178.5	187.57	168.28	165	147.58	141.87	155.49	155.16	174.49	184.33	197.65	
Efficiency of water heater													188.96 (216)
(217)m =	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	188.96	(217)
Fuel for water heating, kWh/month (219)m = $(64)m \times 100 \div (217)m$													
(219)m =	107.16	94.47	99.27	89.06	87.32	78.1	75.08	82.29	82.11	92.34	97.55	104.6	
Total = $\text{Sum}(219a)_{1..12} =$													1089.35 (219)
Annual totals													
													kWh/year
Space heating fuel used, main system 1													1908.65
Water heating fuel used													1089.35
Electricity for pumps, fans and electric keep-hot													
Total electricity for the above, kWh/year													0 (231)
Electricity for lighting													366.07 (232)
Electricity generated by PVs													-1899.96 (233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =													1464.11 (238)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	=	990.59 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.519	=	565.37 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1555.96 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0 (267)
Electricity for lighting	(232) x	0.519	=	189.99 (268)
Energy saving/generation technologies				
Item 1		0.519	=	-986.08 (269)
Total CO2, kg/year			sum of (265)...(271) =	759.87 (272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =	9.22 (273)

DER WorkSheet: New dwelling design stage

EI rating (section 14)

92

(274)

Appendix D

Project Emission Calculations & SAP 10 Conversion

SAP 2012 PERFORMANCE

SAP10 PERFORMANCE

DOMESTIC

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	8	
After energy demand reduction	7	
After heat network / CHP	7	
After renewable energy	4	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	1	16%
Savings from heat network / CHP	0	0%
Savings from renewable energy	3	38%
Cumulative on site savings	4	53%
Annual savings from off-set payment	4	-
	(Tonnes CO ₂)	
Cumulative savings for off-set payment	117	-
Cash in-lieu contribution (£)	6,999	

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	7	
After energy demand reduction	6	
After heat network / CHP	6	
After renewable energy	2	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	1	17%
Savings from heat network / CHP	0	0%
Savings from renewable energy	4	60%
Cumulative on site savings	6	77%
Annual savings from off-set payment	2	-
	(Tonnes CO ₂)	
Cumulative savings for off-set payment	52	-
Cash in-lieu contribution (£)	3,142	

NON-DOMESTIC

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	39	
After energy demand reduction	25	
After heat network / CHP	25	
After renewable energy	24	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	14	35%
Savings from heat network / CHP	0	0%
Savings from renewable energy	1	2%
Total Cumulative Savings	15	38%

Table 5: Shortfall in regulated carbon dioxide savings

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	19	
After energy demand reduction	13	
After heat network / CHP	13	
After renewable energy	11	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	6	33%
Savings from heat network / CHP	0	0%
Savings from renewable energy	2	11%
Total Cumulative Savings	8	44%

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO ₂)	Cumulative Shortfall (Tonnes CO ₂)
Total Target Savings	14	-
Shortfall	-1	-31
Cash in-lieu contribution (£)	-1,835	-

	Annual Shortfall (Tonnes CO ₂)	Cumulative Shortfall (Tonnes CO ₂)
Total Target Savings	7	-
Shortfall	-2	-50
Cash in-lieu contribution (£)	-3,022	-

SITE-WIDE

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	47		
Be lean	32	15	32%
Be clean	32	0	0%
Be green	28	4	8%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	86	-

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	27		
Be lean	19	8	29%
Be clean	19	0	0%
Be green	13	7	24%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	2	-

Building use	Energy demand following energy efficiency measures (MWh/year)						
	Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Unregulated electricity	Unregulated gas
Domestic	0	0	0	0	0	0	0
Non-domestic	0	0	0	0	0	0	0

	Target Fabric Energy Efficiency (kWh/m ²)	Dwelling Fabric Energy Efficiency (kWh/m ²)	Improvement (%)
Development total	0.00	0.00	

	Area weighted average non-domestic cooling demand (MJ/m ²)	Total area weighted non-domestic cooling demand (MJ/year)
Actual		
Notional		