



St Edward

Green Park Village Phase 6A, Reading

Sustainability & Energy Statement

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RSK GENERAL NOTES

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1 INTRODUCTION

RSK Environment Ltd (“RSK”) has been appointed by St Edward (the applicant) to prepare this Sustainability & Energy Statement in support of a detailed planning application to Reading Borough Council in support of the proposed development of 281 dwellings and 630 sqm commercial space across three development blocks (F, G & H) at Green Park Village Phase 6A, Reading.

Chapter 2 of this Statement sets out Reading Borough Council’s key planning policy requirements in relation to sustainability and energy / CO₂ emissions. **Chapter 3** reports the energy strategy for the development based on SAP and SBEM energy modelling. **Chapter 4** provides the completed Reading Borough Council Sustainable Design Checklist to summarise the key sustainability measures integrated into the scheme design. SAP reports from the modelled apartments, SBEM reports for the modelled commercial unit and the completed Water Calculator Tool are presented at **Appendices 1, 2 and 3** respectively.

2 PLANNING POLICY REQUIREMENTS

2.1 Reading Borough Council

2.1.1 Core Strategy Adopted 2008 (Altered January 2015)

Core Strategy Policy CS1 'Sustainable Construction and Design' requires proposals for major new residential development will be acceptable where the design of buildings and site layouts use energy, water, minerals, materials and other natural resources appropriately, efficiently and with care and takes account of the effects of climate change. To meet these requirements, residential development of more than 10 dwellings are required to:

- meet the most up to date Eco-Homes 'Excellent' standard for 50% of provision, and with 'Very Good' standards for the remaining 50% of provision;
- maximise the use of energy efficiency and energy conservation measures in their design, layout and orientation to reduce overall energy demand;
- incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to offset at least 20% of predicted CO₂ emissions from the completed and occupied development;
- Reduce mains water use and demonstrate that water conservation measures are incorporated so that predicted per capita consumption does not exceed the appropriate levels set out in the Code for Sustainable Homes; and
- incorporate sustainable drainage (SuDS) facilities and techniques as part of the layout of a development as appropriate and as advised by the Environment Agency, including minimising the size of impermeable areas so that peak run-off and annual water run-off is reduced where possible and in any case is no greater than the original conditions of the site. Particular care will be needed in areas of flood risk where different solutions may be required.

2.1.2 Sites and Detailed Policies Document (2015)

Policy DM2 'Decentralised Energy' states that any development of more than 20 dwellings shall consider the inclusion of a CHP plant, biomass-fuelled heating system or other form of decentralised heating provision within the site unless it can be demonstrated unless it can be demonstrated that the scheme is not suitable or feasible for this form of provision.

2.1.3 Revised Sustainable Design & Construction SPD (2011)

This SPD provides a Sustainable Design Checklist that should be completed and submitted as part of planning application in order to demonstrate how the proposals respond to a range of sustainability issues including energy / CO₂, pollution, health, waste, ecology and transport.

2.2 Housing Standards Review

The Government's Written Ministerial Statement of 25th March 2015 announced the conclusion to the Housing Standards Review. This review aimed to simplify regulations and standards into one key set, driven by Building Regulations. One outcome from the review is the withdrawal of the Code for Sustainable Homes in England, and as a result Local Authorities are no longer able to require certification to a particular Code rating as a planning condition for new development.

2.3 Summary of Requirements

In summary therefore and following the revocation of the Code for new planning applications, the following key sustainability and energy / CO₂ targets apply to the development:

- The consideration of decentralised energy solutions including combined heat & power (CHP);
- 20% reduction in regulated CO₂ emissions from energy efficiency measures and on-site low / zero carbon energy generation;
- Completion of Reading Council's Sustainability Checklist; and
- Potable water efficiency.

3 ENERGY STRATEGY

3.1 Introduction

In order to demonstrate how Phase 6A can meet Reading's 20% CO₂ reduction target, 9 No. selected apartments have been modelled in SAP 2012 to establish their energy / CO₂ performance. Similarly, the circa 334 sqm commercial space in Block H has been modelled in SBEM.

The apartments have been selected for modelling to give a range of sizes, orientations and positions with the development blocks (mid floor, top floor etc) that together are likely to have energy / CO₂ performance that is representative of the development as a whole, based on professional judgement.

Results from the modelled apartments and commercial space are extrapolated on an area-weighted basis to provide an estimate of performance for Phase 6A as a whole.

The SAP and SBEM models were run initially to achieve a 'baseline' performance, being compliance with current (2013) Building Regulations Part L standards. Further model iterations were then run to evaluate the energy / CO₂ saving performance of various energy efficiency measures including enhanced building envelope performance to ensure a "fabric first" approach in accordance with the energy hierarchy.

Further model iterations were then run to establish additional energy / CO₂ savings achieved through various on-site low and zero carbon energy technologies including combined heat and power (CHP), solar photovoltaics (PV) and heat pumps.

3.2 Energy Hierarchy

3.2.1 Energy Efficiency

A range of enhanced energy efficiency measures beyond maximum 'back stop' values permissible under Building Regulations are proposed as the first step of the energy hierarchy, as summarised in Table 1 overleaf. These measures include the specification of good (low) U values for building envelope elements such as doors, walls, floors and windows, reduced envelope air permeability, 100% low energy lighting, and minimisation of thermal bridging. Heating via communal or individual gas boilers is also proposed.

Table 1: 'Maximum' and 'Enhanced' Energy Efficiency Specifications

Parameter	Maximum Value	Enhanced Value
U values (W/m²K)		
External wall	0.30	0.17
Party wall	0.20	0.00
Ground floor (commercial)	0.25	0.15
Upper exposed floor	0.25	0.15
Roof	0.20	0.10
Glazing	2.00	1.00 (g=0.76)
Door	2.00	1.00
Air permeability (m³/m²/hr)	10	3.5
Thermal bridging (y value, W/m²k)	≈0.10	≈0.11
Low energy lighting	100%	
Heating	Independent gas boilers	Communal gas boiler
Ventilation	Natural	

3.2.2 Low / Zero Carbon Energy Options

The following low / zero carbon energy technology options have been considered and assessed as part of the energy strategy for Phase 6A.

3.2.2.1 Ground Source Heat Pump

Ground source heat pumps extract heat from the ground by circulating fluid through buried pipes in horizontal trenches or vertical boreholes. They concentrate heat by using a vapour compression cycle, and they transfer heat into buildings to provide heating and hot water without burning fossil fuels.

The Kensa Shoebox heat pump is designed to provide space heating and domestic hot water for well insulated buildings with multiple accommodation. By using a communal ground array, high heat losses associated with running high temperature pipe throughout buildings is avoided which improves overall system efficiency. The Shoebox is designed specifically to operate with low noise levels enabling easy installation in places such as an apartment's kitchen. The unit is designed to provide a renewable alternative for heating multiple apartment blocks. When combined with a District Vertical Array (D-VA) communal ground array, Shoebox units are eligible for the Renewable Heat Incentive (RHI) commercial tariff.



This solution has however been discounted given the availability of mains gas for the development as well as potential uncertainties relating to the suitability of below ground conditions for a ground array of sufficient size to meet the requirements of Phase 6A. Inappropriately specified and/or installed heat pumps can result in substantial mains electricity consumption with associated high utility costs.

3.2.2.2 Combined Heat & Power (CHP)

Combined Heat & Power (CHP) converts a single fuel into both electricity and heat in a single process at the point of use. CHP is highly energy efficient and as well as supplying heat and power, it can deliver a number of positive financial, operational and environmental benefits.



This solution has also been discounted however given the applicant's concerns regarding system maintenance requirements and potential cost concerns for end users.

3.2.2.3 Solar Photovoltaics (PV)

Solar photovoltaics (PV) panels capture sunlight using photovoltaic cells and convert the energy into electricity to run household appliances and lighting, or alternatively export to the national grid where output from the PV array exceeds energy demand within the building.



Despite a number of reductions in financial support for solar PV from the Government's Feed in Tariff (FiT), ongoing reductions in PV capital costs mean this technology remains cost-effective, particular when combined with additional advantages including relative ease of integrating into the roof of new buildings, limited maintenance requirements and its acceptance by the large majority of households.

3.2.3 Energy Modelling Results

Table 2 presents energy modelling results for the solar PV scenario, including estimates of both "regulated" and "unregulated" CO₂ emissions for the Phase 6A as a whole. Results for the "baseline" scenario of compliance with 2013 Building Regulations Part L standards are first presented, followed by improved results from the specification of the energy efficiency measures set out in Table 1. Finally, energy / CO₂ results following the further addition of a 62.01 kWp solar PV array are presented.

Table 2. Development CO₂ Emissions at each Energy Hierarchy stage

Scenario	CO ₂ emissions (tonnes/year)	
	Regulated	Unregulated
2013 Building Regulations compliant baseline	311.13	336.47
+ energy efficiency measures (Table 1)	276.70	
+ 62.01 kWp solar PV	248.90	

Table 3 presents the savings in development CO₂ emissions achieved by each of the above energy hierarchy stages. It can be seen that the proposed energy efficiency measures achieve a 11.1% saving in regulated CO₂ emissions, with a further 8.9% CO₂ saving achieved by the proposed 62.01 kWp solar PV array. Together these measures deliver a 20.0% CO₂ saving in accordance with Reading Borough Council planning policy.

Table 3. Development Regulated CO₂ Savings at each Energy Hierarchy stage

Scenario	CO ₂ emissions savings	
	Tonnes CO ₂ / annum	% Saving
2013 Building Regulations compliant baseline	--	--
+ energy efficiency measures (Table 1)	34.43	11.1%
+ 62.01 kWp solar PV	27.80	8.9%
Total saving	62.23	20.0%

SAP and SBEM reports for the modelled apartments and Block H commercial space are presented at **Appendix 1** and **2** respectively.

3.2.4 Solar PV Array Area

For generic mono-crystalline solar PV (as assumed by SAP), each kWp in the UK requires an area of approximately 7.5 sqm. A 62.01 kWp solar PV array may therefore be expected to require a total array area of circa 465 sqm. Such an array can be accommodated on the roofs of Phase 6A without impairing their ability to accommodate additional roof functions that are proposed (e.g. brown roofs).

3.3 Further Work

Further work will be required as part of detailed design and specification to verify, progress and refine the preliminary energy strategy work reported here, including:

- SAP modelling and EPC production for all apartments;
- SBEM modelling and EPC production for the commercial space; and
- Engagement with solar PV installers.

4 SUSTAINABILITY STRATEGY

4.1 Introduction

Reading Borough Council's Revised Sustainable Design & Construction SPD (2011) includes a Sustainable Design Checklist that should be completed and submitted as part of planning applications to demonstrate how the proposals respond to a range of sustainability issues. The following sections set out, under each sustainability issue, the key sustainability measures incorporated into the Phase 6A proposals.

4.2 Reading Borough Council Sustainable Design Checklist

4.2.1 Energy / CO₂

Aim: To conserve energy, in particular CO₂ emissions and maximise the use of energy efficiency techniques.

(1) How has the development been designed to optimise the use of the energy from the sun and limit heat losses?

Yes, enhanced energy efficiency specifications are proposed for the building envelope including good but achievable levels of thermal performance (U values), air tightness and thermal bridging (y values). Only low energy lighting will be specified. A 62.01 kWp solar PV array (approximately 465 sqm) is also proposed which is predicted to reduce regulated CO₂ emissions from the development by 8.9%. Please refer to **Chapter 3** of this statement for further details of the proposed energy strategy

(2) How has the development been designed to optimise natural daylighting, energy efficient lighting, external lighting and natural ventilation?

The extent of glazing has been optimised in order to balance heat-losses with solar gain and internal natural light conditions, and the deeper window reveals enable an enhanced level of thermal wall insulation and the opportunity for building services to be incorporated. Only low energy lighting will be specified.

(3) How will the design of the building make efficient use of energy? (e.g. use of thermally massive materials, levels of insulation, energy efficient white goods and use of green/ brown roofs etc)

See responses to points (1) and (2) above.

(4) Has local energy generation from renewables been considered as part of the scheme?

Yes, a circa 62.01 kWp solar PV array (circa 465 sqm) is predicted to reduce regulated CO₂ emissions from the development by 8.9%.

(5) How have cycle storage facilities been considered?

Yes Berkeley Group's "Our Vision" framework includes a commitment to provide cycle storage to all homes. Covered secure cycle parking is provided at a ratio of 1 cycle space per apartment which is greater than Reading Borough Council policy

requirements in order to encourage sustainable transport and reduce reliance on private car use.

4.2.2 Water

Aim: To improve efficiency in the use of water, conserve water resources and minimise vulnerability to flooding.

(6) How will the development incorporate the use of water saving devices to achieve a maximum consumption of 105 litres per person per day?

The apartments will be designed to meet a potable water efficiency standard of 105 litres / person / day through the specification of efficient fixtures and fittings such as dual flush WCs, aerated taps and flow controlled showers. See **Appendix 3** for an example Water Calculator tool showing how this standard may be achieved.

(7) How will the development incorporate recycling rainwater and reduce the use of potable water?

Item (6) above explains how potable water consumption will be reduced through the specification of efficient fixture and fittings so that a maximum consumption of 105 litres / person / day is achieved. Please refer to the Green Park Village Phase 6A Flood Risk Assessment prepared by Glanville for further details.

(8) Has the collection, treatment and re-use of grey water been considered? If so, how will these facilities be incorporated within the development?

Greywater recycling is not proposed.

4.2.3 Materials

Aim: To retain local character and promote the use of materials with a low environmental impact.

(9) How will the selected materials help retain local character, ensure long life and ensure a low environmental impact?

Berkeley Group's 'fabric first' design approach focuses on high quality insulation standards, boilers and ventilation systems, making a major contribution to reducing CO₂ emissions in the homes. All Berkeley homes have 100% low energy internal light fittings and all appliances are at least 'A+' rated to reduce energy consumption and their environmental impact.

4.2.4 Surface Water Run-Off

Aim: To reduce flooding, pollution and other environmental damage.

(10) How has the development considered flooding and pollution?

Yes, Environment Agency flood maps indicate the site to be within Flood Zones 2 and 3 meaning a medium or high risk of flooding, respectively. However, as part of the agreed Green Park Flood Alleviation Scheme, site levels will be raised to provide a minimum platform height of 40.20m Above Ordnance Datum (AOD) which will mitigate this flood risk in the completed development from fluvial, groundwater and surface water sources.

Existing underlying geology at the site is contaminated, therefore surface water will be attenuated in lined below ground cellular tanks. Furthermore, the road to the east of the

podium will drain to permeable parking spaces from an impermeable aisle, providing two levels of treatment to the surface waters generated by the road and parking areas. Surface water generated by the roof and podium will discharge through trapped gullies and/or catchpit manholes to the surface water system, providing a minimum of one level of treatment to these waters. Please refer to the Green Park Village Phase 6A Flood Risk Assessment prepared by Glanville for further details.

(11) Has the design considered the use of sustainable drainage systems (SUDS) and how will they be incorporated within the development?

The selection of SuDS techniques for the development follows the approved strategy under the FRA approved as part of the original outline planning permission 10/01461/OUT. The concept is to use drainage techniques in series to incrementally reduce pollution, flow rates and volumes.

The proposed SuDS will consist of one drainage catchment. As the existing underlying geology is contaminated, the surface water will be attenuated in lined below ground cellular tanks and discharged to the lake at a maximum rate of 5.0 litres / second. The road to the east of the podium will drain to permeable parking spaces from an impermeable aisle, providing two levels of treatment to the surface waters generated by the road and parking areas. Surface water generated by the roof and podium will discharge through trapped gullies and/or catchpit manholes to the surface water system, providing a minimum of one level of treatment to these waters.

The measures include varying levels of improvement to water quality. Although not in strict accordance with the current SuDS Manual C753, the approach provides a minimum of two levels of water treatment to road areas and one level to roof/podium waters in accordance with the SuDS Manual C697 and previously approved FRA prepared by PBA under 10/01461/OUT. Please refer to the Green Park Village Phase 6A Flood Risk Assessment prepared by Glanville for further details.

4.2.5 Waste

Aim: To minimise the production of waste and maximise re-use and recycling.

(12) How will the development minimise waste sent to landfill?

Berkeley Group's "Our Vision" framework includes a commitment on waste which has two targets; to reduce waste by 10% and target a 90% diversion from landfill. Necessary steps have been taken at planning and design stage to reduce waste to acceptable levels.

Procurement:

- 1) Material schedules are in place to show clearly the details and data of materials being ordered for the site. This provides the site team with the information they require to call-off materials;
- 2) Ready mix mortar silos to be used;
- 3) Any surplus materials to be taken off site by original supplier;
- 4) Just-in time deliveries are procured to give consideration to the movement of materials to site and once on site; and
- 5) Number of skips to account for segregation of waste streams.

Construction:

- 1) Recycling waste management is adopted and implemented in the method of separate Timber, Plasterboard, Inert Hardcore, mixed and packaging skips;
- 2) Produced in sufficient quantities to make the operating costs of recovery economically attractive;
- 3) Easily segregated on site;
- 4) Add significant value by segregation compared to mixed waste;
- 5) Use local reprocessing facilities wherever possible; and
- 6) Where practicable, redundant concrete foundations, paving etc will be crushed on site for re-use under roads and parking areas.

On site, excess wood is collected by community wood recycling scheme where they reuse the wood and make wine racks and other products out the wood. We have partnered with Reading College to donate materials that are used in their classes, for example temporary doors and chipped bricks.

(13) How will the development make the maximum use of construction and demolition waste?

In order to reduce waste and maximum use of construction and demolition waste the project has a Project Waste Management Plan which sets out actions and responsibilities to aid a reduction in waste. Demolition waste is crushed and used as temporary roads. Excavated uncontaminated soils are reused on site to raise levels assisting with the flood prevention plans

(14) How will the development make maximum use of re-used and recycled materials?

The Berkeley Group's "Our Vision" framework includes a commitment to implement a sustainable specification and procurement strategy, this encourages the commercial team to buy materials with recycled content, for example Thermalite blocks are manufactured with up to 80% recycled material, have a long life span and are recyclable after use, making them an exceptionally sustainable building material.

The combination of high quality, low maintenance materials used in a way which supports the wider architectural language of the proposed scheme, together with simple but careful detailing, including relief assists in creating a series of buildings which are timeless in their appearance and will weather well.

(15) How will provision be made for the storage and recycling of waste for all users of the site?

To help make recycling easier for our customers, recycling bins are provided in the kitchens enabling easy waste separation. Bin store areas with recycling bins will be provided. Customers will be informed by the sales and customer relation teams of collection days and what items can be recycled etc.

Internal and external facilities for the storage of recyclable and non-recyclable domestic wastes will be designed with the requirements of Reading Borough Council (as waste domestic collection authority) in mind. Separate waste storage facilities will be provided for the commercial space.

4.2.6 Pollution

Aim: To minimise damage to the environment through air, ground/surface water, land, noise or light pollution.

(16) What measures have been incorporated to ensure that noise and light pollution will be minimised throughout the development?

A noise and vibration impact assessment has been undertaken for the proposed residential development at Green Park Village Phase 6, Reading. The assessment includes baseline noise monitoring at positions indicative of those façades most exposed to the dominant noise sources across the site.

A site suitability assessment, to the requirements of BS 8233: 2014 has been undertaken to determine internal noise levels at various locations across the development site. Noise levels are of a magnitude where a suitable double glazed system (as part of the facade of each room providing a transmission loss from outside to inside of 33 dB) would be required to meet recommended internal noise levels for residential space. The glazing would need to be accompanied by similar specification ventilation systems. In practice the noise levels are not considered to be significant and are typical to those that would be found in close proximity to similar road transport links.

Due to the scale of the development, traffic impacts are predicted to be negligible along the surrounding road network. Occupiers of the closest sensitive receptors to the substation located at the north west of the site are not predicted to be impacted by the resulting noise when assessed against British Standard BS4142, once the proposed facade mitigation is appropriately applied.

In summary, the noise assessment indicates that the proposed development is unlikely to have a significant impact on the existing environment on completion. In addition existing noise levels are predicted to be of a magnitude suitable for residential development assuming appropriate mitigation is included through design. The proposed site is therefore considered to be suitable for the intended development. Please refer to the Phase 6 Noise & Vibration Assessment report prepared by RSK for further details.

Regarding the mitigation of potential impacts from light pollution, no lighting installations are proposed to the northern boundary in order to protect ecological receptors in this area. In the courtyards, wayfinding and aesthetic lighting is reduced to emergency wayfinding lighting only during night hours.

(17) What measures have been incorporated to reduce nitrogen oxide emissions and reduce the global warming potential of insulants?

The specification of communal gas boilers with low NOx emissions is proposed, together with building insulating materials with a global warming potential (GWP) below 5 wherever possible.

(18) What measures have been incorporated to reduce the release of pollution into the atmosphere?

Regarding greenhouse gas emissions, a combination of energy efficiency measures and on-site renewable energy technology (solar PV) is proposed to reduce regulated CO₂ emissions from the operational development by 20% in accordance with Reading Borough Council planning policy. See Chapter 3 for further details of the proposed

energy strategy. The specification of communal gas boilers with low NOx emissions is also proposed as stated in item (17) above.

Regarding local air quality, a range of measures are proposed to minimise atmospheric pollution during construction and operation. Prior to commencement of demolition/construction activities, it is anticipated that an agreement on the scope of a dust management plan (DMP) for the construction phase will be reached with Reading Council to ensure that the potential for adverse environmental effects on local receptors (including ecological) is minimised. The DMP should include inter alia, measures for controlling dust and general pollution from site construction operations, and include details of any monitoring scheme, if appropriate. Controls should be applied throughout the construction period to ensure that emissions are mitigated.

The air quality impact of increased traffic during the construction phase will be limited to a relatively short period and will be along traffic routes employed by haulage / construction vehicles and workers. Any effects on air quality will be temporary i.e. during the construction and demolition period only and can be suitably controlled by the employment of mitigation measures appropriate to the development project.

Regarding operational emissions, the proposed development is predicted to have a 'negligible' air quality impact on surrounding sensitive receptors and proposed development receptors. As best practice, it is recommended that transport related mitigation measures are included to minimise the impact of the development on the surrounding road network and hence air quality. These measures could include:

- travel plans;
- car clubs;
- incentives for increased public transport use; and
- provision for alternative fuels, such as electric vehicle charge points.

Please refer to the Phase 6A Air Quality Assessment report prepared by RSK and Transport Statement prepared by Glanville for further details of sustainable transport and air pollution mitigation measures.

4.2.7 Health & Wellbeing

Aim: To improve the quality of life in homes through good daylighting, improved sound insulation, provision of outdoor space with good accessibility.

(19) How has the development been designed to maximise natural lighting, reduce the likelihood of noise complaints, incorporate private outdoor space and ensure the layout of the development can be easily adapted to meet the needs of future occupants?

The response to Question (2) above explains how the extent of glazing has been optimised in order to balance heat-losses with solar gain and internal natural light conditions. Glazed balconies are incorporated to every apartment living area, providing private outdoor amenity space. Similarly the response to question (16) above explains how the proposals minimise the likelihood of noise impacts.

Podium courtyards are semi-private for residents of adjoining blocks only and all apartments have an area of private defensible space. Lakeside and Podium layout is flexible for programme and future use of occupants, accommodating for 1-3 bed

apartments. The development is located within Green Park Village which has extensive communal outdoor environments of varying nature.

4.2.8 Management

Aim: To manage the site in an environmentally and socially considerate manner.

(20) What measures have been taken to ensure the construction of the site is managed in an environmentally and socially considerate manner, mitigating environmental impacts?

Social Sustainability

The Berkeley Group has been working to develop a framework for social sustainability since 2011. In 2014 Berkeley launched a toolkit to help measure and enhance people's quality of life, with this framework used during the design process for all new developments.

The Berkeley Group is also committed to conducting a formal assessment pre-planning for every development of 100 homes or more. The Berkeley Group also seeks to ensure that a long-term plan is in place to facilitate both the creation of communities in our developments and their longevity to ensure a sense of place through the development of a community plan which will create a structure that helps new communities to thrive. They help to identify the needs of the neighbourhood and facilitate activities to enhance the health and wellbeing of the community.

Environmental Sustainability/ Climate Change Adaptation

At The Berkeley Group, environmental sustainability means managing and minimising the environmental impact from their operations and delivering homes and communities that are environmentally sound, as well as being designed and built to a high quality.

The Berkeley Group seeks to ensure they review and improve the design of their homes to consider future climate change, specifically focusing on how to reduce the potential for overheating. New developments are designed to incorporate climate change adaptation measures over and above typical requirements introduced during the planning process. The Berkeley Group has also produced an adaptation checklist that provide project teams with information to assess which climate change issues are likely to be the most significant for the planned development and we work to mitigate these issues through the design.

During Construction

- Berkeley consumes energy to power activities, which in turn releases carbon in to the atmosphere contributing to the global effects on our climate. Therefore Berkeley has committed to reducing operational carbon emissions intensity by 10% and introducing a programme to become carbon positive. Through this commitment, Berkeley aims to reduce contributions to global climate change by focusing on the efficient use of energy and counterbalancing carbon emissions resulting from energy consumed. Berkeley was the first large UK company in the construction industry to commit to being carbon positive;
- Key challenges for industry and government are to encourage young people into the industry and increase capability in the workforce to ensure that there are enough people with the right skills to deliver the pipeline of future work.

Berkeley is committed to addressing the issue of youth unemployment and training by proactively supporting the supply chain in this area; and

- Every Berkeley Group project is registered with the Considerate Constructors Scheme, which aims to improve the image of construction. Registering sites with the scheme throughout construction is a commitment to promoting and achieving best practice in the following areas; Enhancing the Appearance, Respecting the Community, Protecting the Environment, Securing everyone's Safety and Caring for the Workforce.

(21) How has the development been designed to ensure people feel safe and secure?

A range of measures and design approaches have been taken to ensure safety and security for residents, workers and visitors. The design is visually permeable with few blind corners, active frontages and a large amount of natural surveillance. The external realm also provides suitable levels of lighting to ensure entrances and bin / bike stores are well lit and visually accessible.

4.2.9 Ecology

Aim: To retain, protect and enhance wildlife habitats and natural features.

(22) How have the wildlife habitats and natural features on and adjacent to the site been considered and how will they be retained, protected and enhanced?

An initial ecological desk study and extended Phase 1 Habitat survey were undertaken in March 2017. The Phase 6A application site comprises brownfield land with boundary ditches adjacent to two lakes and a railway line.

The Phase 6A application for residential development seeks to replace an existing consent, which allows commercial development of this area, a proposal previously assessed and considered within the Environmental Statement prepared at the time of this original consent. As such it would technically be correct for the baseline position for this new assessment to be taken as for the commercial scheme, not the current ecological conditions on site. However, as considerable time has passed and a candid assessment of current ecological impacts is felt to be most helpful, the current habitat baseline (2017) is referred to within this assessment in order that no important ecological receptors are overlooked with reference to the new proposals. Nonetheless, some of the mitigation measures provided for within the wider scheme remain relevant to potential impacts within this specific phase.

There are no statutory designated wildlife sites covering any part of the site. Whilst no rare or notable plant species have been recorded on-site more recently than 2010, the plant assemblage on-site has potential to contain uncommon species and is considered to be of value at the Local level.

Japanese knotweed, an invasive, legally controlled species, was recorded along the western boundary during the initial PCA surveys. This has since been excavated and removed from site as controlled waste but a monitoring programme is currently underway to ensure that control is effective.

As there will be net habitat losses for bats, birds and terrestrial invertebrates, there has been detailed consultation between CSA, the landscape architects (MacFarlane Associates) and other disciplines to include compensatory habitats or features within the development design of both the current application area and within Phase 1 C to the

south where there was additional scope to provide opportunities for wildlife. These compensatory measures comprise:

- Losses of semi-improved grassland habitat will be compensated for through the provision of species-rich wildflower areas to be managed sensitively for wildlife.
- Reductions in the amount of scrub available for wildlife will be compensated for through the provision of new thicket and tree planting within Phases 6a and 1c. Once established, these will provide replacement opportunities for wildlife, such as nesting birds and invertebrates

The Landscape Plans for Phase 6a and 1c include landscape planting enhancements which will make positive contributions to on-site biodiversity. New habitat creation will provide opportunities for species confirmed to be present on-site at baseline, such as nesting birds and invertebrates. In addition to these enhancements which are embedded into development proposals, a range of additional ecological enhancement measures will be delivered as part of the proposed development, as identified below:

- Increased tree planting and creation of a woodland walk helps to strengthen existing green corridors for wildlife and maintain green links with the local area, in line with local policies for Green Networks and Tree Planting.
- Inclusion of plant species of known wildlife value and species-rich planting areas within the landscaping scheme will increase overall biodiversity at the Site.

Ongoing monitoring of newly established and enhanced habitats within the development to ensure successful establishment. This commitment is prescribed within the Landscape Management Plan for the relevant development phases.

Based on the successful implementation of mitigation, compensation and enhancement, the scheme is considered to accord with all relevant nature conservation legislation, as well as with the provisions of the Reading Borough Local Plan and more specific planning documents relating to south-west Reading.

Overall, the Green Park Village development will form a connected landscape with a variety of habitats and green networks for use by wildlife. The current application area will feed into this design with additional ecological enhancements and mitigation secured to reflect the up-to-date baseline conditions. These measures have been incorporated within the Landscaping plans for Phases 6a and 1c which will form part of a detailed planning application and will thus be secured as part of the approved scheme to be implemented. It is anticipated that precautionary working methods can be secured through compliance with a CEMP.

Please refer to the Ecological Impact Assessment and Landscape reports for further details on the proposed ecological enhancement work proposed for the development.

4.3 Summary

With the exception of rainwater harvesting, therefore, the Phase 6A proposals accord in full with all relevant requirements of Reading Borough Council's Sustainable Design Checklist. This demonstrates the development will make a suitable contribution to sustainable development during both construction and operation.

Appendix 1

SAP Reports (Modelled Apartments)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
Printed on 02 June 2017 at 09:40:14

Project Information:

Assessed By: David Lloyd (STRO006228)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 77.32m²

Site Reference : GPV Ph 6

Plot Reference: 2B K Top (Comm Boiler NV PV)

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 19.66 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.05 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.4 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 44.3 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.19 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, TRVs	OK
Hot water controls:	No cylinder	
	No cylinder	

Regulations Compliance Report

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
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Based on:

Overshading:	Average or unknown
Windows facing: North East	3.9m ²
Windows facing: North East	3.85m ²
Windows facing: South West	3.9m ²
Windows facing: South West	3.85m ²
Windows facing: North East	10.14m ²
Ventilation rate:	6.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

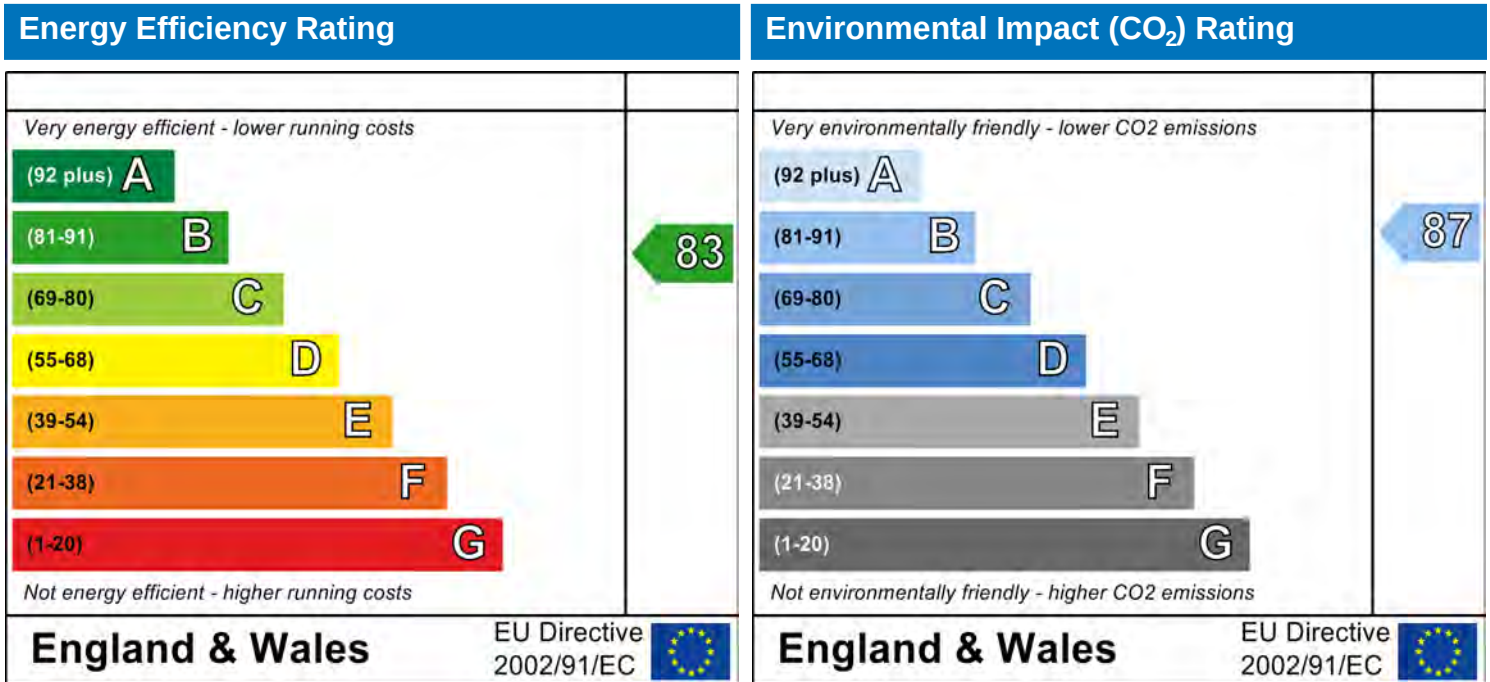
Air permeability	3.5 m ³ /m ² h
Windows U-value	1 W/m ² K
Doors U-value	1 W/m ² K
Roofs U-value	0.1 W/m ² K
Community heating, heat from boilers – mains gas	
Photovoltaic array	

Predicted Energy Assessment

Dwelling type: Top floor Flat
Date of assessment: 20 March 2017
Produced by: David Lloyd
Total floor area: 77.32 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B K Top (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.32 (1a) x	2.5 (2a) =	193.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.32 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	193.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				3 x 10 =	30 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16 (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 <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>			0 (11)
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			3.5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.33 (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) =		0.33 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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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DER WorkSheet: New dwelling design stage

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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.31	0.33	0.35	0.37	0.39
------	------	-----	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.59 0.59 0.58 0.57 0.56 0.55 0.55 0.55 0.55 0.56 0.57 0.58 (24d)

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

(25)m= 0.59 0.59 0.58 0.57 0.56 0.55 0.55 0.55 0.55 0.56 0.57 0.58 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x 1/[1/(1) + 0.04]	= 1.88		(27)
Windows Type 2			3.85	x 1/[1/(1) + 0.04]	= 3.7		(27)
Windows Type 3			1.95	x 1/[1/(1) + 0.04]	= 1.88		(27)
Windows Type 4			3.85	x 1/[1/(1) + 0.04]	= 3.7		(27)
Windows Type 5			10.14	x 1/[1/(1) + 0.04]	= 9.75		(27)
Floor			7.88	x 0.15	= 1.182		(28)
Walls Type1	68.88	25.64	43.24	x 0.17	= 7.35		(29)
Walls Type2	19.63	1.95	17.68	x 0.19	= 3.43		(29)
Roof	77.32	0	77.32	x 0.1	= 7.73		(30)
Total area of elements, m²			173.71				(31)
Party floor			77.32				(32a)
Party ceiling			77.32				(32b)
Internal wall **			129.5				(32c)

* 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) = 46.29 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 27944.78 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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

11.49 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

57.79 (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=	37.55	37.33	37.11	36.1	35.91	35.03	35.03	34.87	35.37	35.91	36.3	36.7

(38)

Heat transfer coefficient, W/K

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

(39)m=	95.34	95.12	94.9	93.89	93.7	92.82	92.82	92.66	93.16	93.7	94.08	94.48
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Average = Sum(39)_{1...12} / 12 =

93.89 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.23	1.23	1.23	1.21	1.21	1.2	1.2	1.2	1.2	1.21	1.22	1.22
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Average = Sum(40)_{1...12} / 12 =

1.21 (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

2.41

(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

91.44

(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=	100.58	96.92	93.27	89.61	85.95	82.29	82.29	85.95	89.61	93.27	96.92	100.58
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

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

1097.26 (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=	149.16	130.46	134.62	117.36	112.61	97.18	90.05	103.33	104.57	121.86	133.02	144.45
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Total = Sum(45)_{1...12} =

1438.68 (45)

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

(46)m=	22.37	19.57	20.19	17.6	16.89	14.58	13.51	15.5	15.69	18.28	19.95	21.67
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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) =

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

DER WorkSheet: New dwelling design stage

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

1.03
1.03

 (54)

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

1.03

 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

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

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(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 $(61)m = (60) \div 365 \times (41)m$

(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 $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=

204.44	180.38	189.9	170.86	167.89	150.67	145.33	158.61	158.06	177.14	186.52	199.73
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

204.44	180.38	189.9	170.86	167.89	150.67	145.33	158.61	158.06	177.14	186.52	199.73
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2089.52

 (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=

93.82	83.32	88.98	81.82	81.67	75.11	74.16	78.58	77.56	84.74	87.03	92.25
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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
120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5

 (66)

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

(67)m=

19.06	16.93	13.76	10.42	7.79	6.58	7.11	9.24	12.4	15.74	18.37	19.59
-------	-------	-------	-------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

213.75	215.97	210.38	198.48	183.46	169.34	159.91	157.69	163.28	175.18	190.2	204.32
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (68)

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

(69)m=

35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (71)

Water heating gains (Table 5)

(72)m=

126.1	123.99	119.6	113.64	109.77	104.31	99.68	105.62	107.73	113.9	120.87	124
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 (72)

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

(73)m=

418.05	416.03	402.89	381.69	360.16	339.38	325.85	331.7	342.56	363.97	388.59	407.05
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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)
Northeast 0.9x	0.77	x	1.95	x	11.28	x	0.76	x	0.7	=	16.22 (75)
Northeast 0.9x	0.77	x	3.85	x	11.28	x	0.76	x	0.7	=	16.02 (75)
Northeast 0.9x	0.77	x	10.14	x	11.28	x	0.76	x	0.7	=	42.18 (75)
Northeast 0.9x	0.77	x	1.95	x	22.97	x	0.76	x	0.7	=	33.02 (75)
Northeast 0.9x	0.77	x	3.85	x	22.97	x	0.76	x	0.7	=	32.6 (75)
Northeast 0.9x	0.77	x	10.14	x	22.97	x	0.76	x	0.7	=	85.86 (75)
Northeast 0.9x	0.77	x	1.95	x	41.38	x	0.76	x	0.7	=	59.5 (75)
Northeast 0.9x	0.77	x	3.85	x	41.38	x	0.76	x	0.7	=	58.73 (75)
Northeast 0.9x	0.77	x	10.14	x	41.38	x	0.76	x	0.7	=	154.69 (75)
Northeast 0.9x	0.77	x	1.95	x	67.96	x	0.76	x	0.7	=	97.71 (75)
Northeast 0.9x	0.77	x	3.85	x	67.96	x	0.76	x	0.7	=	96.46 (75)
Northeast 0.9x	0.77	x	10.14	x	67.96	x	0.76	x	0.7	=	254.04 (75)
Northeast 0.9x	0.77	x	1.95	x	91.35	x	0.76	x	0.7	=	131.34 (75)
Northeast 0.9x	0.77	x	3.85	x	91.35	x	0.76	x	0.7	=	129.66 (75)
Northeast 0.9x	0.77	x	10.14	x	91.35	x	0.76	x	0.7	=	341.49 (75)
Northeast 0.9x	0.77	x	1.95	x	97.38	x	0.76	x	0.7	=	140.02 (75)
Northeast 0.9x	0.77	x	3.85	x	97.38	x	0.76	x	0.7	=	138.23 (75)
Northeast 0.9x	0.77	x	10.14	x	97.38	x	0.76	x	0.7	=	364.06 (75)
Northeast 0.9x	0.77	x	1.95	x	91.1	x	0.76	x	0.7	=	130.99 (75)
Northeast 0.9x	0.77	x	3.85	x	91.1	x	0.76	x	0.7	=	129.31 (75)
Northeast 0.9x	0.77	x	10.14	x	91.1	x	0.76	x	0.7	=	340.57 (75)
Northeast 0.9x	0.77	x	1.95	x	72.63	x	0.76	x	0.7	=	104.43 (75)
Northeast 0.9x	0.77	x	3.85	x	72.63	x	0.76	x	0.7	=	103.09 (75)
Northeast 0.9x	0.77	x	10.14	x	72.63	x	0.76	x	0.7	=	271.51 (75)
Northeast 0.9x	0.77	x	1.95	x	50.42	x	0.76	x	0.7	=	72.5 (75)
Northeast 0.9x	0.77	x	3.85	x	50.42	x	0.76	x	0.7	=	71.57 (75)
Northeast 0.9x	0.77	x	10.14	x	50.42	x	0.76	x	0.7	=	188.49 (75)
Northeast 0.9x	0.77	x	1.95	x	28.07	x	0.76	x	0.7	=	40.36 (75)
Northeast 0.9x	0.77	x	3.85	x	28.07	x	0.76	x	0.7	=	39.84 (75)
Northeast 0.9x	0.77	x	10.14	x	28.07	x	0.76	x	0.7	=	104.93 (75)
Northeast 0.9x	0.77	x	1.95	x	14.2	x	0.76	x	0.7	=	20.41 (75)
Northeast 0.9x	0.77	x	3.85	x	14.2	x	0.76	x	0.7	=	20.15 (75)
Northeast 0.9x	0.77	x	10.14	x	14.2	x	0.76	x	0.7	=	53.07 (75)
Northeast 0.9x	0.77	x	1.95	x	9.21	x	0.76	x	0.7	=	13.25 (75)
Northeast 0.9x	0.77	x	3.85	x	9.21	x	0.76	x	0.7	=	13.08 (75)
Northeast 0.9x	0.77	x	10.14	x	9.21	x	0.76	x	0.7	=	34.45 (75)
Southwest 0.9x	0.77	x	1.95	x	36.79		0.76	x	0.7	=	52.9 (79)
Southwest 0.9x	0.77	x	3.85	x	36.79		0.76	x	0.7	=	52.23 (79)
Southwest 0.9x	0.77	x	1.95	x	62.67		0.76	x	0.7	=	90.11 (79)

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Southwest0.9x	0.77	x	3.85	x	62.67	0.76	x	0.7	=	88.96	(79)
Southwest0.9x	0.77	x	1.95	x	85.75	0.76	x	0.7	=	123.3	(79)
Southwest0.9x	0.77	x	3.85	x	85.75	0.76	x	0.7	=	121.72	(79)
Southwest0.9x	0.77	x	1.95	x	106.25	0.76	x	0.7	=	152.77	(79)
Southwest0.9x	0.77	x	3.85	x	106.25	0.76	x	0.7	=	150.81	(79)
Southwest0.9x	0.77	x	1.95	x	119.01	0.76	x	0.7	=	171.12	(79)
Southwest0.9x	0.77	x	3.85	x	119.01	0.76	x	0.7	=	168.92	(79)
Southwest0.9x	0.77	x	1.95	x	118.15	0.76	x	0.7	=	169.88	(79)
Southwest0.9x	0.77	x	3.85	x	118.15	0.76	x	0.7	=	167.7	(79)
Southwest0.9x	0.77	x	1.95	x	113.91	0.76	x	0.7	=	163.78	(79)
Southwest0.9x	0.77	x	3.85	x	113.91	0.76	x	0.7	=	161.68	(79)
Southwest0.9x	0.77	x	1.95	x	104.39	0.76	x	0.7	=	150.1	(79)
Southwest0.9x	0.77	x	3.85	x	104.39	0.76	x	0.7	=	148.17	(79)
Southwest0.9x	0.77	x	1.95	x	92.85	0.76	x	0.7	=	133.51	(79)
Southwest0.9x	0.77	x	3.85	x	92.85	0.76	x	0.7	=	131.79	(79)
Southwest0.9x	0.77	x	1.95	x	69.27	0.76	x	0.7	=	99.6	(79)
Southwest0.9x	0.77	x	3.85	x	69.27	0.76	x	0.7	=	98.32	(79)
Southwest0.9x	0.77	x	1.95	x	44.07	0.76	x	0.7	=	63.37	(79)
Southwest0.9x	0.77	x	3.85	x	44.07	0.76	x	0.7	=	62.55	(79)
Southwest0.9x	0.77	x	1.95	x	31.49	0.76	x	0.7	=	45.27	(79)
Southwest0.9x	0.77	x	3.85	x	31.49	0.76	x	0.7	=	44.69	(79)

Solar gains in watts, calculated for each month

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

(83)m=	179.55	330.55	517.93	751.8	942.52	979.89	926.33	777.29	597.86	383.03	219.56	150.74	(83)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	597.6	746.58	920.83	1133.48	1302.69	1319.27	1252.18	1108.98	940.41	747	608.15	557.79	(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=	0.94	0.91	0.84	0.72	0.56	0.42	0.31	0.36	0.57	0.8	0.92	0.95	(86)

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

(87)m=	18.69	19.08	19.64	20.27	20.69	20.9	20.96	20.95	20.76	20.15	19.31	18.62	(87)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.89	19.9	19.9	19.91	19.91	19.92	19.92	19.92	19.92	19.91	19.91	19.9	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(89)m=	0.94	0.9	0.82	0.68	0.51	0.35	0.24	0.28	0.51	0.77	0.9	0.94	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.84	17.4	18.19	19.05	19.58	19.83	19.9	19.89	19.7	18.93	17.74	16.74	(90)
--------	-------	------	-------	-------	-------	-------	------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.37 (91)

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

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(92)m=	17.52	18.01	18.72	19.49	19.99	20.22	20.29	20.27	20.09	19.37	18.31	17.43	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.52	18.01	18.72	19.49	19.99	20.22	20.29	20.27	20.09	19.37	18.31	17.43	(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, h_m :

(94)m=	0.91	0.87	0.79	0.67	0.52	0.37	0.27	0.31	0.52	0.75	0.88	0.92	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	545.17	647.32	729.23	757.36	675.45	490.79	332.95	344.94	486.11	560.26	533.14	514.68	(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=	1260.26	1247.36	1160.01	994.72	776.56	521.78	342.24	358.95	557.67	822.17	1054.75	1249.95	(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=	532.02	403.23	320.5	170.9	75.23	0	0	0	0	194.86	375.56	547.04	
--------	--------	--------	-------	-------	-------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 2619.34 (98)

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

33.88 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2619.34

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2750.31 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2089.52

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2194 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

49.44 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

0 (315)

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Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

0 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

$= (330a) + (330b) + (330g) =$

0 (331)

Energy for lighting (calculated in Appendix L)

336.53 (332)

Electricity generated by PVs (Appendix M) (negative quantity)

-92.41 (333)

Electricity generated by wind turbine (Appendix M) (negative quantity)

0 (334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		98.1 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	= 1088.66 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 25.66 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 1114.32 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1114.32 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 0 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 174.66 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$ -47.96 (380)
Total CO2, kg/year	sum of (376) ... (382) =		1241.02 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.05 (384)
EI rating (section 14)			86.4 (385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B K Top (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.32 (1a) x	2.5 (2a) =	193.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.32 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	193.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				3 x 10 =	30 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16 (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 <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>			0 (11)
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)			0.41 (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) =		0.41 (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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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

0.52	0.51	0.5	0.45	0.44	0.38	0.38	0.37	0.41	0.44	0.46	0.48
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.63 0.63 0.62 0.6 0.59 0.57 0.57 0.57 0.58 0.59 0.6 0.61 (24d)

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

(25)m= 0.63 0.63 0.62 0.6 0.59 0.57 0.57 0.57 0.58 0.59 0.6 0.61 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.32	x 1/[1/(1.4)+ 0.04]	= 1.75		(27)
Windows Type 2			2.61	x 1/[1/(1.4)+ 0.04]	= 3.46		(27)
Windows Type 3			1.32	x 1/[1/(1.4)+ 0.04]	= 1.75		(27)
Windows Type 4			2.61	x 1/[1/(1.4)+ 0.04]	= 3.46		(27)
Windows Type 5			6.87	x 1/[1/(1.4)+ 0.04]	= 9.11		(27)
Floor			7.88	x 0.13	= 1.0244		(28)
Walls Type1	68.88	17.37	51.51	x 0.18	= 9.27		(29)
Walls Type2	19.63	1.95	17.68	x 0.18	= 3.18		(29)
Roof	77.32	0	77.32	x 0.13	= 10.05		(30)
Total area of elements, m²			173.71				(31)
Party floor			77.32				(32a)
Party ceiling			77.32				(32b)
Internal wall **			129.5				(32c)

* 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) = 48.51 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 29516.08 (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

11.61 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

60.12 (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=	40.41	40.08	39.75	38.23	37.95	36.62	36.62	36.38	37.13	37.95	38.52	39.12

(38)

Heat transfer coefficient, W/K

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

(39)m=	100.53	100.2	99.88	98.35	98.07	96.74	96.74	96.5	97.25	98.07	98.65	99.25
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Average = Sum(39)_{1...12} / 12 =

98.35 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.3	1.3	1.29	1.27	1.27	1.25	1.25	1.25	1.26	1.27	1.28	1.28
--------	-----	-----	------	------	------	------	------	------	------	------	------	------

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

1.27 (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

2.41

(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

91.44

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

(44)m=	100.58	96.92	93.27	89.61	85.95	82.29	82.29	85.95	89.61	93.27	96.92	100.58
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Total = Sum(44)_{1...12} =

1097.26 (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=	149.16	130.46	134.62	117.36	112.61	97.18	90.05	103.33	104.57	121.86	133.02	144.45
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

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

1438.68 (45)

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

(46)m=	22.37	19.57	20.19	17.6	16.89	14.58	13.51	15.5	15.69	18.28	19.95	21.67
--------	-------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	-------

(46)

Water storage loss:

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

150

(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):

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.75

(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
0.75

 (54)

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

0.75

 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

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

(57)m=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(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 $(61)m = (60) \div 365 \times (41)m$

(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 $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=

195.76	172.54	181.21	162.46	159.21	142.27	136.64	149.93	149.66	168.46	178.11	191.05
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

195.76	172.54	181.21	162.46	159.21	142.27	136.64	149.93	149.66	168.46	178.11	191.05
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) _{1...12}	1987.3
---	--------

 (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=

86.87	77.05	82.04	75.1	74.72	68.39	67.22	71.63	70.84	77.8	80.3	85.31
-------	-------	-------	------	-------	-------	-------	-------	-------	------	------	-------

 (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
120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5

 (66)

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

(67)m=

19.05	16.92	13.76	10.42	7.79	6.58	7.11	9.24	12.4	15.74	18.37	19.58
-------	-------	-------	-------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

213.75	215.97	210.38	198.48	183.46	169.34	159.91	157.69	163.28	175.18	190.2	204.32
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (68)

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

(69)m=

35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4	-96.4
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (71)

Water heating gains (Table 5)

(72)m=

116.76	114.65	110.26	104.3	100.43	94.98	90.35	96.28	98.39	104.56	111.53	114.66
--------	--------	--------	-------	--------	-------	-------	-------	-------	--------	--------	--------

 (72)

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

(73)m=

411.72	409.69	396.56	375.35	353.83	333.05	319.51	325.36	336.22	357.63	382.25	400.71
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)	
Northeast 0.9x	0.77	x	1.32	x	11.28	x	0.63	x	0.7	=	9.1	(75)
Northeast 0.9x	0.77	x	2.61	x	11.28	x	0.63	x	0.7	=	9	(75)
Northeast 0.9x	0.77	x	6.87	x	11.28	x	0.63	x	0.7	=	23.69	(75)
Northeast 0.9x	0.77	x	1.32	x	22.97	x	0.63	x	0.7	=	18.53	(75)
Northeast 0.9x	0.77	x	2.61	x	22.97	x	0.63	x	0.7	=	18.32	(75)
Northeast 0.9x	0.77	x	6.87	x	22.97	x	0.63	x	0.7	=	48.22	(75)
Northeast 0.9x	0.77	x	1.32	x	41.38	x	0.63	x	0.7	=	33.39	(75)
Northeast 0.9x	0.77	x	2.61	x	41.38	x	0.63	x	0.7	=	33.01	(75)
Northeast 0.9x	0.77	x	6.87	x	41.38	x	0.63	x	0.7	=	86.88	(75)
Northeast 0.9x	0.77	x	1.32	x	67.96	x	0.63	x	0.7	=	54.83	(75)
Northeast 0.9x	0.77	x	2.61	x	67.96	x	0.63	x	0.7	=	54.2	(75)
Northeast 0.9x	0.77	x	6.87	x	67.96	x	0.63	x	0.7	=	142.68	(75)
Northeast 0.9x	0.77	x	1.32	x	91.35	x	0.63	x	0.7	=	73.7	(75)
Northeast 0.9x	0.77	x	2.61	x	91.35	x	0.63	x	0.7	=	72.86	(75)
Northeast 0.9x	0.77	x	6.87	x	91.35	x	0.63	x	0.7	=	191.79	(75)
Northeast 0.9x	0.77	x	1.32	x	97.38	x	0.63	x	0.7	=	78.57	(75)
Northeast 0.9x	0.77	x	2.61	x	97.38	x	0.63	x	0.7	=	77.68	(75)
Northeast 0.9x	0.77	x	6.87	x	97.38	x	0.63	x	0.7	=	204.46	(75)
Northeast 0.9x	0.77	x	1.32	x	91.1	x	0.63	x	0.7	=	73.5	(75)
Northeast 0.9x	0.77	x	2.61	x	91.1	x	0.63	x	0.7	=	72.67	(75)
Northeast 0.9x	0.77	x	6.87	x	91.1	x	0.63	x	0.7	=	191.27	(75)
Northeast 0.9x	0.77	x	1.32	x	72.63	x	0.63	x	0.7	=	58.6	(75)
Northeast 0.9x	0.77	x	2.61	x	72.63	x	0.63	x	0.7	=	57.93	(75)
Northeast 0.9x	0.77	x	6.87	x	72.63	x	0.63	x	0.7	=	152.48	(75)
Northeast 0.9x	0.77	x	1.32	x	50.42	x	0.63	x	0.7	=	40.68	(75)
Northeast 0.9x	0.77	x	2.61	x	50.42	x	0.63	x	0.7	=	40.22	(75)
Northeast 0.9x	0.77	x	6.87	x	50.42	x	0.63	x	0.7	=	105.86	(75)
Northeast 0.9x	0.77	x	1.32	x	28.07	x	0.63	x	0.7	=	22.65	(75)
Northeast 0.9x	0.77	x	2.61	x	28.07	x	0.63	x	0.7	=	22.39	(75)
Northeast 0.9x	0.77	x	6.87	x	28.07	x	0.63	x	0.7	=	58.93	(75)
Northeast 0.9x	0.77	x	1.32	x	14.2	x	0.63	x	0.7	=	11.45	(75)
Northeast 0.9x	0.77	x	2.61	x	14.2	x	0.63	x	0.7	=	11.32	(75)
Northeast 0.9x	0.77	x	6.87	x	14.2	x	0.63	x	0.7	=	29.81	(75)
Northeast 0.9x	0.77	x	1.32	x	9.21	x	0.63	x	0.7	=	7.43	(75)
Northeast 0.9x	0.77	x	2.61	x	9.21	x	0.63	x	0.7	=	7.35	(75)
Northeast 0.9x	0.77	x	6.87	x	9.21	x	0.63	x	0.7	=	19.35	(75)
Southwest 0.9x	0.77	x	1.32	x	36.79		0.63	x	0.7	=	29.69	(79)
Southwest 0.9x	0.77	x	2.61	x	36.79		0.63	x	0.7	=	29.35	(79)
Southwest 0.9x	0.77	x	1.32	x	62.67		0.63	x	0.7	=	50.57	(79)

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Southwest	0.9x	0.77	x	2.61	x	62.67	0.63	x	0.7	=	49.99	(79)
Southwest	0.9x	0.77	x	1.32	x	85.75	0.63	x	0.7	=	69.19	(79)
Southwest	0.9x	0.77	x	2.61	x	85.75	0.63	x	0.7	=	68.4	(79)
Southwest	0.9x	0.77	x	1.32	x	106.25	0.63	x	0.7	=	85.73	(79)
Southwest	0.9x	0.77	x	2.61	x	106.25	0.63	x	0.7	=	84.75	(79)
Southwest	0.9x	0.77	x	1.32	x	119.01	0.63	x	0.7	=	96.02	(79)
Southwest	0.9x	0.77	x	2.61	x	119.01	0.63	x	0.7	=	94.93	(79)
Southwest	0.9x	0.77	x	1.32	x	118.15	0.63	x	0.7	=	95.33	(79)
Southwest	0.9x	0.77	x	2.61	x	118.15	0.63	x	0.7	=	94.24	(79)
Southwest	0.9x	0.77	x	1.32	x	113.91	0.63	x	0.7	=	91.9	(79)
Southwest	0.9x	0.77	x	2.61	x	113.91	0.63	x	0.7	=	90.86	(79)
Southwest	0.9x	0.77	x	1.32	x	104.39	0.63	x	0.7	=	84.22	(79)
Southwest	0.9x	0.77	x	2.61	x	104.39	0.63	x	0.7	=	83.27	(79)
Southwest	0.9x	0.77	x	1.32	x	92.85	0.63	x	0.7	=	74.91	(79)
Southwest	0.9x	0.77	x	2.61	x	92.85	0.63	x	0.7	=	74.06	(79)
Southwest	0.9x	0.77	x	1.32	x	69.27	0.63	x	0.7	=	55.89	(79)
Southwest	0.9x	0.77	x	2.61	x	69.27	0.63	x	0.7	=	55.25	(79)
Southwest	0.9x	0.77	x	1.32	x	44.07	0.63	x	0.7	=	35.56	(79)
Southwest	0.9x	0.77	x	2.61	x	44.07	0.63	x	0.7	=	35.15	(79)
Southwest	0.9x	0.77	x	1.32	x	31.49	0.63	x	0.7	=	25.4	(79)
Southwest	0.9x	0.77	x	2.61	x	31.49	0.63	x	0.7	=	25.12	(79)

Solar gains in watts, calculated for each month

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

(83)m=	100.83	185.63	290.86	422.19	529.3	550.28	520.21	436.5	335.74	215.1	123.3	84.65	(83)
--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	-------	-------	-------	------

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

(84)m=	512.54	595.32	687.41	797.54	883.12	883.33	839.72	761.86	671.96	572.73	505.55	485.36	(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	0.94	0.84	0.66	0.5	0.56	0.82	0.97	0.99	1	(86)

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

(87)m=	19.62	19.79	20.08	20.48	20.79	20.95	20.99	20.98	20.86	20.45	19.97	19.6	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(88)m=	19.84	19.84	19.85	19.86	19.87	19.88	19.88	19.88	19.87	19.87	19.86	19.85	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.92	0.78	0.56	0.38	0.44	0.74	0.95	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.02	18.27	18.7	19.27	19.67	19.85	19.88	19.87	19.77	19.23	18.54	18	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	----	------

fLA = Living area ÷ (4) =

0.37

(91)

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

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(92)m=

18.6	18.83	19.21	19.71	20.08	20.25	20.28	20.28	20.17	19.68	19.06	18.58
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m=

18.6	18.83	19.21	19.71	20.08	20.25	20.28	20.28	20.17	19.68	19.06	18.58
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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	0.99	0.97	0.92	0.79	0.59	0.42	0.48	0.77	0.95	0.99	1
------	------	------	------	------	------	------	------	------	------	------	---

 (94)

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

(95)m=

509.55	588.32	667.81	732.09	699.66	523.44	352.61	367.53	514.99	544.09	499.79	483.13
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

1437.98	1395.47	1268.99	1063.09	821.97	546.83	356.29	374.35	589.88	890.22	1180.14	1427.28
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------

 (97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=

690.76	542.41	447.27	238.32	91	0	0	0	0	257.52	489.85	702.44
--------	--------	--------	--------	----	---	---	---	---	--------	--------	--------

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

3459.58

 (98)

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

44.74

 (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

93.5

 (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)

690.76	542.41	447.27	238.32	91	0	0	0	0	257.52	489.85	702.44
--------	--------	--------	--------	----	---	---	---	---	--------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

738.78	580.12	478.37	254.89	97.33	0	0	0	0	275.42	523.91	751.28
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3700.08

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

0

 (215)

Water heating

Output from water heater (calculated above)

195.76	172.54	181.21	162.46	159.21	142.27	136.64	149.93	149.66	168.46	178.11	191.05
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

79.8

 (216)

(217)m=

87.9	87.66	87.13	85.83	83.39	79.8	79.8	79.8	79.8	85.94	87.38	87.98
------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=

222.71	196.82	207.98	189.27	190.93	178.28	171.23	187.88	187.54	196.01	203.85	217.16
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2349.67

 (219)

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Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3700.08
Water heating fuel used		2349.67
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		336.49 (232)

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 =	799.22 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	507.53 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1306.75 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	174.64 (268)
Total CO2, kg/year		sum of (265)...(271) =	1520.31 (272)
TER =			19.66 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
Printed on 02 June 2017 at 09:41:12

Project Information:

Assessed By: David Lloyd (STRO006228)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 65.27m²

Site Reference : GPV Ph 6

Plot Reference: 2B E Top (Comm Boiler NV PV)

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 19.81 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.11 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 56.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 41.6 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, TRVs	OK
Hot water controls:	No cylinder	
	No cylinder	

Regulations Compliance Report

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
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Based on:

Overshading:	Average or unknown	
Windows facing: North East	3.84m ²	
Windows facing: North East	5.25m ²	
Windows facing: North West	5.25m ²	
Windows facing: North West	1.92m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

Air permeability	3.5 m ³ /m ² h	
Windows U-value	1 W/m ² K	
Doors U-value	1 W/m ² K	
Roofs U-value	0.1 W/m ² K	
Party Walls U-value	0 W/m ² K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

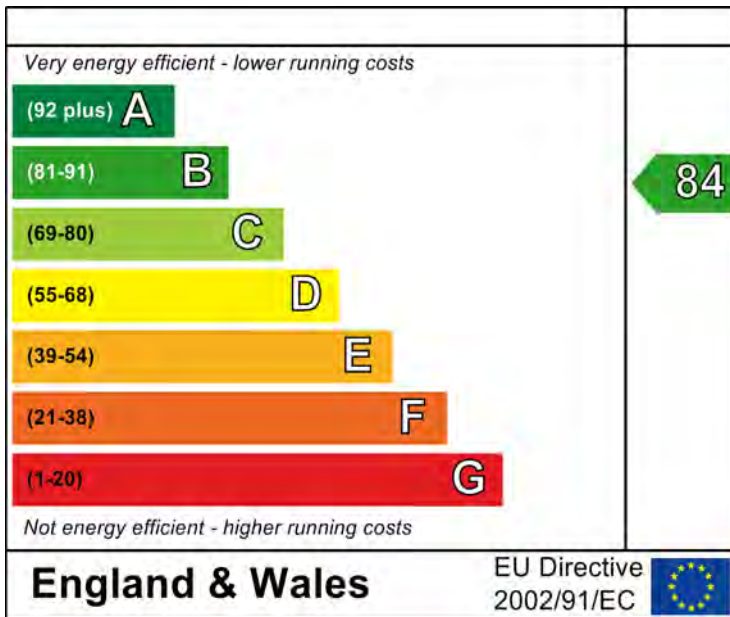
Predicted Energy Assessment

Dwelling type: Top floor Flat
Date of assessment: 20 March 2017
Produced by: David Lloyd
Total floor area: 65.27 m²

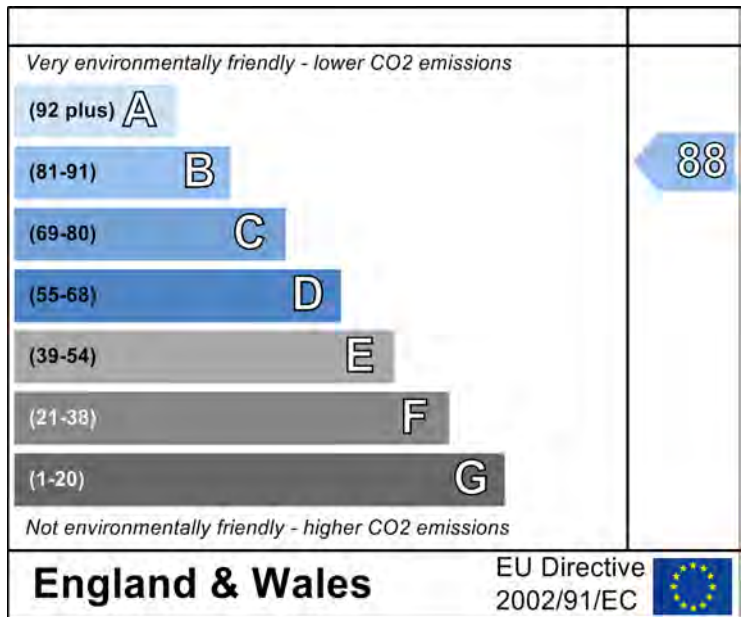
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



Environmental Impact (CO₂) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B E Top (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.27 (1a) x	2.5 (2a) =	163.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.27 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	163.17 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				3 x 10 =	30 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.18 (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 <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>		0 (11)
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		3.5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.36 (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) =	0.36 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage

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

0.46	0.45	0.44	0.39	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.6 0.6 0.6 0.58 0.57 0.56 0.56 0.56 0.56 0.57 0.58 0.59 (24d)

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

(25)m= 0.6 0.6 0.6 0.58 0.57 0.56 0.56 0.56 0.56 0.57 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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.92	x 1/[1/(1) + 0.04]	= 1.85		(27)
Windows Type 2			5.25	x 1/[1/(1) + 0.04]	= 5.05		(27)
Windows Type 3			5.25	x 1/[1/(1) + 0.04]	= 5.05		(27)
Windows Type 4			1.92	x 1/[1/(1) + 0.04]	= 1.85		(27)
Walls Type1	42.13	16.26	25.87	x 0.17	= 4.4		(29)
Walls Type2	14.13	1.95	12.18	x 0.19	= 2.36		(29)
Roof	65.27	0	65.27	x 0.1	= 6.53		(30)
Total area of elements, m²			121.53				(31)
Party wall			28	x 0	= 0		(32)
Party floor			65.27				(32a)
Party ceiling			65.27				(32b)
Internal wall **			129.5				(32c)

* 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) = 30.87 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 22691.03 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.33 (36)

DER WorkSheet: New dwelling design stage

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = (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=	32.56	32.34	32.13	31.12	30.93	30.05	30.05	29.89	30.39	30.93	31.31	31.71	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	73.76	73.54	73.33	72.32	72.13	71.25	71.25	71.09	71.59	72.13	72.51	72.91	

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

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.13	1.13	1.12	1.11	1.11	1.09	1.09	1.09	1.1	1.11	1.11	1.12	

Average = Sum(40)_{1...12} / 12 = (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 (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 (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	
(44)m=	93.16	89.78	86.39	83	79.61	76.22	76.22	79.61	83	86.39	89.78	93.16	
Total = Sum(44) _{1...12} =												1016.33	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	138.16	120.83	124.69	108.71	104.31	90.01	83.41	95.71	96.85	112.87	123.21	133.8	
Total = Sum(45) _{1...12} =												1332.57	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	20.72	18.13	18.7	16.31	15.65	13.5	12.51	14.36	14.53	16.93	18.48	20.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel (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): (48)

Temperature factor from Table 2b (49)

Energy lost from water storage, kWh/year (48) x (49) = (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) (51)

If community heating see section 4.3

Volume factor from Table 2a (52)

Temperature factor from Table 2b (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = (54)

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

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

193.44	170.76	179.97	162.2	159.58	143.5	138.68	150.99	150.35	168.15	176.7	189.08
--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	-------	--------

 (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=

193.44	170.76	179.97	162.2	159.58	143.5	138.68	150.99	150.35	168.15	176.7	189.08
--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	-------	--------

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

1983.41

 (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=

90.16	80.12	85.68	78.94	78.9	72.72	71.95	76.05	75	81.75	83.76	88.71
-------	-------	-------	-------	------	-------	-------	-------	----	-------	-------	-------

 (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
106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3

 (66)

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

(67)m=

16.58	14.73	11.98	9.07	6.78	5.72	6.18	8.04	10.79	13.7	15.99	17.04
-------	-------	-------	------	------	------	------	------	-------	------	-------	-------

 (67)

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

(68)m=

186.02	187.95	183.08	172.73	159.66	147.37	139.16	137.23	142.1	152.45	165.52	177.81
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (68)

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

(69)m=

33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

121.18	119.23	115.16	109.64	106.05	101	96.71	102.21	104.17	109.88	116.34	119.23
--------	--------	--------	--------	--------	-----	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

378.67	376.79	365.11	346.33	327.38	308.99	296.95	302.37	311.94	330.92	352.74	368.98
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)
Northeast 0.9x	0.77	x	1.92	x	11.28	x	0.76	x	0.7	=	15.97 (75)
Northeast 0.9x	0.77	x	5.25	x	11.28	x	0.76	x	0.7	=	21.84 (75)
Northeast 0.9x	0.77	x	1.92	x	22.97	x	0.76	x	0.7	=	32.51 (75)
Northeast 0.9x	0.77	x	5.25	x	22.97	x	0.76	x	0.7	=	44.45 (75)
Northeast 0.9x	0.77	x	1.92	x	41.38	x	0.76	x	0.7	=	58.58 (75)
Northeast 0.9x	0.77	x	5.25	x	41.38	x	0.76	x	0.7	=	80.09 (75)
Northeast 0.9x	0.77	x	1.92	x	67.96	x	0.76	x	0.7	=	96.21 (75)
Northeast 0.9x	0.77	x	5.25	x	67.96	x	0.76	x	0.7	=	131.53 (75)
Northeast 0.9x	0.77	x	1.92	x	91.35	x	0.76	x	0.7	=	129.32 (75)
Northeast 0.9x	0.77	x	5.25	x	91.35	x	0.76	x	0.7	=	176.8 (75)
Northeast 0.9x	0.77	x	1.92	x	97.38	x	0.76	x	0.7	=	137.87 (75)
Northeast 0.9x	0.77	x	5.25	x	97.38	x	0.76	x	0.7	=	188.49 (75)
Northeast 0.9x	0.77	x	1.92	x	91.1	x	0.76	x	0.7	=	128.97 (75)
Northeast 0.9x	0.77	x	5.25	x	91.1	x	0.76	x	0.7	=	176.33 (75)
Northeast 0.9x	0.77	x	1.92	x	72.63	x	0.76	x	0.7	=	102.82 (75)
Northeast 0.9x	0.77	x	5.25	x	72.63	x	0.76	x	0.7	=	140.57 (75)
Northeast 0.9x	0.77	x	1.92	x	50.42	x	0.76	x	0.7	=	71.38 (75)
Northeast 0.9x	0.77	x	5.25	x	50.42	x	0.76	x	0.7	=	97.59 (75)
Northeast 0.9x	0.77	x	1.92	x	28.07	x	0.76	x	0.7	=	39.74 (75)
Northeast 0.9x	0.77	x	5.25	x	28.07	x	0.76	x	0.7	=	54.33 (75)
Northeast 0.9x	0.77	x	1.92	x	14.2	x	0.76	x	0.7	=	20.1 (75)
Northeast 0.9x	0.77	x	5.25	x	14.2	x	0.76	x	0.7	=	27.48 (75)
Northeast 0.9x	0.77	x	1.92	x	9.21	x	0.76	x	0.7	=	13.04 (75)
Northeast 0.9x	0.77	x	5.25	x	9.21	x	0.76	x	0.7	=	17.83 (75)
Northwest 0.9x	0.77	x	5.25	x	11.28	x	0.76	x	0.7	=	21.84 (81)
Northwest 0.9x	0.77	x	1.92	x	11.28	x	0.76	x	0.7	=	7.99 (81)
Northwest 0.9x	0.77	x	5.25	x	22.97	x	0.76	x	0.7	=	44.45 (81)
Northwest 0.9x	0.77	x	1.92	x	22.97	x	0.76	x	0.7	=	16.26 (81)
Northwest 0.9x	0.77	x	5.25	x	41.38	x	0.76	x	0.7	=	80.09 (81)
Northwest 0.9x	0.77	x	1.92	x	41.38	x	0.76	x	0.7	=	29.29 (81)
Northwest 0.9x	0.77	x	5.25	x	67.96	x	0.76	x	0.7	=	131.53 (81)
Northwest 0.9x	0.77	x	1.92	x	67.96	x	0.76	x	0.7	=	48.1 (81)
Northwest 0.9x	0.77	x	5.25	x	91.35	x	0.76	x	0.7	=	176.8 (81)
Northwest 0.9x	0.77	x	1.92	x	91.35	x	0.76	x	0.7	=	64.66 (81)
Northwest 0.9x	0.77	x	5.25	x	97.38	x	0.76	x	0.7	=	188.49 (81)
Northwest 0.9x	0.77	x	1.92	x	97.38	x	0.76	x	0.7	=	68.93 (81)
Northwest 0.9x	0.77	x	5.25	x	91.1	x	0.76	x	0.7	=	176.33 (81)
Northwest 0.9x	0.77	x	1.92	x	91.1	x	0.76	x	0.7	=	64.49 (81)
Northwest 0.9x	0.77	x	5.25	x	72.63	x	0.76	x	0.7	=	140.57 (81)

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Northwest 0.9x	0.77	x	1.92	x	72.63	x	0.76	x	0.7	=	51.41	(81)
Northwest 0.9x	0.77	x	5.25	x	50.42	x	0.76	x	0.7	=	97.59	(81)
Northwest 0.9x	0.77	x	1.92	x	50.42	x	0.76	x	0.7	=	35.69	(81)
Northwest 0.9x	0.77	x	5.25	x	28.07	x	0.76	x	0.7	=	54.33	(81)
Northwest 0.9x	0.77	x	1.92	x	28.07	x	0.76	x	0.7	=	19.87	(81)
Northwest 0.9x	0.77	x	5.25	x	14.2	x	0.76	x	0.7	=	27.48	(81)
Northwest 0.9x	0.77	x	1.92	x	14.2	x	0.76	x	0.7	=	10.05	(81)
Northwest 0.9x	0.77	x	5.25	x	9.21	x	0.76	x	0.7	=	17.83	(81)
Northwest 0.9x	0.77	x	1.92	x	9.21	x	0.76	x	0.7	=	6.52	(81)

Solar gains in watts, calculated for each month

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

(83)m=	67.64	137.68	248.05	407.37	547.59	583.79	546.12	435.37	302.26	168.25	85.11	55.24	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	446.31	514.47	613.17	753.7	874.97	892.78	843.07	737.75	614.2	499.18	437.85	424.21	(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

(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=	0.96	0.93	0.89	0.78	0.63	0.47	0.36	0.41	0.65	0.86	0.94	0.96	(86)

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

(87)m=	18.78	19.06	19.56	20.2	20.66	20.89	20.96	20.94	20.73	20.1	19.34	18.74	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	20	20.01	20.01	20.01	20	20	19.99	19.99	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.95	0.93	0.87	0.75	0.58	0.4	0.28	0.33	0.58	0.83	0.93	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.02	17.42	18.14	19.03	19.63	19.91	19.98	19.97	19.74	18.92	17.84	16.96	(90)
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fLA = Living area ÷ (4) =

0.36

(91)

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

(92)m=	17.65	18.01	18.65	19.45	20	20.26	20.33	20.32	20.09	19.34	18.38	17.6	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.65	18.01	18.65	19.45	20	20.26	20.33	20.32	20.09	19.34	18.38	17.6	(93)
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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
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Utilisation factor for gains, hm:

(94)m=	0.93	0.9	0.84	0.73	0.58	0.42	0.31	0.36	0.59	0.81	0.9	0.94	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	414.27	463.7	517.67	551.74	507.44	375.96	257.78	265.66	361.9	402.62	395.07	396.77	(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)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	984.65	963.98	890.97	762.94	598.38	403.37	266.01	278.49	429.13	630.63	817.72	976.81	(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=	424.36	336.19	277.73	152.07	67.66	0	0	0	0	169.64	304.31	431.55	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2163.51 (98)

Space heating requirement in kWh/m ² /year	33.15 (99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating

Annual space heating requirement kWh/year 2163.51

Space heat from Community boilers (98) x (304a) x (305) x (306) = 2271.68 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308)

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1983.41

If DHW from community scheme:
Water heat from Community boilers (64) x (303a) x (305) x (306) = 2082.58 (310a)

Electricity used for heat distribution 0.01 x [(307a)...(307e) + (310a)...(310e)] = 43.54 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):
mechanical ventilation - balanced, extract or positive input from outside 0 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 0 (331)

Energy for lighting (calculated in Appendix L) 292.87 (332)

Electricity generated by PVs (Appendix M) (negative quantity) -158.04 (333)

Electricity generated by wind turbine (Appendix M) (negative quantity) 0 (334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel			98.1 (367a)

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CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	=	958.74	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	22.6	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	981.33	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			981.33	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	0	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	152	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$	-82.02	(380)
Total CO2, kg/year	sum of (376)...(382) =			1051.31	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			16.11	(384)
EI rating (section 14)				87.22	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd
Software Name: Stroma FSAP 2012
Stroma Number: STRO006228
Software Version: Version: 1.0.4.7

Property Address: 2B E Top (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.27 (1a) x	2.5 (2a) =	163.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.27 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	163.17 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				2 x 10 =	20 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12 (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 <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>			0 (11)
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)			0.37 (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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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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TER WorkSheet: New dwelling design stage

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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.7	x 1/[1/(1.4)+ 0.04]	= 2.25		(27)
Windows Type 2			4.64	x 1/[1/(1.4)+ 0.04]	= 6.15		(27)
Windows Type 3			4.64	x 1/[1/(1.4)+ 0.04]	= 6.15		(27)
Windows Type 4			1.7	x 1/[1/(1.4)+ 0.04]	= 2.25		(27)
Walls Type1	42.13	14.38	27.75	x 0.18	= 5		(29)
Walls Type2	14.13	1.95	12.18	x 0.18	= 2.19		(29)
Roof	65.27	0	65.27	x 0.13	= 8.49		(30)
Total area of elements, m²			121.53				(31)
Party wall			28	x 0	= 0		(32)
Party floor			65.27				(32a)
Party ceiling			65.27				(32b)
Internal wall **			129.5				(32c)

* 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) = 36.69 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 23048.23 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.92 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 45.61 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33	32.76	32.53	31.45	31.24	30.3	30.3	30.12	30.66	31.24	31.65	32.08	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.61	78.37	78.14	77.06	76.85	75.91	75.91	75.73	76.27	76.85	77.26	77.69	
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Average = Sum(39)_{1...12} / 12 = 77.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.2	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19	
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Average = Sum(40)_{1...12} / 12 = 1.18 (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 2.13 (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 84.69 (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 $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	93.16	89.78	86.39	83	79.61	76.22	76.22	79.61	83	86.39	89.78	93.16	
Total = Sum(44) _{1...12} =												1016.33	(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=	138.16	120.83	124.69	108.71	104.31	90.01	83.41	95.71	96.85	112.87	123.21	133.8		
Total = Sum(45) _{1...12} =													1332.57	(45)

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

(46)m=	20.72	18.13	18.7	16.31	15.65	13.5	12.51	14.36	14.53	16.93	18.48	20.07	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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Water storage loss calculated for each month

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
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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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
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Primary circuit loss (annual) from Table 3	0	(58)
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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)
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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)
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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=	184.75	162.92	171.29	153.8	150.9	135.1	130	142.31	141.95	159.47	168.3	180.39	(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=	184.75	162.92	171.29	153.8	150.9	135.1	130	142.31	141.95	159.47	168.3	180.39	
Output from water heater (annual) _{1...12}												1881.18	(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=	83.21	73.85	78.74	72.22	71.96	66	65.01	69.1	68.28	74.81	77.04	81.76	(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=	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	(66)

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

(67)m=	16.59	14.73	11.98	9.07	6.78	5.72	6.19	8.04	10.79	13.7	15.99	17.05	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	------	-------	-------	------

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

(68)m=	186.02	187.95	183.08	172.73	159.66	147.37	139.16	137.23	142.1	152.45	165.52	177.81	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

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

(69)m=	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	(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=	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	111.85	109.89	105.83	100.3	96.72	91.67	87.38	92.88	94.83	100.55	107	109.9	(72)
--------	--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	-----	-------	------

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

(73)m=	372.34	370.46	358.78	339.99	321.05	302.65	290.62	296.04	305.61	324.59	346.41	362.65	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

TER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)
Northeast 0.9x	0.77	x	1.7	x	11.28	x	0.63	x	0.7	=	11.72 (75)
Northeast 0.9x	0.77	x	4.64	x	11.28	x	0.63	x	0.7	=	16 (75)
Northeast 0.9x	0.77	x	1.7	x	22.97	x	0.63	x	0.7	=	23.86 (75)
Northeast 0.9x	0.77	x	4.64	x	22.97	x	0.63	x	0.7	=	32.57 (75)
Northeast 0.9x	0.77	x	1.7	x	41.38	x	0.63	x	0.7	=	43 (75)
Northeast 0.9x	0.77	x	4.64	x	41.38	x	0.63	x	0.7	=	58.68 (75)
Northeast 0.9x	0.77	x	1.7	x	67.96	x	0.63	x	0.7	=	70.61 (75)
Northeast 0.9x	0.77	x	4.64	x	67.96	x	0.63	x	0.7	=	96.36 (75)
Northeast 0.9x	0.77	x	1.7	x	91.35	x	0.63	x	0.7	=	94.92 (75)
Northeast 0.9x	0.77	x	4.64	x	91.35	x	0.63	x	0.7	=	129.53 (75)
Northeast 0.9x	0.77	x	1.7	x	97.38	x	0.63	x	0.7	=	101.19 (75)
Northeast 0.9x	0.77	x	4.64	x	97.38	x	0.63	x	0.7	=	138.1 (75)
Northeast 0.9x	0.77	x	1.7	x	91.1	x	0.63	x	0.7	=	94.66 (75)
Northeast 0.9x	0.77	x	4.64	x	91.1	x	0.63	x	0.7	=	129.19 (75)
Northeast 0.9x	0.77	x	1.7	x	72.63	x	0.63	x	0.7	=	75.47 (75)
Northeast 0.9x	0.77	x	4.64	x	72.63	x	0.63	x	0.7	=	102.99 (75)
Northeast 0.9x	0.77	x	1.7	x	50.42	x	0.63	x	0.7	=	52.39 (75)
Northeast 0.9x	0.77	x	4.64	x	50.42	x	0.63	x	0.7	=	71.5 (75)
Northeast 0.9x	0.77	x	1.7	x	28.07	x	0.63	x	0.7	=	29.16 (75)
Northeast 0.9x	0.77	x	4.64	x	28.07	x	0.63	x	0.7	=	39.8 (75)
Northeast 0.9x	0.77	x	1.7	x	14.2	x	0.63	x	0.7	=	14.75 (75)
Northeast 0.9x	0.77	x	4.64	x	14.2	x	0.63	x	0.7	=	20.13 (75)
Northeast 0.9x	0.77	x	1.7	x	9.21	x	0.63	x	0.7	=	9.57 (75)
Northeast 0.9x	0.77	x	4.64	x	9.21	x	0.63	x	0.7	=	13.07 (75)
Northwest 0.9x	0.77	x	4.64	x	11.28	x	0.63	x	0.7	=	16 (81)
Northwest 0.9x	0.77	x	1.7	x	11.28	x	0.63	x	0.7	=	5.86 (81)
Northwest 0.9x	0.77	x	4.64	x	22.97	x	0.63	x	0.7	=	32.57 (81)
Northwest 0.9x	0.77	x	1.7	x	22.97	x	0.63	x	0.7	=	11.93 (81)
Northwest 0.9x	0.77	x	4.64	x	41.38	x	0.63	x	0.7	=	58.68 (81)
Northwest 0.9x	0.77	x	1.7	x	41.38	x	0.63	x	0.7	=	21.5 (81)
Northwest 0.9x	0.77	x	4.64	x	67.96	x	0.63	x	0.7	=	96.36 (81)
Northwest 0.9x	0.77	x	1.7	x	67.96	x	0.63	x	0.7	=	35.31 (81)
Northwest 0.9x	0.77	x	4.64	x	91.35	x	0.63	x	0.7	=	129.53 (81)
Northwest 0.9x	0.77	x	1.7	x	91.35	x	0.63	x	0.7	=	47.46 (81)
Northwest 0.9x	0.77	x	4.64	x	97.38	x	0.63	x	0.7	=	138.1 (81)
Northwest 0.9x	0.77	x	1.7	x	97.38	x	0.63	x	0.7	=	50.6 (81)
Northwest 0.9x	0.77	x	4.64	x	91.1	x	0.63	x	0.7	=	129.19 (81)
Northwest 0.9x	0.77	x	1.7	x	91.1	x	0.63	x	0.7	=	47.33 (81)
Northwest 0.9x	0.77	x	4.64	x	72.63	x	0.63	x	0.7	=	102.99 (81)

TER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	1.7	x	72.63	x	0.63	x	0.7	=	37.73	(81)
Northwest 0.9x	0.77	x	4.64	x	50.42	x	0.63	x	0.7	=	71.5	(81)
Northwest 0.9x	0.77	x	1.7	x	50.42	x	0.63	x	0.7	=	26.2	(81)
Northwest 0.9x	0.77	x	4.64	x	28.07	x	0.63	x	0.7	=	39.8	(81)
Northwest 0.9x	0.77	x	1.7	x	28.07	x	0.63	x	0.7	=	14.58	(81)
Northwest 0.9x	0.77	x	4.64	x	14.2	x	0.63	x	0.7	=	20.13	(81)
Northwest 0.9x	0.77	x	1.7	x	14.2	x	0.63	x	0.7	=	7.38	(81)
Northwest 0.9x	0.77	x	4.64	x	9.21	x	0.63	x	0.7	=	13.07	(81)
Northwest 0.9x	0.77	x	1.7	x	9.21	x	0.63	x	0.7	=	4.79	(81)

Solar gains in watts, calculated for each month

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

(83)m=	49.59	100.93	181.85	298.65	401.44	427.98	400.36	319.17	221.58	123.35	62.39	40.49	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	421.93	471.39	540.63	638.64	722.48	730.63	690.98	615.21	527.19	447.94	408.8	403.14	(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	0.99	0.95	0.83	0.63	0.48	0.55	0.83	0.97	0.99	1	(86)

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

(87)m=	19.73	19.87	20.14	20.53	20.83	20.97	20.99	20.99	20.87	20.48	20.05	19.71	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.95	19.94	19.93	19.93	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.93	0.77	0.54	0.37	0.43	0.76	0.96	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.23	18.44	18.84	19.39	19.78	19.93	19.95	19.95	19.85	19.34	18.71	18.21	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.36 (91)

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

(92)m=	18.77	18.95	19.31	19.8	20.16	20.3	20.32	20.32	20.21	19.75	19.19	18.75	(92)
--------	-------	-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.77	18.95	19.31	19.8	20.16	20.3	20.32	20.32	20.21	19.75	19.19	18.75	(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	0.99	0.98	0.92	0.78	0.57	0.41	0.48	0.78	0.96	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	419.74	466.98	527.87	589.12	566.89	419.15	280.6	292.74	409.88	429.02	404.79	401.46	(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)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1137.38	1101.29	1000.71	839.91	649.98	432.73	282.56	296.84	466.35	702.9	933.84	1130.39	(97)
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TER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	533.92	426.25	351.79	180.57	61.82	0	0	0	0	203.77	380.91	542.33	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2681.37 (98)

Space heating requirement in kWh/m ² /year	41.08 (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) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		93.5 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

	533.92	426.25	351.79	180.57	61.82	0	0	0	0	203.77	380.91	542.33	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)													(211)
	571.04	455.89	376.25	193.12	66.12	0	0	0	0	217.93	407.39	580.03	
Total (kWh/year) = Sum(211) _{1...5,10...12} =													2867.77 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 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)

	184.75	162.92	171.29	153.8	150.9	135.1	130	142.31	141.95	159.47	168.3	180.39	
Efficiency of water heater													79.8 (216)
(217)m=	87.48	87.26	86.69	85.24	82.64	79.8	79.8	79.8	79.8	85.47	86.93	87.57	(217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m													
(219)m=	211.18	186.7	197.58	180.43	182.6	169.3	162.91	178.33	177.88	186.58	193.61	206	
Total = Sum(219a) _{1...12} =													2233.1 (219)

Annual totals

Space heating fuel used, main system 1	kWh/year	2867.77
Water heating fuel used	kWh/year	2233.1

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		292.96 (232)

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

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	619.44	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	482.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1101.79	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	152.04	(268)
Total CO2, kg/year	sum of (265)...(271) =			1292.76	(272)
TER	=			19.81	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
Printed on 02 June 2017 at 09:41:22

Project Information:

Assessed By: David Lloyd (STRO006228)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 65.27m²

Site Reference : GPV Ph 6

Plot Reference: 2B E Mid (Comm Boiler NV PV)

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)

17.5 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

14.24 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

44.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

34.7 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.18 (max. 0.30)

0.19 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

(no floor)

Roof

(no roof)

Openings

1.00 (max. 2.00)

1.00 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

3.50 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Community heating schemes - mains gas

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

No cylinder

6 Controls

Space heating controls

Charging system linked to use of community heating, TRVs

OK

Hot water controls:

No cylinder

No cylinder

Regulations Compliance Report

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
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Based on:

Overshading:	Average or unknown	
Windows facing: North East	3.84m ²	
Windows facing: North East	5.25m ²	
Windows facing: North West	5.25m ²	
Windows facing: North West	1.92m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

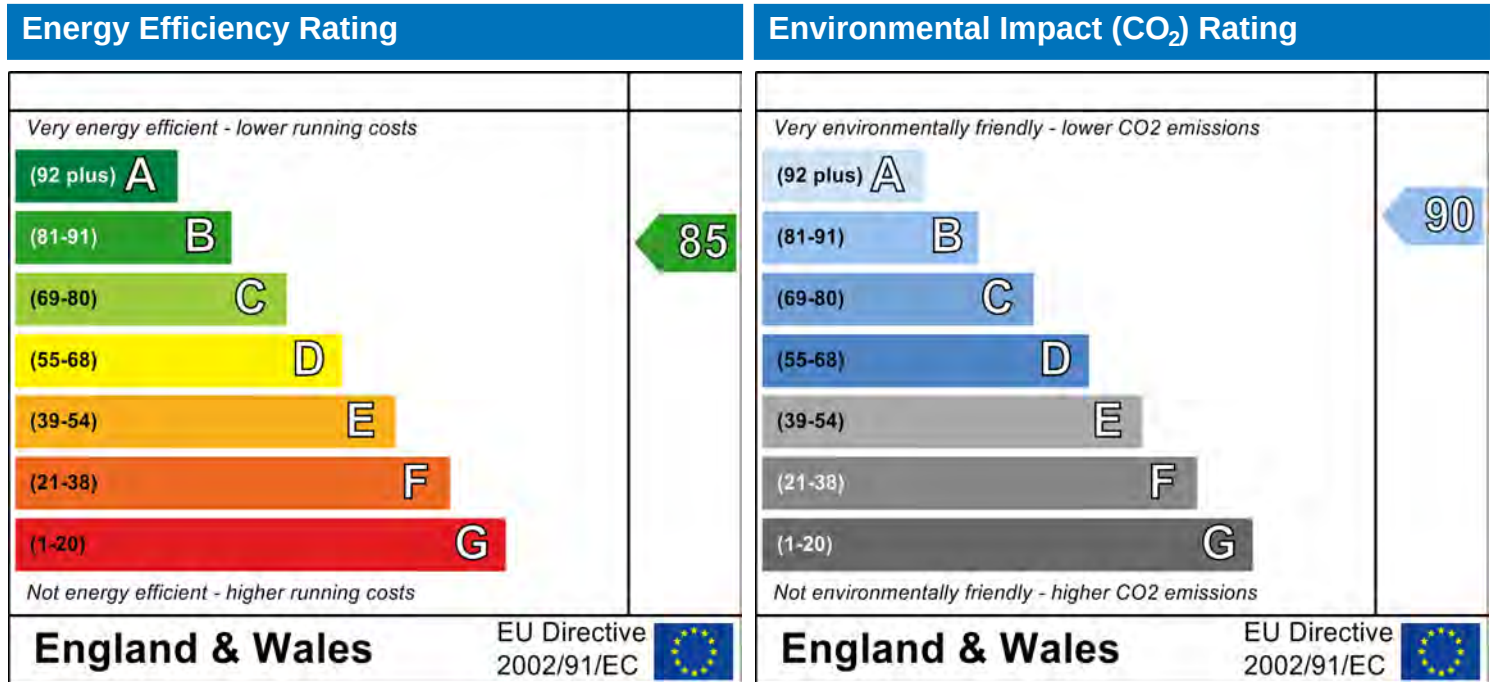
Air permeability	3.5 m ³ /m ² h	
Windows U-value	1 W/m ² K	
Doors U-value	1 W/m ² K	
Party Walls U-value	0 W/m ² K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

Predicted Energy Assessment

Dwelling type: Mid floor Flat
Date of assessment: 20 March 2017
Produced by: David Lloyd
Total floor area: 65.27 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B E Mid (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.27 (1a) x	2.5 (2a) =	163.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.27 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	163.17 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				3 x 10 =	30 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.18 (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 <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>		0 (11)
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		3.5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.36 (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) =	0.36 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage



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

0.46	0.45	0.44	0.39	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.6 0.6 0.6 0.58 0.57 0.56 0.56 0.56 0.56 0.57 0.58 0.59 (24d)

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

(25)m= 0.6 0.6 0.6 0.58 0.57 0.56 0.56 0.56 0.56 0.57 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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.92	x 1/[1/(1) + 0.04]	= 1.85		(27)
Windows Type 2			5.25	x 1/[1/(1) + 0.04]	= 5.05		(27)
Windows Type 3			5.25	x 1/[1/(1) + 0.04]	= 5.05		(27)
Windows Type 4			1.92	x 1/[1/(1) + 0.04]	= 1.85		(27)
Walls Type1	42.13	16.26	25.87	x 0.17	= 4.4		(29)
Walls Type2	14.13	1.95	12.18	x 0.19	= 2.36		(29)
Total area of elements, m²			56.26				(31)
Party wall			28	x 0	= 0		(32)
Party floor			65.27				(32a)
Party ceiling			65.27				(32b)
Internal wall **			129.5				(32c)

* 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) = 24.34 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 22103.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.61 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 31.95 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.56	32.34	32.13	31.12	30.93	30.05	30.05	29.89	30.39	30.93	31.31	31.71	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.51	64.29	64.08	63.07	62.88	62.01	62.01	61.84	62.34	62.88	63.26	63.66	
Average = Sum(39) _{1...12} / 12 =												63.07	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.99	0.99	0.98	0.97	0.96	0.95	0.95	0.95	0.96	0.96	0.97	0.98	
Average = Sum(40) _{1...12} / 12 =												0.97	(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 2.13 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 84.69 (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	
(44)m=	93.16	89.78	86.39	83	79.61	76.22	76.22	79.61	83	86.39	89.78	93.16	
Total = Sum(44) _{1...12} =												1016.33	(44)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	138.16	120.83	124.69	108.71	104.31	90.01	83.41	95.71	96.85	112.87	123.21	133.8	
Total = Sum(45) _{1...12} =												1332.57	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	20.72	18.13	18.7	16.31	15.65	13.5	12.51	14.36	14.53	16.93	18.48	20.07	(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) × (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
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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=

193.44	170.76	179.97	162.2	159.58	143.5	138.68	150.99	150.35	168.15	176.7	189.08
--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	-------	--------

 (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=

193.44	170.76	179.97	162.2	159.58	143.5	138.68	150.99	150.35	168.15	176.7	189.08
--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	-------	--------

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

1983.41

 (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=

90.16	80.12	85.68	78.94	78.9	72.72	71.95	76.05	75	81.75	83.76	88.71
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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
106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3

 (66)

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

(67)m=

16.58	14.73	11.98	9.07	6.78	5.72	6.18	8.04	10.79	13.7	15.99	17.04
-------	-------	-------	------	------	------	------	------	-------	------	-------	-------

 (67)

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

(68)m=

186.02	187.95	183.08	172.73	159.66	147.37	139.16	137.23	142.1	152.45	165.52	177.81
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (68)

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

(69)m=

33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

121.18	119.23	115.16	109.64	106.05	101	96.71	102.21	104.17	109.88	116.34	119.23
--------	--------	--------	--------	--------	-----	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

378.67	376.79	365.11	346.33	327.38	308.99	296.95	302.37	311.94	330.92	352.74	368.98
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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)
Northeast 0.9x	0.77	x	1.92	x	11.28	x	0.76	x	0.7	=	15.97 (75)
Northeast 0.9x	0.77	x	5.25	x	11.28	x	0.76	x	0.7	=	21.84 (75)
Northeast 0.9x	0.77	x	1.92	x	22.97	x	0.76	x	0.7	=	32.51 (75)
Northeast 0.9x	0.77	x	5.25	x	22.97	x	0.76	x	0.7	=	44.45 (75)
Northeast 0.9x	0.77	x	1.92	x	41.38	x	0.76	x	0.7	=	58.58 (75)
Northeast 0.9x	0.77	x	5.25	x	41.38	x	0.76	x	0.7	=	80.09 (75)
Northeast 0.9x	0.77	x	1.92	x	67.96	x	0.76	x	0.7	=	96.21 (75)
Northeast 0.9x	0.77	x	5.25	x	67.96	x	0.76	x	0.7	=	131.53 (75)
Northeast 0.9x	0.77	x	1.92	x	91.35	x	0.76	x	0.7	=	129.32 (75)
Northeast 0.9x	0.77	x	5.25	x	91.35	x	0.76	x	0.7	=	176.8 (75)
Northeast 0.9x	0.77	x	1.92	x	97.38	x	0.76	x	0.7	=	137.87 (75)
Northeast 0.9x	0.77	x	5.25	x	97.38	x	0.76	x	0.7	=	188.49 (75)
Northeast 0.9x	0.77	x	1.92	x	91.1	x	0.76	x	0.7	=	128.97 (75)
Northeast 0.9x	0.77	x	5.25	x	91.1	x	0.76	x	0.7	=	176.33 (75)
Northeast 0.9x	0.77	x	1.92	x	72.63	x	0.76	x	0.7	=	102.82 (75)
Northeast 0.9x	0.77	x	5.25	x	72.63	x	0.76	x	0.7	=	140.57 (75)
Northeast 0.9x	0.77	x	1.92	x	50.42	x	0.76	x	0.7	=	71.38 (75)
Northeast 0.9x	0.77	x	5.25	x	50.42	x	0.76	x	0.7	=	97.59 (75)
Northeast 0.9x	0.77	x	1.92	x	28.07	x	0.76	x	0.7	=	39.74 (75)
Northeast 0.9x	0.77	x	5.25	x	28.07	x	0.76	x	0.7	=	54.33 (75)
Northeast 0.9x	0.77	x	1.92	x	14.2	x	0.76	x	0.7	=	20.1 (75)
Northeast 0.9x	0.77	x	5.25	x	14.2	x	0.76	x	0.7	=	27.48 (75)
Northeast 0.9x	0.77	x	1.92	x	9.21	x	0.76	x	0.7	=	13.04 (75)
Northeast 0.9x	0.77	x	5.25	x	9.21	x	0.76	x	0.7	=	17.83 (75)
Northwest 0.9x	0.77	x	5.25	x	11.28	x	0.76	x	0.7	=	21.84 (81)
Northwest 0.9x	0.77	x	1.92	x	11.28	x	0.76	x	0.7	=	7.99 (81)
Northwest 0.9x	0.77	x	5.25	x	22.97	x	0.76	x	0.7	=	44.45 (81)
Northwest 0.9x	0.77	x	1.92	x	22.97	x	0.76	x	0.7	=	16.26 (81)
Northwest 0.9x	0.77	x	5.25	x	41.38	x	0.76	x	0.7	=	80.09 (81)
Northwest 0.9x	0.77	x	1.92	x	41.38	x	0.76	x	0.7	=	29.29 (81)
Northwest 0.9x	0.77	x	5.25	x	67.96	x	0.76	x	0.7	=	131.53 (81)
Northwest 0.9x	0.77	x	1.92	x	67.96	x	0.76	x	0.7	=	48.1 (81)
Northwest 0.9x	0.77	x	5.25	x	91.35	x	0.76	x	0.7	=	176.8 (81)
Northwest 0.9x	0.77	x	1.92	x	91.35	x	0.76	x	0.7	=	64.66 (81)
Northwest 0.9x	0.77	x	5.25	x	97.38	x	0.76	x	0.7	=	188.49 (81)
Northwest 0.9x	0.77	x	1.92	x	97.38	x	0.76	x	0.7	=	68.93 (81)
Northwest 0.9x	0.77	x	5.25	x	91.1	x	0.76	x	0.7	=	176.33 (81)
Northwest 0.9x	0.77	x	1.92	x	91.1	x	0.76	x	0.7	=	64.49 (81)
Northwest 0.9x	0.77	x	5.25	x	72.63	x	0.76	x	0.7	=	140.57 (81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	1.92	x	72.63	x	0.76	x	0.7	=	51.41	(81)
Northwest 0.9x	0.77	x	5.25	x	50.42	x	0.76	x	0.7	=	97.59	(81)
Northwest 0.9x	0.77	x	1.92	x	50.42	x	0.76	x	0.7	=	35.69	(81)
Northwest 0.9x	0.77	x	5.25	x	28.07	x	0.76	x	0.7	=	54.33	(81)
Northwest 0.9x	0.77	x	1.92	x	28.07	x	0.76	x	0.7	=	19.87	(81)
Northwest 0.9x	0.77	x	5.25	x	14.2	x	0.76	x	0.7	=	27.48	(81)
Northwest 0.9x	0.77	x	1.92	x	14.2	x	0.76	x	0.7	=	10.05	(81)
Northwest 0.9x	0.77	x	5.25	x	9.21	x	0.76	x	0.7	=	17.83	(81)
Northwest 0.9x	0.77	x	1.92	x	9.21	x	0.76	x	0.7	=	6.52	(81)

Solar gains in watts, calculated for each month

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

(83)m=	67.64	137.68	248.05	407.37	547.59	583.79	546.12	435.37	302.26	168.25	85.11	55.24	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	446.31	514.47	613.17	753.7	874.97	892.78	843.07	737.75	614.2	499.18	437.85	424.21	(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 (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=	0.95	0.93	0.87	0.75	0.58	0.42	0.32	0.37	0.6	0.84	0.93	0.96	(86)

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

(87)m=	19.11	19.38	19.85	20.42	20.78	20.94	20.98	20.97	20.82	20.31	19.62	19.07	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.1	20.1	20.11	20.11	20.13	20.13	20.13	20.12	20.11	20.11	20.1	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(89)m=	0.95	0.92	0.86	0.72	0.54	0.37	0.26	0.31	0.55	0.81	0.92	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.56	17.95	18.62	19.41	19.87	20.07	20.11	20.11	19.95	19.28	18.31	17.51	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.36 (91)

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

(92)m=	18.11	18.46	19.06	19.77	20.2	20.38	20.42	20.41	20.26	19.65	18.78	18.07	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.11	18.46	19.06	19.77	20.2	20.38	20.42	20.41	20.26	19.65	18.78	18.07	(93)
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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
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Utilisation factor for gains, hm:

(94)m=	0.93	0.9	0.83	0.71	0.55	0.38	0.28	0.33	0.56	0.79	0.9	0.93	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	413.52	461.48	511.16	533.96	476.86	343.52	233	241.59	341.17	395.11	393.18	396.27	(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)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	891.15	872.06	805.09	685.67	534.44	358.47	237.07	248.28	384.18	568.91	738.88	882.74	(97)
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DER WorkSheet: New dwelling design stage



Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	355.36	275.9	218.68	109.23	42.84	0	0	0	0	129.31	248.91	361.94	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													1742.17 (98)

Space heating requirement in kWh/m ² /year	26.69 (99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating

Annual space heating requirement kWh/year 1742.17

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1829.27 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308)

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1983.41

If DHW from community scheme:
Water heat from Community boilers (64) x (303a) x (305) x (306) = 2082.58 (310a)

Electricity used for heat distribution 0.01 x [(307a)...(307e) + (310a)...(310e)] = 39.12 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):
mechanical ventilation - balanced, extract or positive input from outside 0 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 0 (331)

Energy for lighting (calculated in Appendix L) 292.87 (332)

Electricity generated by PVs (Appendix M) (negative quantity) -200.36 (333)

Electricity generated by wind turbine (Appendix M) (negative quantity) 0 (334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel			98.1 (367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	=	861.33	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	20.3	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	881.63	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			881.63	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	0	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	152	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$	-103.99	(380)
Total CO2, kg/year	$\text{sum of (376)...(382) =}$			929.64	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			14.24	(384)
EI rating (section 14)				88.7	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B E Mid (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.27 (1a) x	2.5 (2a) =	163.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.27 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	163.17 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				2 x 10 =	20 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12 (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 <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>			0 (11)
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)			0.37 (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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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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TER WorkSheet: New dwelling design stage

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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.7	x 1/[1/(1.4)+ 0.04]	= 2.25		(27)
Windows Type 2			4.64	x 1/[1/(1.4)+ 0.04]	= 6.15		(27)
Windows Type 3			4.64	x 1/[1/(1.4)+ 0.04]	= 6.15		(27)
Windows Type 4			1.7	x 1/[1/(1.4)+ 0.04]	= 2.25		(27)
Walls Type1	42.13	14.38	27.75	x 0.18	= 5		(29)
Walls Type2	14.13	1.95	12.18	x 0.18	= 2.19		(29)
Total area of elements, m²			56.26				(31)
Party wall			28	x 0	= 0		(32)
Party floor			65.27				(32a)
Party ceiling			65.27				(32b)
Internal wall **			129.5				(32c)

* 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) = 28.2 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 22460.8 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss (33) + (36) = 33.65 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33	32.76	32.53	31.45	31.24	30.3	30.3	30.12	30.66	31.24	31.65	32.08	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.65	66.41	66.18	65.1	64.89	63.95	63.95	63.77	64.31	64.89	65.3	65.73	
Average = Sum(39) _{1...12} / 12 =												65.09	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.01	1	0.99	0.98	0.98	0.98	0.99	0.99	1	1.01	
Average = Sum(40) _{1...12} / 12 =												1	(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 2.13 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 84.69 (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	
(44)m=	93.16	89.78	86.39	83	79.61	76.22	76.22	79.61	83	86.39	89.78	93.16	
Total = Sum(44) _{1...12} =												1016.33	(44)

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

(45)m=	138.16	120.83	124.69	108.71	104.31	90.01	83.41	95.71	96.85	112.87	123.21	133.8	
Total = Sum(45) _{1...12} =												1332.57	(45)

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

(46)m=	20.72	18.13	18.7	16.31	15.65	13.5	12.51	14.36	14.53	16.93	18.48	20.07	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0.75 (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)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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Water storage loss calculated for each month

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
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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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
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Primary circuit loss (annual) from Table 3	0	(58)
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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)
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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)
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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=	184.75	162.92	171.29	153.8	150.9	135.1	130	142.31	141.95	159.47	168.3	180.39	(62)
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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)
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Output from water heater

(64)m=	184.75	162.92	171.29	153.8	150.9	135.1	130	142.31	141.95	159.47	168.3	180.39	
Output from water heater (annual) ^{1...12}												1881.18	(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=	83.21	73.85	78.74	72.22	71.96	66	65.01	69.1	68.28	74.81	77.04	81.76	(65)
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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=	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	(66)

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

(67)m=	16.59	14.73	11.98	9.07	6.78	5.72	6.19	8.04	10.79	13.7	15.99	17.05	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	186.02	187.95	183.08	172.73	159.66	147.37	139.16	137.23	142.1	152.45	165.52	177.81	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	(69)
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Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	(71)
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Water heating gains (Table 5)

(72)m=	111.85	109.89	105.83	100.3	96.72	91.67	87.38	92.88	94.83	100.55	107	109.9	(72)
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Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

(73)m=	372.34	370.46	358.78	339.99	321.05	302.65	290.62	296.04	305.61	324.59	346.41	362.65	(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.

TER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)
Northeast 0.9x	0.77	x	1.7	x	11.28	x	0.63	x	0.7	=	11.72 (75)
Northeast 0.9x	0.77	x	4.64	x	11.28	x	0.63	x	0.7	=	16 (75)
Northeast 0.9x	0.77	x	1.7	x	22.97	x	0.63	x	0.7	=	23.86 (75)
Northeast 0.9x	0.77	x	4.64	x	22.97	x	0.63	x	0.7	=	32.57 (75)
Northeast 0.9x	0.77	x	1.7	x	41.38	x	0.63	x	0.7	=	43 (75)
Northeast 0.9x	0.77	x	4.64	x	41.38	x	0.63	x	0.7	=	58.68 (75)
Northeast 0.9x	0.77	x	1.7	x	67.96	x	0.63	x	0.7	=	70.61 (75)
Northeast 0.9x	0.77	x	4.64	x	67.96	x	0.63	x	0.7	=	96.36 (75)
Northeast 0.9x	0.77	x	1.7	x	91.35	x	0.63	x	0.7	=	94.92 (75)
Northeast 0.9x	0.77	x	4.64	x	91.35	x	0.63	x	0.7	=	129.53 (75)
Northeast 0.9x	0.77	x	1.7	x	97.38	x	0.63	x	0.7	=	101.19 (75)
Northeast 0.9x	0.77	x	4.64	x	97.38	x	0.63	x	0.7	=	138.1 (75)
Northeast 0.9x	0.77	x	1.7	x	91.1	x	0.63	x	0.7	=	94.66 (75)
Northeast 0.9x	0.77	x	4.64	x	91.1	x	0.63	x	0.7	=	129.19 (75)
Northeast 0.9x	0.77	x	1.7	x	72.63	x	0.63	x	0.7	=	75.47 (75)
Northeast 0.9x	0.77	x	4.64	x	72.63	x	0.63	x	0.7	=	102.99 (75)
Northeast 0.9x	0.77	x	1.7	x	50.42	x	0.63	x	0.7	=	52.39 (75)
Northeast 0.9x	0.77	x	4.64	x	50.42	x	0.63	x	0.7	=	71.5 (75)
Northeast 0.9x	0.77	x	1.7	x	28.07	x	0.63	x	0.7	=	29.16 (75)
Northeast 0.9x	0.77	x	4.64	x	28.07	x	0.63	x	0.7	=	39.8 (75)
Northeast 0.9x	0.77	x	1.7	x	14.2	x	0.63	x	0.7	=	14.75 (75)
Northeast 0.9x	0.77	x	4.64	x	14.2	x	0.63	x	0.7	=	20.13 (75)
Northeast 0.9x	0.77	x	1.7	x	9.21	x	0.63	x	0.7	=	9.57 (75)
Northeast 0.9x	0.77	x	4.64	x	9.21	x	0.63	x	0.7	=	13.07 (75)
Northwest 0.9x	0.77	x	4.64	x	11.28	x	0.63	x	0.7	=	16 (81)
Northwest 0.9x	0.77	x	1.7	x	11.28	x	0.63	x	0.7	=	5.86 (81)
Northwest 0.9x	0.77	x	4.64	x	22.97	x	0.63	x	0.7	=	32.57 (81)
Northwest 0.9x	0.77	x	1.7	x	22.97	x	0.63	x	0.7	=	11.93 (81)
Northwest 0.9x	0.77	x	4.64	x	41.38	x	0.63	x	0.7	=	58.68 (81)
Northwest 0.9x	0.77	x	1.7	x	41.38	x	0.63	x	0.7	=	21.5 (81)
Northwest 0.9x	0.77	x	4.64	x	67.96	x	0.63	x	0.7	=	96.36 (81)
Northwest 0.9x	0.77	x	1.7	x	67.96	x	0.63	x	0.7	=	35.31 (81)
Northwest 0.9x	0.77	x	4.64	x	91.35	x	0.63	x	0.7	=	129.53 (81)
Northwest 0.9x	0.77	x	1.7	x	91.35	x	0.63	x	0.7	=	47.46 (81)
Northwest 0.9x	0.77	x	4.64	x	97.38	x	0.63	x	0.7	=	138.1 (81)
Northwest 0.9x	0.77	x	1.7	x	97.38	x	0.63	x	0.7	=	50.6 (81)
Northwest 0.9x	0.77	x	4.64	x	91.1	x	0.63	x	0.7	=	129.19 (81)
Northwest 0.9x	0.77	x	1.7	x	91.1	x	0.63	x	0.7	=	47.33 (81)
Northwest 0.9x	0.77	x	4.64	x	72.63	x	0.63	x	0.7	=	102.99 (81)

TER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	1.7	x	72.63	x	0.63	x	0.7	=	37.73	(81)
Northwest 0.9x	0.77	x	4.64	x	50.42	x	0.63	x	0.7	=	71.5	(81)
Northwest 0.9x	0.77	x	1.7	x	50.42	x	0.63	x	0.7	=	26.2	(81)
Northwest 0.9x	0.77	x	4.64	x	28.07	x	0.63	x	0.7	=	39.8	(81)
Northwest 0.9x	0.77	x	1.7	x	28.07	x	0.63	x	0.7	=	14.58	(81)
Northwest 0.9x	0.77	x	4.64	x	14.2	x	0.63	x	0.7	=	20.13	(81)
Northwest 0.9x	0.77	x	1.7	x	14.2	x	0.63	x	0.7	=	7.38	(81)
Northwest 0.9x	0.77	x	4.64	x	9.21	x	0.63	x	0.7	=	13.07	(81)
Northwest 0.9x	0.77	x	1.7	x	9.21	x	0.63	x	0.7	=	4.79	(81)

Solar gains in watts, calculated for each month

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

(83)m=	49.59	100.93	181.85	298.65	401.44	427.98	400.36	319.17	221.58	123.35	62.39	40.49	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	421.93	471.39	540.63	638.64	722.48	730.63	690.98	615.21	527.19	447.94	408.8	403.14	(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	0.92	0.76	0.55	0.41	0.47	0.77	0.96	0.99	1	(86)

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

(87)m=	19.98	20.11	20.37	20.71	20.92	20.99	21	21	20.94	20.64	20.26	19.96	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.07	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.9	0.71	0.48	0.32	0.38	0.69	0.95	0.99	1	(89)
--------	---	------	------	-----	------	------	------	------	------	------	------	---	------

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

(90)m=	18.71	18.9	19.27	19.75	20.02	20.09	20.1	20.1	20.05	19.67	19.12	18.69	(90)
--------	-------	------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.36 (91)

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

(92)m=	19.16	19.34	19.66	20.09	20.34	20.42	20.42	20.42	20.37	20.02	19.53	19.15	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.16	19.34	19.66	20.09	20.34	20.42	20.42	20.42	20.37	20.02	19.53	19.15	(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	0.99	0.97	0.9	0.73	0.5	0.35	0.42	0.72	0.95	0.99	1	(94)
--------	------	------	------	-----	------	-----	------	------	------	------	------	---	------

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

(95)m=	419.77	466.69	525.56	574.39	524.11	368.01	243.99	255.51	378.63	424.35	404.48	401.51	(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, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	990.54	958.82	871.19	728.69	560.89	371.87	244.4	256.5	403.34	611.33	811.77	982.42	(97)
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TER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	424.66	330.71	257.14	111.09	27.36	0	0	0	0	139.12	293.25	432.19	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2015.53 (98)

Space heating requirement in kWh/m ² /year	30.88 (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) × [1 – (203)] = 1 (204)
Efficiency of main space heating system 1	93.5 (206)
Efficiency of secondary/supplementary heating system, %	0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

424.66	330.71	257.14	111.09	27.36	0	0	0	0	139.12	293.25	432.19
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

454.18	353.7	275.02	118.82	29.26	0	0	0	0	148.79	313.63	462.24		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												2155.64	(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) = Sum(215) _{1...5,10...12} =													0 (215)

Water heating

Output from water heater (calculated above)

184.75	162.92	171.29	153.8	150.9	135.1	130	142.31	141.95	159.47	168.3	180.39
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Efficiency of water heater 79.8 (216)

(217)m=	86.96	86.66	85.9	83.96	81.27	79.8	79.8	79.8	79.8	84.45	86.28	87.06	(217)
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Fuel for water heating, kWh/month

(219)m = $(64)m \times 100 \div (217)m$

(219)m=	212.45	187.99	199.41	183.18	185.67	169.3	162.91	178.33	177.88	188.83	195.06	207.2	
Total = Sum(219a) _{1...12} =													2248.2 (219)

Annual totals

Space heating fuel used, main system 1 kWh/year kWh/year 2155.64

Water heating fuel used kWh/year 2248.2

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 292.96 (232)

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

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	465.62	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	485.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =			951.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	152.04	(268)
Total CO2, kg/year	sum of (265)...(271) =			1142.2	(272)
TER	=			17.5	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
Printed on 02 June 2017 at 09:41:32

Project Information:

Assessed By: David Lloyd (STRO006228)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 65.27m²

Site Reference : GPV Ph 6

Plot Reference: 2B E Lwr (Comm Boiler NV PV)

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)

20.56 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

16.71 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

60.7 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

42.1 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.18 (max. 0.30)

0.19 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

0.15 (max. 0.25)

0.15 (max. 0.70)

OK

Roof

(no roof)

0.15 (max. 0.70)

OK

Openings

1.00 (max. 2.00)

1.00 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

3.50 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Community heating schemes - mains gas

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

No cylinder

6 Controls

Space heating controls

Charging system linked to use of community heating, TRVs

OK

Hot water controls:

No cylinder

No cylinder

Regulations Compliance Report

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
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Based on:

Overshading:	Average or unknown	
Windows facing: North East	3.84m ²	
Windows facing: North East	5.25m ²	
Windows facing: North West	5.25m ²	
Windows facing: North West	1.92m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

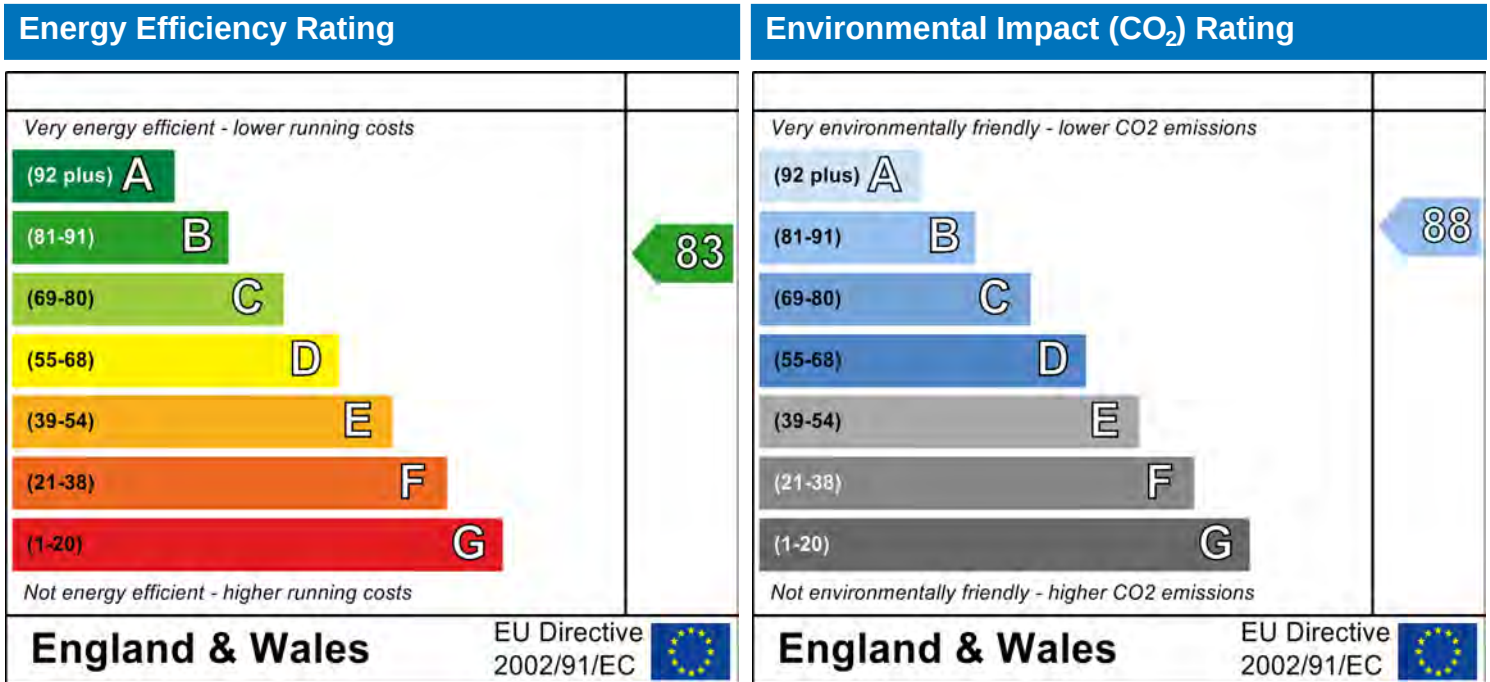
Air permeability	3.5 m ³ /m ² h	
Windows U-value	1 W/m ² K	
Doors U-value	1 W/m ² K	
Party Walls U-value	0 W/m ² K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

Predicted Energy Assessment

Dwelling type: Mid floor Flat
Date of assessment: 20 March 2017
Produced by: David Lloyd
Total floor area: 65.27 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B E Lwr (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.27 (1a)	2.5 (2a)	163.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.27 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	163.17 (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) =	0.18 (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 <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>			0 (11)
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			3.5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.36 (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) =		0.36 (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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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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DER WorkSheet: New dwelling design stage

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

0.46	0.45	0.44	0.39	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.6 0.6 0.6 0.58 0.57 0.56 0.56 0.56 0.56 0.57 0.58 0.59 (24d)

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

(25)m= 0.6 0.6 0.6 0.58 0.57 0.56 0.56 0.56 0.56 0.57 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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.92	x 1/[1/(1) + 0.04]	= 1.85		(27)
Windows Type 2			5.25	x 1/[1/(1) + 0.04]	= 5.05		(27)
Windows Type 3			5.25	x 1/[1/(1) + 0.04]	= 5.05		(27)
Windows Type 4			1.92	x 1/[1/(1) + 0.04]	= 1.85		(27)
Floor			65.27	x 0.15	= 9.7905		(28)
Walls Type1	42.13	16.26	25.87	x 0.17	= 4.4		(29)
Walls Type2	14.13	1.95	12.18	x 0.19	= 2.36		(29)
Total area of elements, m²			121.53				(31)
Party wall			28	x 0	= 0		(32)
Party floor			65.27				(32a)
Party ceiling			65.27				(32b)
Internal wall **			129.5				(32c)

* 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) = 34.13 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 26998.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.83 (36)

DER WorkSheet: New dwelling design stage

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.96 (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=	32.56	32.34	32.13	31.12	30.93	30.05	30.05	29.89	30.39	30.93	31.31	31.71	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.52	74.3	74.09	73.08	72.89	72.01	72.01	71.85	72.35	72.89	73.27	73.67	
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Average = Sum(39)_{1...12} / 12 = 73.08 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.12	1.12	1.1	1.1	1.1	1.11	1.12	1.12	1.13	
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Average = Sum(40)_{1...12} / 12 = 1.12 (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 2.13 (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 84.69 (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	
(44)m=	93.16	89.78	86.39	83	79.61	76.22	76.22	79.61	83	86.39	89.78	93.16	
Total = Sum(44) _{1...12} =												1016.33	(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=	138.16	120.83	124.69	108.71	104.31	90.01	83.41	95.71	96.85	112.87	123.21	133.8	
Total = Sum(45) _{1...12} =												1332.57	(45)

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

(46)m=	20.72	18.13	18.7	16.31	15.65	13.5	12.51	14.36	14.53	16.93	18.48	20.07	(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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
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Primary circuit loss (annual) from Table 3	0	(58)
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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)
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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=	193.44	170.76	179.97	162.2	159.58	143.5	138.68	150.99	150.35	168.15	176.7	189.08	(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=	193.44	170.76	179.97	162.2	159.58	143.5	138.68	150.99	150.35	168.15	176.7	189.08	
Output from water heater (annual) _{1...12}												1983.41	(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=	90.16	80.12	85.68	78.94	78.9	72.72	71.95	76.05	75	81.75	83.76	88.71	(65)
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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=	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	(66)

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

(67)m=	16.58	14.73	11.98	9.07	6.78	5.72	6.18	8.04	10.79	13.7	15.99	17.04	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	186.02	187.95	183.08	172.73	159.66	147.37	139.16	137.23	142.1	152.45	165.52	177.81	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	(71)
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Water heating gains (Table 5)

(72)m=	121.18	119.23	115.16	109.64	106.05	101	96.71	102.21	104.17	109.88	116.34	119.23	(72)
--------	--------	--------	--------	--------	--------	-----	-------	--------	--------	--------	--------	--------	------

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

(73)m=	378.67	376.79	365.11	346.33	327.38	308.99	296.95	302.37	311.94	330.92	352.74	368.98	(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.

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)
Northeast 0.9x	0.77	x	1.92	x	11.28	x	0.76	x	0.7	=	15.97 (75)
Northeast 0.9x	0.77	x	5.25	x	11.28	x	0.76	x	0.7	=	21.84 (75)
Northeast 0.9x	0.77	x	1.92	x	22.97	x	0.76	x	0.7	=	32.51 (75)
Northeast 0.9x	0.77	x	5.25	x	22.97	x	0.76	x	0.7	=	44.45 (75)
Northeast 0.9x	0.77	x	1.92	x	41.38	x	0.76	x	0.7	=	58.58 (75)
Northeast 0.9x	0.77	x	5.25	x	41.38	x	0.76	x	0.7	=	80.09 (75)
Northeast 0.9x	0.77	x	1.92	x	67.96	x	0.76	x	0.7	=	96.21 (75)
Northeast 0.9x	0.77	x	5.25	x	67.96	x	0.76	x	0.7	=	131.53 (75)
Northeast 0.9x	0.77	x	1.92	x	91.35	x	0.76	x	0.7	=	129.32 (75)
Northeast 0.9x	0.77	x	5.25	x	91.35	x	0.76	x	0.7	=	176.8 (75)
Northeast 0.9x	0.77	x	1.92	x	97.38	x	0.76	x	0.7	=	137.87 (75)
Northeast 0.9x	0.77	x	5.25	x	97.38	x	0.76	x	0.7	=	188.49 (75)
Northeast 0.9x	0.77	x	1.92	x	91.1	x	0.76	x	0.7	=	128.97 (75)
Northeast 0.9x	0.77	x	5.25	x	91.1	x	0.76	x	0.7	=	176.33 (75)
Northeast 0.9x	0.77	x	1.92	x	72.63	x	0.76	x	0.7	=	102.82 (75)
Northeast 0.9x	0.77	x	5.25	x	72.63	x	0.76	x	0.7	=	140.57 (75)
Northeast 0.9x	0.77	x	1.92	x	50.42	x	0.76	x	0.7	=	71.38 (75)
Northeast 0.9x	0.77	x	5.25	x	50.42	x	0.76	x	0.7	=	97.59 (75)
Northeast 0.9x	0.77	x	1.92	x	28.07	x	0.76	x	0.7	=	39.74 (75)
Northeast 0.9x	0.77	x	5.25	x	28.07	x	0.76	x	0.7	=	54.33 (75)
Northeast 0.9x	0.77	x	1.92	x	14.2	x	0.76	x	0.7	=	20.1 (75)
Northeast 0.9x	0.77	x	5.25	x	14.2	x	0.76	x	0.7	=	27.48 (75)
Northeast 0.9x	0.77	x	1.92	x	9.21	x	0.76	x	0.7	=	13.04 (75)
Northeast 0.9x	0.77	x	5.25	x	9.21	x	0.76	x	0.7	=	17.83 (75)
Northwest 0.9x	0.77	x	5.25	x	11.28	x	0.76	x	0.7	=	21.84 (81)
Northwest 0.9x	0.77	x	1.92	x	11.28	x	0.76	x	0.7	=	7.99 (81)
Northwest 0.9x	0.77	x	5.25	x	22.97	x	0.76	x	0.7	=	44.45 (81)
Northwest 0.9x	0.77	x	1.92	x	22.97	x	0.76	x	0.7	=	16.26 (81)
Northwest 0.9x	0.77	x	5.25	x	41.38	x	0.76	x	0.7	=	80.09 (81)
Northwest 0.9x	0.77	x	1.92	x	41.38	x	0.76	x	0.7	=	29.29 (81)
Northwest 0.9x	0.77	x	5.25	x	67.96	x	0.76	x	0.7	=	131.53 (81)
Northwest 0.9x	0.77	x	1.92	x	67.96	x	0.76	x	0.7	=	48.1 (81)
Northwest 0.9x	0.77	x	5.25	x	91.35	x	0.76	x	0.7	=	176.8 (81)
Northwest 0.9x	0.77	x	1.92	x	91.35	x	0.76	x	0.7	=	64.66 (81)
Northwest 0.9x	0.77	x	5.25	x	97.38	x	0.76	x	0.7	=	188.49 (81)
Northwest 0.9x	0.77	x	1.92	x	97.38	x	0.76	x	0.7	=	68.93 (81)
Northwest 0.9x	0.77	x	5.25	x	91.1	x	0.76	x	0.7	=	176.33 (81)
Northwest 0.9x	0.77	x	1.92	x	91.1	x	0.76	x	0.7	=	64.49 (81)
Northwest 0.9x	0.77	x	5.25	x	72.63	x	0.76	x	0.7	=	140.57 (81)

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Northwest 0.9x	0.77	x	1.92	x	72.63	x	0.76	x	0.7	=	51.41	(81)
Northwest 0.9x	0.77	x	5.25	x	50.42	x	0.76	x	0.7	=	97.59	(81)
Northwest 0.9x	0.77	x	1.92	x	50.42	x	0.76	x	0.7	=	35.69	(81)
Northwest 0.9x	0.77	x	5.25	x	28.07	x	0.76	x	0.7	=	54.33	(81)
Northwest 0.9x	0.77	x	1.92	x	28.07	x	0.76	x	0.7	=	19.87	(81)
Northwest 0.9x	0.77	x	5.25	x	14.2	x	0.76	x	0.7	=	27.48	(81)
Northwest 0.9x	0.77	x	1.92	x	14.2	x	0.76	x	0.7	=	10.05	(81)
Northwest 0.9x	0.77	x	5.25	x	9.21	x	0.76	x	0.7	=	17.83	(81)
Northwest 0.9x	0.77	x	1.92	x	9.21	x	0.76	x	0.7	=	6.52	(81)

Solar gains in watts, calculated for each month

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

(83)m=	67.64	137.68	248.05	407.37	547.59	583.79	546.12	435.37	302.26	168.25	85.11	55.24	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	446.31	514.47	613.17	753.7	874.97	892.78	843.07	737.75	614.2	499.18	437.85	424.21	(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 (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=	0.96	0.93	0.89	0.78	0.63	0.47	0.36	0.42	0.65	0.86	0.94	0.96	(86)

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

(87)m=	18.75	19.03	19.54	20.18	20.65	20.88	20.96	20.94	20.72	20.08	19.32	18.71	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.98	19.99	20	20	20	19.99	19.99	19.98	19.98	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.95	0.93	0.87	0.75	0.58	0.41	0.28	0.34	0.59	0.83	0.93	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.98	17.38	18.1	19	19.61	19.9	19.97	19.96	19.72	18.89	17.8	16.92	(90)
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fLA = Living area ÷ (4) =

0.36 (91)

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

(92)m=	17.61	17.97	18.62	19.42	19.98	20.25	20.33	20.31	20.08	19.32	18.35	17.56	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.61	17.97	18.62	19.42	19.98	20.25	20.33	20.31	20.08	19.32	18.35	17.56	(93)
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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
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Utilisation factor for gains, hm:

(94)m=	0.93	0.9	0.84	0.73	0.58	0.42	0.31	0.36	0.59	0.81	0.9	0.94	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	414.3	463.84	518.09	552.92	509.58	378.35	259.66	267.45	363.34	403.1	395.18	396.79	(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)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	992.09	971.3	897.78	769.05	603.43	406.94	268.31	280.89	432.67	635.51	823.98	984.3	(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=	429.88	341.01	282.49	155.61	69.83	0	0	0	0	172.91	308.74	437.11	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2197.58 (98)

Space heating requirement in kWh/m ² /year	33.67 (99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating

Annual space heating requirement kWh/year 2197.58

Space heat from Community boilers (98) x (304a) x (305) x (306) = 2307.46 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308)

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1983.41

If DHW from community scheme:
Water heat from Community boilers (64) x (303a) x (305) x (306) = 2082.58 (310a)

Electricity used for heat distribution 0.01 x [(307a)...(307e) + (310a)...(310e)] = 43.9 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):
mechanical ventilation - balanced, extract or positive input from outside 0 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 0 (331)

Energy for lighting (calculated in Appendix L) 292.87 (332)

Electricity generated by PVs (Appendix M) (negative quantity) -97.59 (333)

Electricity generated by wind turbine (Appendix M) (negative quantity) 0 (334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel			98.1 (367a)

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CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	=	966.61	(367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	22.78	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	989.4	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			989.4	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	0	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	152	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$	-50.65	(380)
Total CO2, kg/year	$\text{sum of } (376)...(382) =$			1090.75	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			16.71	(384)
EI rating (section 14)				86.75	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B E Lwr (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.27 (1a) ×	2.5 (2a) =	163.17 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.27 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	163.17 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 × 40 =	0 (6a)
Number of open flues	0	0	0	0 × 20 =	0 (6b)
Number of intermittent fans				2 × 10 =	20 (7a)
Number of passive vents				0 × 10 =	0 (7b)
Number of flueless gas fires				0 × 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20 ÷ (5) =	0.12 (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]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <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>		0 (11)
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 × (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)		0.37 (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 × (19)] =	1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (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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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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TER WorkSheet: New dwelling design stage

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
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.7	x 1/[1/(1.4)+ 0.04]	= 2.25		(27)
Windows Type 2			4.64	x 1/[1/(1.4)+ 0.04]	= 6.15		(27)
Windows Type 3			4.64	x 1/[1/(1.4)+ 0.04]	= 6.15		(27)
Windows Type 4			1.7	x 1/[1/(1.4)+ 0.04]	= 2.25		(27)
Floor			65.27	x 0.13	= 8.485099		(28)
Walls Type1	42.13	14.38	27.75	x 0.18	= 5		(29)
Walls Type2	14.13	1.95	12.18	x 0.18	= 2.19		(29)
Total area of elements, m²			121.53				(31)
Party wall			28	x 0	= 0		(32)
Party floor			65.27				(32a)
Party ceiling			65.27				(32b)
Internal wall **			129.5				(32c)

* 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) = 36.69 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 27356.05 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.86 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 49.55 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33	32.76	32.53	31.45	31.24	30.3	30.3	30.12	30.66	31.24	31.65	32.08	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	82.55	82.31	82.08	81	80.79	79.85	79.85	79.67	80.21	80.79	81.21	81.63	
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Average = Sum(39)_{1...12} / 12 = 81 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.26	1.26	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.24	1.25	
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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 2.13 (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 84.69 (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	
(44)m=	93.16	89.78	86.39	83	79.61	76.22	76.22	79.61	83	86.39	89.78	93.16	
Total = Sum(44) _{1...12} =												1016.33	(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=	138.16	120.83	124.69	108.71	104.31	90.01	83.41	95.71	96.85	112.87	123.21	133.8	
Total = Sum(45) _{1...12} =												1332.57	(45)

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

(46)m=	20.72	18.13	18.7	16.31	15.65	13.5	12.51	14.36	14.53	16.93	18.48	20.07	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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Water storage loss calculated for each month

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
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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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
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Primary circuit loss (annual) from Table 3	0	(58)
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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)
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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)
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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=	184.75	162.92	171.29	153.8	150.9	135.1	130	142.31	141.95	159.47	168.3	180.39	(62)
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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)
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Output from water heater

(64)m=	184.75	162.92	171.29	153.8	150.9	135.1	130	142.31	141.95	159.47	168.3	180.39	
Output from water heater (annual) _{1...12}												1881.18	(64)

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

(65)m=	83.21	73.85	78.74	72.22	71.96	66	65.01	69.1	68.28	74.81	77.04	81.76	(65)
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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=	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	106.3	(66)

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

(67)m=	16.59	14.73	11.98	9.07	6.78	5.72	6.19	8.04	10.79	13.7	15.99	17.05	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	186.02	187.95	183.08	172.73	159.66	147.37	139.16	137.23	142.1	152.45	165.52	177.81	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	33.63	(69)
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Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	-85.04	(71)
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Water heating gains (Table 5)

(72)m=	111.85	109.89	105.83	100.3	96.72	91.67	87.38	92.88	94.83	100.55	107	109.9	(72)
--------	--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	-----	-------	------

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

(73)m=	372.34	370.46	358.78	339.99	321.05	302.65	290.62	296.04	305.61	324.59	346.41	362.65	(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.

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)
Northeast 0.9x	0.77	x	1.7	x	11.28	x	0.63	x	0.7	=	11.72 (75)
Northeast 0.9x	0.77	x	4.64	x	11.28	x	0.63	x	0.7	=	16 (75)
Northeast 0.9x	0.77	x	1.7	x	22.97	x	0.63	x	0.7	=	23.86 (75)
Northeast 0.9x	0.77	x	4.64	x	22.97	x	0.63	x	0.7	=	32.57 (75)
Northeast 0.9x	0.77	x	1.7	x	41.38	x	0.63	x	0.7	=	43 (75)
Northeast 0.9x	0.77	x	4.64	x	41.38	x	0.63	x	0.7	=	58.68 (75)
Northeast 0.9x	0.77	x	1.7	x	67.96	x	0.63	x	0.7	=	70.61 (75)
Northeast 0.9x	0.77	x	4.64	x	67.96	x	0.63	x	0.7	=	96.36 (75)
Northeast 0.9x	0.77	x	1.7	x	91.35	x	0.63	x	0.7	=	94.92 (75)
Northeast 0.9x	0.77	x	4.64	x	91.35	x	0.63	x	0.7	=	129.53 (75)
Northeast 0.9x	0.77	x	1.7	x	97.38	x	0.63	x	0.7	=	101.19 (75)
Northeast 0.9x	0.77	x	4.64	x	97.38	x	0.63	x	0.7	=	138.1 (75)
Northeast 0.9x	0.77	x	1.7	x	91.1	x	0.63	x	0.7	=	94.66 (75)
Northeast 0.9x	0.77	x	4.64	x	91.1	x	0.63	x	0.7	=	129.19 (75)
Northeast 0.9x	0.77	x	1.7	x	72.63	x	0.63	x	0.7	=	75.47 (75)
Northeast 0.9x	0.77	x	4.64	x	72.63	x	0.63	x	0.7	=	102.99 (75)
Northeast 0.9x	0.77	x	1.7	x	50.42	x	0.63	x	0.7	=	52.39 (75)
Northeast 0.9x	0.77	x	4.64	x	50.42	x	0.63	x	0.7	=	71.5 (75)
Northeast 0.9x	0.77	x	1.7	x	28.07	x	0.63	x	0.7	=	29.16 (75)
Northeast 0.9x	0.77	x	4.64	x	28.07	x	0.63	x	0.7	=	39.8 (75)
Northeast 0.9x	0.77	x	1.7	x	14.2	x	0.63	x	0.7	=	14.75 (75)
Northeast 0.9x	0.77	x	4.64	x	14.2	x	0.63	x	0.7	=	20.13 (75)
Northeast 0.9x	0.77	x	1.7	x	9.21	x	0.63	x	0.7	=	9.57 (75)
Northeast 0.9x	0.77	x	4.64	x	9.21	x	0.63	x	0.7	=	13.07 (75)
Northwest 0.9x	0.77	x	4.64	x	11.28	x	0.63	x	0.7	=	16 (81)
Northwest 0.9x	0.77	x	1.7	x	11.28	x	0.63	x	0.7	=	5.86 (81)
Northwest 0.9x	0.77	x	4.64	x	22.97	x	0.63	x	0.7	=	32.57 (81)
Northwest 0.9x	0.77	x	1.7	x	22.97	x	0.63	x	0.7	=	11.93 (81)
Northwest 0.9x	0.77	x	4.64	x	41.38	x	0.63	x	0.7	=	58.68 (81)
Northwest 0.9x	0.77	x	1.7	x	41.38	x	0.63	x	0.7	=	21.5 (81)
Northwest 0.9x	0.77	x	4.64	x	67.96	x	0.63	x	0.7	=	96.36 (81)
Northwest 0.9x	0.77	x	1.7	x	67.96	x	0.63	x	0.7	=	35.31 (81)
Northwest 0.9x	0.77	x	4.64	x	91.35	x	0.63	x	0.7	=	129.53 (81)
Northwest 0.9x	0.77	x	1.7	x	91.35	x	0.63	x	0.7	=	47.46 (81)
Northwest 0.9x	0.77	x	4.64	x	97.38	x	0.63	x	0.7	=	138.1 (81)
Northwest 0.9x	0.77	x	1.7	x	97.38	x	0.63	x	0.7	=	50.6 (81)
Northwest 0.9x	0.77	x	4.64	x	91.1	x	0.63	x	0.7	=	129.19 (81)
Northwest 0.9x	0.77	x	1.7	x	91.1	x	0.63	x	0.7	=	47.33 (81)
Northwest 0.9x	0.77	x	4.64	x	72.63	x	0.63	x	0.7	=	102.99 (81)

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Northwest 0.9x	0.77	x	1.7	x	72.63	x	0.63	x	0.7	=	37.73	(81)
Northwest 0.9x	0.77	x	4.64	x	50.42	x	0.63	x	0.7	=	71.5	(81)
Northwest 0.9x	0.77	x	1.7	x	50.42	x	0.63	x	0.7	=	26.2	(81)
Northwest 0.9x	0.77	x	4.64	x	28.07	x	0.63	x	0.7	=	39.8	(81)
Northwest 0.9x	0.77	x	1.7	x	28.07	x	0.63	x	0.7	=	14.58	(81)
Northwest 0.9x	0.77	x	4.64	x	14.2	x	0.63	x	0.7	=	20.13	(81)
Northwest 0.9x	0.77	x	1.7	x	14.2	x	0.63	x	0.7	=	7.38	(81)
Northwest 0.9x	0.77	x	4.64	x	9.21	x	0.63	x	0.7	=	13.07	(81)
Northwest 0.9x	0.77	x	1.7	x	9.21	x	0.63	x	0.7	=	4.79	(81)

Solar gains in watts, calculated for each month

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

(83)m=	49.59	100.93	181.85	298.65	401.44	427.98	400.36	319.17	221.58	123.35	62.39	40.49	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	421.93	471.39	540.63	638.64	722.48	730.63	690.98	615.21	527.19	447.94	408.8	403.14	(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

(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	0.99	0.95	0.84	0.66	0.5	0.57	0.85	0.98	0.99	1	(86)

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

(87)m=	19.65	19.79	20.07	20.47	20.8	20.95	20.99	20.98	20.85	20.43	19.98	19.63	(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	19.9	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=	1	0.99	0.98	0.93	0.79	0.56	0.38	0.45	0.77	0.96	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.08	18.29	18.7	19.27	19.7	19.87	19.9	19.9	19.78	19.23	18.57	18.06	(90)
--------	-------	-------	------	-------	------	-------	------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.36

(91)

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

(92)m=	18.64	18.83	19.19	19.7	20.09	20.26	20.29	20.29	20.16	19.66	19.08	18.62	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.64	18.83	19.19	19.7	20.09	20.26	20.29	20.29	20.16	19.66	19.08	18.62	(93)
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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	0.99	0.98	0.93	0.8	0.59	0.42	0.49	0.79	0.96	0.99	1	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	419.71	467	528.27	592.1	576.95	433.53	291.72	303.73	417.23	429.91	404.81	401.42	(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)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1184.18	1146.67	1041.9	875.08	678.01	452.01	294.6	309.55	486.07	731.87	972.66	1177.55	(97)
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TER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	568.77	456.74	382.14	203.75	75.19	0	0	0	0	224.66	408.85	577.44	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2897.54 (98)

Space heating requirement in kWh/m ² /year	44.39 (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) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		93.5 (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)

568.77	456.74	382.14	203.75	75.19	0	0	0	0	224.66	408.85	577.44
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(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

608.31	488.49	408.7	217.91	80.42	0	0	0	0	240.28	437.27	617.59		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												3098.98	(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) = Sum(215) _{1...5,10...12} =													0 (215)

Water heating

Output from water heater (calculated above)

184.75	162.92	171.29	153.8	150.9	135.1	130	142.31	141.95	159.47	168.3	180.39
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Efficiency of water heater 79.8 (216)

(217)m=	87.62	87.42	86.89	85.56	83.07	79.8	79.8	79.8	79.8	85.73	87.09	87.7	(217)
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Fuel for water heating, kWh/month

(219)m = $(64)m \times 100 \div (217)m$

(219)m=	210.86	186.37	197.12	179.75	181.67	169.3	162.91	178.33	177.88	186.02	193.24	205.69	
Total = Sum(219a) _{1...12} =													2229.13 (219)

Annual totals

Space heating fuel used, main system 1	3098.98
Water heating fuel used	2229.13

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 292.96 (232)

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

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	669.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	481.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1150.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	152.04	(268)
Total CO2, kg/year	sum of (265)...(271) =			1341.84	(272)
TER	=			20.56	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
Printed on 02 June 2017 at 09:40:24

Project Information:

Assessed By: David Lloyd (STRO006228)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 64.88m²

Site Reference : GPV Ph 6

Plot Reference: 2B D Top (Comm Boiler NV PV)

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 19.58 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.94 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 38.6 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, TRVs	OK
Hot water controls:	No cylinder	
	No cylinder	

Regulations Compliance Report

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
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Based on:

Overshading:	Average or unknown
Windows facing: North East	3.9m ²
Windows facing: North East	5.75m ²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

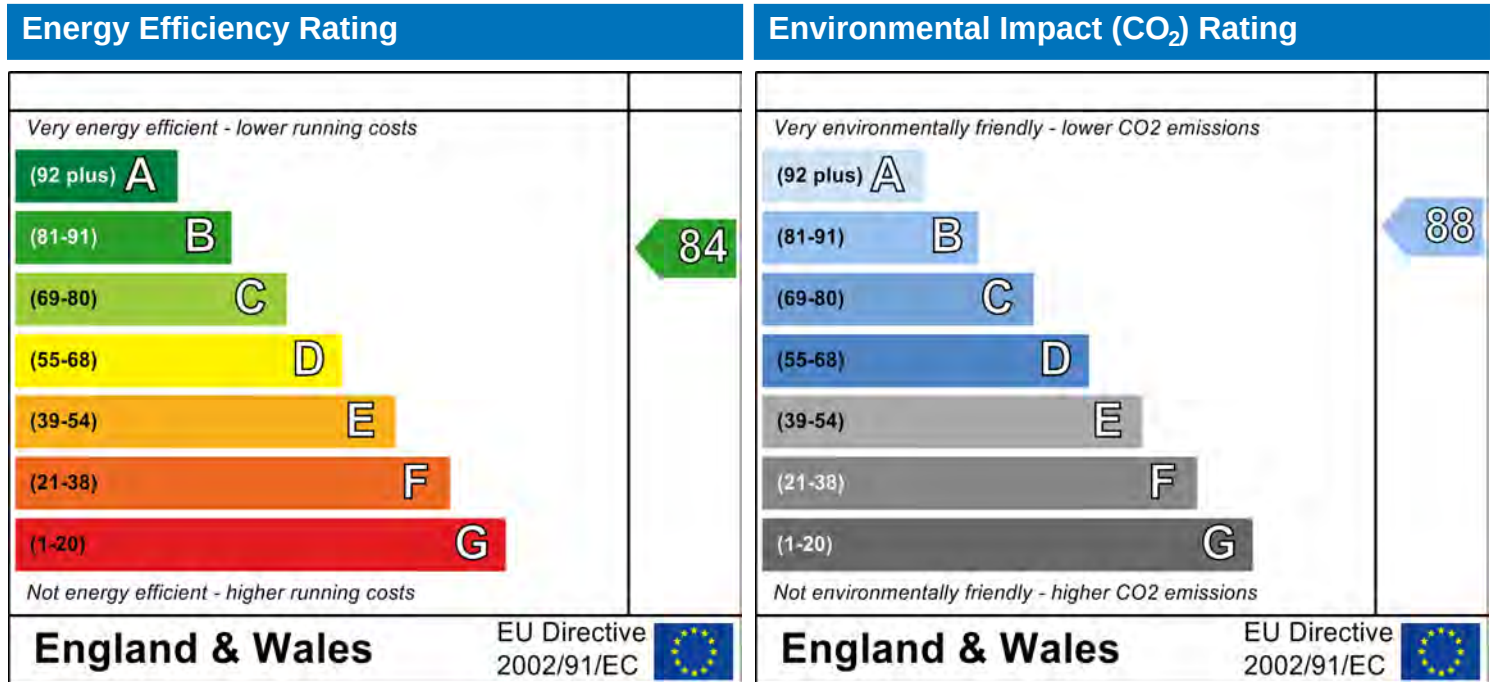
Air permeability	3.5 m ³ /m ² h
Windows U-value	1 W/m ² K
Doors U-value	1 W/m ² K
Roofs U-value	0.1 W/m ² K
Party Walls U-value	0 W/m ² K
Community heating, heat from boilers – mains gas	
Photovoltaic array	

Predicted Energy Assessment

Dwelling type: Top floor Flat
Date of assessment: 20 March 2017
Produced by: David Lloyd
Total floor area: 64.88 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B D Top (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64.88 (1a)	2.5 (2a)	162.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.88 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	162.2 (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) =	0.18 (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 <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>			0 (11)
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			3.5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.36 (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) =		0.36 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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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DER WorkSheet: New dwelling design stage

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

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42
------	------	------	-----	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 0.6 0.58 0.57 0.56 0.56 0.56 0.56 0.57 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 0.57 0.56 0.56 0.56 0.56 0.57 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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x 1/[1/(1) + 0.04]	= 1.88		(27)
Windows Type 2			5.75	x 1/[1/(1) + 0.04]	= 5.53		(27)
Walls Type1	26.31	9.65	16.66	x 0.17	= 2.83		(29)
Walls Type2	31.59	1.95	29.64	x 0.19	= 5.74		(29)
Roof	68.88	0	68.88	x 0.1	= 6.89		(30)
Total area of elements, m²			126.78				(31)
Party wall			26.23	x 0	= 0		(32)
Party floor			64.88				(32a)
Party ceiling			64.88				(32b)
Internal wall **			129.5				(32c)

* 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) = 26.69 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 24096.92 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.01 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.7 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.4	32.18	31.97	30.96	30.77	29.89	29.89	29.73	30.23	30.77	31.15	31.55	(38)

Heat transfer coefficient, W/K

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	67.1	66.89	66.67	65.66	65.47	64.6	64.6	64.43	64.93	65.47	65.86	66.25	
Average = Sum(39) _{1...12} / 12 =												65.66	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.03	1.03	1.03	1.01	1.01	1	1	0.99	1	1.01	1.02	1.02	
Average = Sum(40) _{1...12} / 12 =												1.01	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

2.12

(42)

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

84.45

(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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	92.89	89.52	86.14	82.76	79.38	76	76	79.38	82.76	86.14	89.52	92.89	
Total = Sum(44) _{1...12} =												1013.38	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	137.76	120.48	124.33	108.39	104.01	89.75	83.17	95.43	96.57	112.55	122.85	133.41	
Total = Sum(45) _{1...12} =												1328.7	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	20.66	18.07	18.65	16.26	15.6	13.46	12.47	14.32	14.49	16.88	18.43	20.01	(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

$$(48) \times (49) =$$

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

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

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
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Primary circuit loss (annual) from Table 3	0	(58)
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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=	193.04	170.41	179.61	161.89	159.28	143.24	138.44	150.71	150.07	167.82	176.35	188.69	(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=	193.04	170.41	179.61	161.89	159.28	143.24	138.44	150.71	150.07	167.82	176.35	188.69	
Output from water heater (annual) _{1...12}												1979.54	(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=	90.03	80	85.56	78.84	78.8	72.64	71.87	75.95	74.91	81.64	83.64	88.58	(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=	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	(66)

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

(67)m=	17.47	15.52	12.62	9.55	7.14	6.03	6.52	8.47	11.37	14.43	16.84	17.96	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	185.07	186.99	182.15	171.84	158.84	146.62	138.45	136.53	141.37	151.67	164.68	176.9	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(69)m=	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	(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=	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	121	119.05	115	109.49	105.92	100.88	96.6	102.09	104.04	109.74	116.17	119.06	(72)
--------	-----	--------	-----	--------	--------	--------	------	--------	--------	--------	--------	--------	------

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

(73)m=	378.28	376.29	364.5	345.63	326.64	308.27	296.31	301.82	311.51	330.58	352.43	368.65	(73)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	1.95	x	11.28	x	0.76	x	0.7	=	16.22	(75)
Northeast 0.9x	0.77	x	5.75	x	11.28	x	0.76	x	0.7	=	23.92	(75)
Northeast 0.9x	0.77	x	1.95	x	22.97	x	0.76	x	0.7	=	33.02	(75)
Northeast 0.9x	0.77	x	5.75	x	22.97	x	0.76	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	1.95	x	41.38	x	0.76	x	0.7	=	59.5	(75)
Northeast 0.9x	0.77	x	5.75	x	41.38	x	0.76	x	0.7	=	87.72	(75)
Northeast 0.9x	0.77	x	1.95	x	67.96	x	0.76	x	0.7	=	97.71	(75)
Northeast 0.9x	0.77	x	5.75	x	67.96	x	0.76	x	0.7	=	144.06	(75)
Northeast 0.9x	0.77	x	1.95	x	91.35	x	0.76	x	0.7	=	131.34	(75)
Northeast 0.9x	0.77	x	5.75	x	91.35	x	0.76	x	0.7	=	193.64	(75)
Northeast 0.9x	0.77	x	1.95	x	97.38	x	0.76	x	0.7	=	140.02	(75)
Northeast 0.9x	0.77	x	5.75	x	97.38	x	0.76	x	0.7	=	206.44	(75)
Northeast 0.9x	0.77	x	1.95	x	91.1	x	0.76	x	0.7	=	130.99	(75)
Northeast 0.9x	0.77	x	5.75	x	91.1	x	0.76	x	0.7	=	193.12	(75)
Northeast 0.9x	0.77	x	1.95	x	72.63	x	0.76	x	0.7	=	104.43	(75)
Northeast 0.9x	0.77	x	5.75	x	72.63	x	0.76	x	0.7	=	153.96	(75)
Northeast 0.9x	0.77	x	1.95	x	50.42	x	0.76	x	0.7	=	72.5	(75)
Northeast 0.9x	0.77	x	5.75	x	50.42	x	0.76	x	0.7	=	106.89	(75)
Northeast 0.9x	0.77	x	1.95	x	28.07	x	0.76	x	0.7	=	40.36	(75)
Northeast 0.9x	0.77	x	5.75	x	28.07	x	0.76	x	0.7	=	59.5	(75)
Northeast 0.9x	0.77	x	1.95	x	14.2	x	0.76	x	0.7	=	20.41	(75)
Northeast 0.9x	0.77	x	5.75	x	14.2	x	0.76	x	0.7	=	30.1	(75)
Northeast 0.9x	0.77	x	1.95	x	9.21	x	0.76	x	0.7	=	13.25	(75)
Northeast 0.9x	0.77	x	5.75	x	9.21	x	0.76	x	0.7	=	19.53	(75)

Solar gains in watts, calculated for each month

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

(83)m=	40.14	81.71	147.21	241.77	324.98	346.47	324.11	258.39	179.38	99.86	50.51	32.78	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

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

(84)m=	418.42	458	511.72	587.4	651.62	654.73	620.42	560.21	490.89	430.43	402.94	401.44	(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	(86)
	0.96	0.95	0.91	0.84	0.71	0.56	0.43	0.49	0.71	0.88	0.94	0.96	

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

(87)m=	18.94	19.15	19.56	20.13	20.58	20.86	20.95	20.93	20.7	20.12	19.45	18.91	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(88)m=	20.05	20.06	20.06	20.07	20.08	20.09	20.09	20.09	20.08	20.08	20.07	20.07	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.95	0.94	0.9	0.81	0.67	0.49	0.35	0.4	0.65	0.86	0.93	0.96	(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=	17.29	17.6	18.19	18.99	19.61	19.95	20.05	20.04	19.78	19.01	18.05	17.25	(90)
$fLA = \text{Living area} \div (4) =$													(91)
												0.39	

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

(92)m=	17.92	18.2	18.72	19.43	19.99	20.3	20.4	20.38	20.14	19.44	18.59	17.89	(92)
--------	-------	------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

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

(93)m=	17.92	18.2	18.72	19.43	19.99	20.3	20.4	20.38	20.14	19.44	18.59	17.89	(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, h_m :

(94)m=	0.94	0.92	0.88	0.8	0.67	0.51	0.38	0.43	0.65	0.84	0.91	0.94	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(95)m=	391.4	420.24	449.4	467.45	435.45	333.5	234.64	240.92	320.33	360.22	368.03	377.79	(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=	914.27	889.45	814.88	691.45	542.47	368.4	245.39	256.52	392.2	578.69	756.67	907.03	(97)
--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	389.02	315.31	271.92	161.28	79.62	0	0	0	0	162.54	279.82	393.75	
$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} =$													(98)
												2053.26	

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

(99)	31.65
------	-------

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

(301)	0
-------	---

Fraction of space heat from community system 1 – (301) =

(302)	1
-------	---

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

(303a)	1
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Fraction of total space heat from Community boilers

(302) x (303a) =

(304a)	1
--------	---

Factor for control and charging method (Table 4c(3)) for community heating system

(305)	1
-------	---

Distribution loss factor (Table 12c) for community heating system

(306)	1.05
-------	------

Space heating

kWh/year

Annual space heating requirement

	2053.26
--	---------

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

(307a)	2155.92
--------	---------

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

(308)	0
-------	---

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

(309)	0
-------	---

Water heating

Annual water heating requirement

	1979.54
--	---------

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

(310a)	2078.52
--------	---------

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

(313)	42.34
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DER WorkSheet: New dwelling design stage

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	0	(331)
Energy for lighting (calculated in Appendix L)		308.56	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-154.59	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	98.1	(367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	$=$ 932.35 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	$=$ 21.98 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		$=$ 954.33 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	$=$ 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	$=$ 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		954.33 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	$=$ 0 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	$=$ 160.14 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52 $\times 0.01 =$	-80.23 (380)
Total CO2, kg/year	sum of (376) ... (382) =		1034.24 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.94 (384)
EI rating (section 14)			87.39 (385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B D Top (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64.88 (1a) x	2.5 (2a) =	162.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.88 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	162.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				2 x 10 =	20 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20 ÷ (5) =	0.12 (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 <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>		0 (11)
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)		0.37 (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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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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TER WorkSheet: New dwelling design stage

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	0.35	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x 1/[1/(1.4)+0.04]	= 2.59		(27)
Windows Type 2			5.75	x 1/[1/(1.4)+0.04]	= 7.62		(27)
Walls Type1	26.31	9.65	16.66	x 0.18	= 3		(29)
Walls Type2	31.59	1.95	29.64	x 0.18	= 5.34		(29)
Roof	68.88	0	68.88	x 0.13	= 8.95		(30)
Total area of elements, m²			126.78				(31)
Party wall			26.23	x 0	= 0		(32)
Party floor			64.88				(32a)
Party ceiling			64.88				(32b)
Internal wall **			129.5				(32c)

* 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) = 32.03 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 24096.92 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.93 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 39.96 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.83	32.59	32.36	31.28	31.07	30.13	30.13	29.95	30.49	31.07	31.48	31.91	(38)

Heat transfer coefficient, W/K

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	72.79	72.55	72.32	71.24	71.04	70.09	70.09	69.92	70.46	71.04	71.45	71.88	
Average = Sum(39) _{1...12} /12=												71.24	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.12	1.12	1.11	1.1	1.09	1.08	1.08	1.08	1.09	1.09	1.1	1.11	
Average = Sum(40) _{1...12} /12=												1.1	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

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 $V_{d,m} = \text{factor from Table 1c} \times (43)$													

(44)m=	92.89	89.52	86.14	82.76	79.38	76	76	79.38	82.76	86.14	89.52	92.89	
Total = Sum(44) _{1...12} =												1013.38	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	137.76	120.48	124.33	108.39	104.01	89.75	83.17	95.43	96.57	112.55	122.85	133.41	
Total = Sum(45) _{1...12} =												1328.7	(45)

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

(46)m=	20.66	18.07	18.65	16.26	15.6	13.46	12.47	14.32	14.49	16.88	18.43	20.01	(46)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

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

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):

Temperature factor from Table 2b

Energy lost from water storage, kWh/year $(48) \times (49) =$

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

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

If community heating see section 4.3

Volume factor from Table 2a

Temperature factor from Table 2b

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

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

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

TER WorkSheet: New dwelling design stage

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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	184.35	162.57	170.92	153.48	150.6	134.84	129.76	142.03	141.67	159.14	167.95	180.01	(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=	184.35	162.57	170.92	153.48	150.6	134.84	129.76	142.03	141.67	159.14	167.95	180.01	
Output from water heater (annual) _{1...12}												1877.32	(64)

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

(65)m=	83.08	73.73	78.62	72.11	71.86	65.92	64.93	69.01	68.18	74.7	76.92	81.64	(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=	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	(66)

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

(67)m=	17.47	15.52	12.62	9.55	7.14	6.03	6.52	8.47	11.37	14.43	16.84	17.96	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	185.07	186.99	182.15	171.84	158.84	146.62	138.45	136.53	141.37	151.67	164.68	176.9	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(69)m=	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	(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=	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	111.67	109.72	105.67	100.16	96.58	91.55	87.27	92.75	94.7	100.4	106.84	109.72	(72)
--------	--------	--------	--------	--------	-------	-------	-------	-------	------	-------	--------	--------	------

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

(73)m=	371.94	369.96	358.17	339.29	320.3	301.93	289.97	295.49	305.17	324.24	346.1	362.32	(73)
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	------

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)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

TER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	1.95	x	11.28	x	0.63	x	0.7	=	13.45	(75)
Northeast 0.9x	0.77	x	5.75	x	11.28	x	0.63	x	0.7	=	19.83	(75)
Northeast 0.9x	0.77	x	1.95	x	22.97	x	0.63	x	0.7	=	27.37	(75)
Northeast 0.9x	0.77	x	5.75	x	22.97	x	0.63	x	0.7	=	40.36	(75)
Northeast 0.9x	0.77	x	1.95	x	41.38	x	0.63	x	0.7	=	49.32	(75)
Northeast 0.9x	0.77	x	5.75	x	41.38	x	0.63	x	0.7	=	72.71	(75)
Northeast 0.9x	0.77	x	1.95	x	67.96	x	0.63	x	0.7	=	81	(75)
Northeast 0.9x	0.77	x	5.75	x	67.96	x	0.63	x	0.7	=	119.42	(75)
Northeast 0.9x	0.77	x	1.95	x	91.35	x	0.63	x	0.7	=	108.87	(75)
Northeast 0.9x	0.77	x	5.75	x	91.35	x	0.63	x	0.7	=	160.52	(75)
Northeast 0.9x	0.77	x	1.95	x	97.38	x	0.63	x	0.7	=	116.07	(75)
Northeast 0.9x	0.77	x	5.75	x	97.38	x	0.63	x	0.7	=	171.13	(75)
Northeast 0.9x	0.77	x	1.95	x	91.1	x	0.63	x	0.7	=	108.58	(75)
Northeast 0.9x	0.77	x	5.75	x	91.1	x	0.63	x	0.7	=	160.09	(75)
Northeast 0.9x	0.77	x	1.95	x	72.63	x	0.63	x	0.7	=	86.56	(75)
Northeast 0.9x	0.77	x	5.75	x	72.63	x	0.63	x	0.7	=	127.63	(75)
Northeast 0.9x	0.77	x	1.95	x	50.42	x	0.63	x	0.7	=	60.1	(75)
Northeast 0.9x	0.77	x	5.75	x	50.42	x	0.63	x	0.7	=	88.6	(75)
Northeast 0.9x	0.77	x	1.95	x	28.07	x	0.63	x	0.7	=	33.45	(75)
Northeast 0.9x	0.77	x	5.75	x	28.07	x	0.63	x	0.7	=	49.32	(75)
Northeast 0.9x	0.77	x	1.95	x	14.2	x	0.63	x	0.7	=	16.92	(75)
Northeast 0.9x	0.77	x	5.75	x	14.2	x	0.63	x	0.7	=	24.95	(75)
Northeast 0.9x	0.77	x	1.95	x	9.21	x	0.63	x	0.7	=	10.98	(75)
Northeast 0.9x	0.77	x	5.75	x	9.21	x	0.63	x	0.7	=	16.19	(75)

Solar gains in watts, calculated for each month

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

(83)m=	33.28	67.73	122.03	200.41	269.39	287.2	268.67	214.19	148.7	82.77	41.87	27.17	(83)
--------	-------	-------	--------	--------	--------	-------	--------	--------	-------	-------	-------	-------	------

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

(84)m=	405.22	437.69	480.2	539.71	589.69	589.13	558.64	509.68	453.87	407.02	387.96	389.49	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.88	0.71	0.54	0.61	0.87	0.98	1	1	(86)

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

(87)m=	19.82	19.93	20.16	20.5	20.8	20.95	20.99	20.98	20.86	20.5	20.11	19.81	(87)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	-------	-------	------

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

(88)m=	19.98	19.99	19.99	20	20	20.02	20.02	20.02	20.01	20	20	19.99	(88)
--------	-------	-------	-------	----	----	-------	-------	-------	-------	----	----	-------	------

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

(89)m=	1	0.99	0.99	0.95	0.84	0.62	0.43	0.49	0.8	0.97	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	-----	------	------	---	------

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

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(90)m=	18.41	18.58	18.92	19.41	19.8	19.99	20.01	20.01	19.9	19.42	18.85	18.4	(90)
$fLA = \text{Living area} \div (4) =$												0.39	(91)

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

(92)m=	18.95	19.1	19.4	19.83	20.19	20.36	20.39	20.39	20.27	19.84	19.34	18.94	(92)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.95	19.1	19.4	19.83	20.19	20.36	20.39	20.39	20.27	19.84	19.34	18.94	(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=	1	0.99	0.98	0.95	0.85	0.65	0.47	0.54	0.82	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	403.45	434.59	472.47	512.45	500.37	384.75	262.95	273.51	373.02	393.61	384.8	388.11	(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=	1066.73	1030.49	932.95	778.75	602.79	403.76	265.72	278.8	434.89	656.21	874.49	1059.61	(97)
--------	---------	---------	--------	--------	--------	--------	--------	-------	--------	--------	--------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	493.48	400.45	342.6	191.74	76.2	0	0	0	0	195.37	352.58	499.6	
$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} =$												2552.01	(98)

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

39.33	(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 93.5 (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)

493.48	400.45	342.6	191.74	76.2	0	0	0	0	195.37	352.58	499.6
--------	--------	-------	--------	------	---	---	---	---	--------	--------	-------

$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

527.79	428.28	366.41	205.07	81.5	0	0	0	0	208.96	377.09	534.33		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												2729.42	(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)

184.35	162.57	170.92	153.48	150.6	134.84	129.76	142.03	141.67	159.14	167.95	180.01
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Efficiency of water heater 79.8 (216)

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(217)m=

87.32	87.13	86.63	85.41	83.1	79.8	79.8	79.8	79.8	85.36	86.75	87.4
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 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

211.13	186.59	197.3	179.71	181.23	168.97	162.61	177.98	177.53	186.43	193.6	205.97
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

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

2229.04

 (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

308.56

(232)

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	= 589.56 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 481.47 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1071.03 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 160.14 (268)
Total CO2, kg/year		sum of (265)...(271) =	1270.09 (272)

TER =

19.58 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
Printed on 02 June 2017 at 09:40:33

Project Information:

Assessed By: David Lloyd (STRO006228)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 64.88m²

Site Reference : GPV Ph 6

Plot Reference: 2B D Mid (Comm Boiler NV PV)

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 17.16 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.99 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 41.5 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 31.6 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, TRVs	OK
Hot water controls:	No cylinder	
	No cylinder	

Regulations Compliance Report

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
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Based on:

Overshading:	Average or unknown	
Windows facing: North East	3.9m ²	
Windows facing: North East	5.75m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

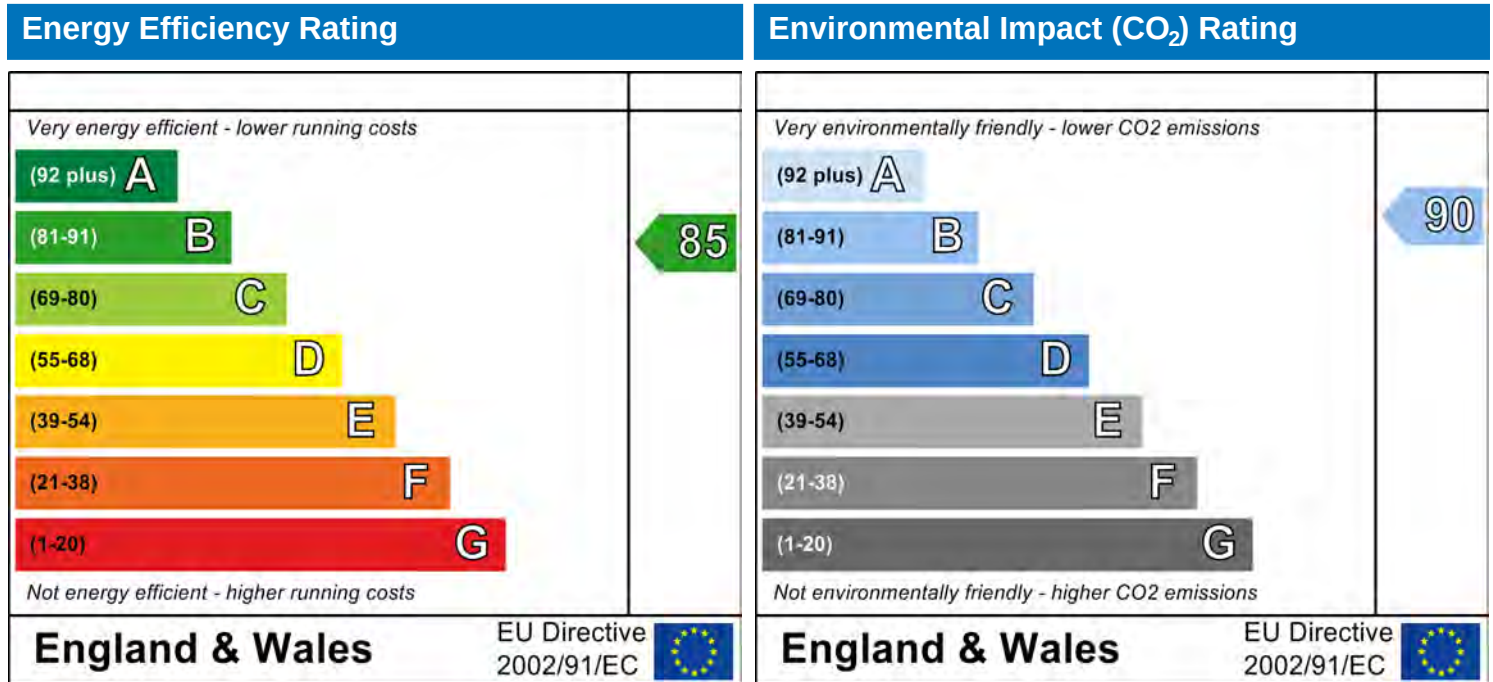
Air permeability	3.5 m ³ /m ² h	
Windows U-value	1 W/m ² K	
Doors U-value	1 W/m ² K	
Party Walls U-value	0 W/m ² K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

Predicted Energy Assessment

Dwelling type: Mid floor Flat
Date of assessment: 20 March 2017
Produced by: David Lloyd
Total floor area: 64.88 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B D Mid (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64.88 (1a) x	2.5 (2a) =	162.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.88 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	162.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				3 x 10 =	30 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18 (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 <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>			0 (11)
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			3.5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.36 (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) =		0.36 (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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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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DER WorkSheet: New dwelling design stage

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

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 0.6 0.58 0.57 0.56 0.56 0.56 0.56 0.57 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 0.57 0.56 0.56 0.56 0.56 0.57 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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x 1/[1/(1) + 0.04]	= 1.88		(27)
Windows Type 2			5.75	x 1/[1/(1) + 0.04]	= 5.53		(27)
Walls Type1	26.31	9.65	16.66	x 0.17	= 2.83		(29)
Walls Type2	31.59	1.95	29.64	x 0.19	= 5.74		(29)
Total area of elements, m²			57.9				(31)
Party wall			26.23	x 0	= 0		(32)
Party floor			64.88				(32a)
Party ceiling			64.88				(32b)
Internal wall **			129.5				(32c)

* 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) = 19.8 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 23477 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.06 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 25.86 (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
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DER WorkSheet: New dwelling design stage

(38)m=

32.4	32.18	31.97	30.96	30.77	29.89	29.89	29.73	30.23	30.77	31.15	31.55
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 (38)

Heat transfer coefficient, W/K

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

(39)m=

58.26	58.04	57.83	56.82	56.63	55.75	55.75	55.59	56.09	56.63	57.01	57.41
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Average = Sum(39)_{1...12} /12=

56.82

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.9	0.89	0.89	0.88	0.87	0.86	0.86	0.86	0.86	0.87	0.88	0.88
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Average = Sum(40)_{1...12} /12=

0.88

 (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

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

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
92.89	89.52	86.14	82.76	79.38	76	76	79.38	82.76	86.14	89.52	92.89

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)
Total = Sum(44)_{1...12} =

1013.38

 (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=

137.76	120.48	124.33	108.39	104.01	89.75	83.17	95.43	96.57	112.55	122.85	133.41
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Total = Sum(45)_{1...12} =

1328.7

 (45)

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

(46)m=

20.66	18.07	18.65	16.26	15.6	13.46	12.47	14.32	14.49	16.88	18.43	20.01
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 (46)

Water storage loss:

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

0

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

Temperature factor from Table 2b

0

Energy lost from water storage, kWh/year

(48) x (49) =

110

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

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

0.02

If community heating see section 4.3

Volume factor from Table 2a

1.03

Temperature factor from Table 2b

0.6

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

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

1.03

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
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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=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
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 (57)

DER WorkSheet: New dwelling design stage

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
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 (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
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 (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=

193.04	170.41	179.61	161.89	159.28	143.24	138.44	150.71	150.07	167.82	176.35	188.69
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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
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 (63)

Output from water heater

(64)m=

193.04	170.41	179.61	161.89	159.28	143.24	138.44	150.71	150.07	167.82	176.35	188.69
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Output from water heater (annual)_{1...12} 1979.54 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

90.03	80	85.56	78.84	78.8	72.64	71.87	75.95	74.91	81.64	83.64	88.58
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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
105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79

 (66)

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

(67)m=

17.47	15.52	12.62	9.55	7.14	6.03	6.52	8.47	11.37	14.43	16.84	17.96
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 (67)

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

(68)m=

185.07	186.99	182.15	171.84	158.84	146.62	138.45	136.53	141.37	151.67	164.68	176.9
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 (68)

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

(69)m=

33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58
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 (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=

-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63
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 (71)

Water heating gains (Table 5)

(72)m=

121	119.05	115	109.49	105.92	100.88	96.6	102.09	104.04	109.74	116.17	119.06
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 (72)

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

(73)m=

378.28	376.29	364.5	345.63	326.64	308.27	296.31	301.82	311.51	330.58	352.43	368.65
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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.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
Northeast 0.9x	0.77	1.95	11.28	0.76	0.7	16.22 (75)
Northeast 0.9x	0.77	5.75	11.28	0.76	0.7	23.92 (75)

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	1.95	x	22.97	x	0.76	x	0.7	=	33.02	(75)
Northeast 0.9x	0.77	x	5.75	x	22.97	x	0.76	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	1.95	x	41.38	x	0.76	x	0.7	=	59.5	(75)
Northeast 0.9x	0.77	x	5.75	x	41.38	x	0.76	x	0.7	=	87.72	(75)
Northeast 0.9x	0.77	x	1.95	x	67.96	x	0.76	x	0.7	=	97.71	(75)
Northeast 0.9x	0.77	x	5.75	x	67.96	x	0.76	x	0.7	=	144.06	(75)
Northeast 0.9x	0.77	x	1.95	x	91.35	x	0.76	x	0.7	=	131.34	(75)
Northeast 0.9x	0.77	x	5.75	x	91.35	x	0.76	x	0.7	=	193.64	(75)
Northeast 0.9x	0.77	x	1.95	x	97.38	x	0.76	x	0.7	=	140.02	(75)
Northeast 0.9x	0.77	x	5.75	x	97.38	x	0.76	x	0.7	=	206.44	(75)
Northeast 0.9x	0.77	x	1.95	x	91.1	x	0.76	x	0.7	=	130.99	(75)
Northeast 0.9x	0.77	x	5.75	x	91.1	x	0.76	x	0.7	=	193.12	(75)
Northeast 0.9x	0.77	x	1.95	x	72.63	x	0.76	x	0.7	=	104.43	(75)
Northeast 0.9x	0.77	x	5.75	x	72.63	x	0.76	x	0.7	=	153.96	(75)
Northeast 0.9x	0.77	x	1.95	x	50.42	x	0.76	x	0.7	=	72.5	(75)
Northeast 0.9x	0.77	x	5.75	x	50.42	x	0.76	x	0.7	=	106.89	(75)
Northeast 0.9x	0.77	x	1.95	x	28.07	x	0.76	x	0.7	=	40.36	(75)
Northeast 0.9x	0.77	x	5.75	x	28.07	x	0.76	x	0.7	=	59.5	(75)
Northeast 0.9x	0.77	x	1.95	x	14.2	x	0.76	x	0.7	=	20.41	(75)
Northeast 0.9x	0.77	x	5.75	x	14.2	x	0.76	x	0.7	=	30.1	(75)
Northeast 0.9x	0.77	x	1.95	x	9.21	x	0.76	x	0.7	=	13.25	(75)
Northeast 0.9x	0.77	x	5.75	x	9.21	x	0.76	x	0.7	=	19.53	(75)

Solar gains in watts, calculated for each month

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

(83)m=	40.14	81.71	147.21	241.77	324.98	346.47	324.11	258.39	179.38	99.86	50.51	32.78	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	418.42	458	511.72	587.4	651.62	654.73	620.42	560.21	490.89	430.43	402.94	401.44	(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 (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	(86)
	0.96	0.94	0.9	0.81	0.67	0.51	0.38	0.43	0.66	0.86	0.94	0.96	

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

(87)m=	19.27	19.48	19.86	20.36	20.73	20.92	20.98	20.96	20.81	20.33	19.74	19.24	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.19	20.19	20.2	20.2	20.2	20.2	20.19	20.19	20.18	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.95	0.93	0.89	0.79	0.63	0.45	0.32	0.37	0.61	0.84	0.93	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.84	18.14	18.69	19.4	19.89	20.13	20.18	20.18	20.01	19.38	18.53	17.81	(90)
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fLA = Living area ÷ (4) =

0.39 (91)

DER WorkSheet: New dwelling design stage

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

(92)m=	18.39	18.65	19.14	19.77	20.21	20.43	20.49	20.48	20.32	19.75	18.99	18.36	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.39	18.65	19.14	19.77	20.21	20.43	20.49	20.48	20.32	19.75	18.99	18.36	(93)
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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, h_m :

(94)m=	0.93	0.91	0.87	0.78	0.63	0.47	0.34	0.39	0.62	0.82	0.91	0.94	(94)
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Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	390.57	418.42	444.87	455.56	413.2	306.21	211.69	218.9	303.16	353.95	366.16	377.18	(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)
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	821.02	798.37	730.89	617.53	482.01	325.26	216.88	226.82	348.69	517.92	678.1	813.09	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	320.25	255.33	212.8	116.62	51.2	0	0	0	0	121.99	224.6	324.32	
--------	--------	--------	-------	--------	------	---	---	---	---	--------	-------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$ 1627.11 (98)

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

25.08 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) $\times$ (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1627.11

Space heat from Community boilers

(98) $\times$ (304a) $\times$ (305) $\times$ (306) =

1708.47 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) $\times$ (301) $\times$ 100 $\div$ (308) =

0 (309)

Water heating

Annual water heating requirement

1979.54

If DHW from community scheme:

Water heat from Community boilers

(64) $\times$ (303a) $\times$ (305) $\times$ (306) =

2078.52 (310a)

Electricity used for heat distribution

$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$ 37.87 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) $\div$ (314) =

0 (315)

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Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

0 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

$= (330a) + (330b) + (330g) =$

0 (331)

Energy for lighting (calculated in Appendix L)

308.56 (332)

Electricity generated by PVs (Appendix M) (negative quantity)

-204.68 (333)

Electricity generated by wind turbine (Appendix M) (negative quantity)

0 (334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		98.1 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	= 833.83 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 19.65 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 853.49 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		853.49 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 0 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 160.14 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$ -106.23 (380)
Total CO2, kg/year	sum of (376) ... (382) =		907.4 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		13.99 (384)
EI rating (section 14)			88.93 (385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B D Mid (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64.88 (1a) x	2.5 (2a) =	162.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.88 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	162.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				2 x 10 =	20 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12 (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 <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>			0 (11)
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)			0.37 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

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	0.35	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x1/[1/(1.4)+0.04]	= 2.59		(27)
Windows Type 2			5.75	x1/[1/(1.4)+0.04]	= 7.62		(27)
Walls Type1	26.31	9.65	16.66	x 0.18	= 3		(29)
Walls Type2	31.59	1.95	29.64	x 0.18	= 5.34		(29)
Total area of elements, m²			57.9				(31)
Party wall			26.23	x 0	= 0		(32)
Party floor			64.88				(32a)
Party ceiling			64.88				(32b)
Internal wall **			129.5				(32c)

* 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) = 23.08 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 23477 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.91 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 27.99 (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
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(38)m=

32.83	32.59	32.36	31.28	31.07	30.13	30.13	29.95	30.49	31.07	31.48	31.91
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (38)

Heat transfer coefficient, W/K

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

(39)m=

60.82	60.58	60.35	59.27	59.06	58.12	58.12	57.95	58.48	59.06	59.47	59.9
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

59.27 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.94	0.93	0.93	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.92
------	------	------	------	------	-----	-----	------	-----	------	------	------

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

0.91 (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

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

2.12 (42)

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

84.45 (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=

92.89	89.52	86.14	82.76	79.38	76	76	79.38	82.76	86.14	89.52	92.89
-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	-------

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

1013.38 (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=

137.76	120.48	124.33	108.39	104.01	89.75	83.17	95.43	96.57	112.55	122.85	133.41
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Total = Sum(45)_{1...12} =

1328.7 (45)

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

(46)m=

20.66	18.07	18.65	16.26	15.6	13.46	12.47	14.32	14.49	16.88	18.43	20.01
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 (46)

Water storage loss:

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

150 (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):

1.39 (48)

Temperature factor from Table 2b

0.54 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.75 (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)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0.75 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

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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=

184.35	162.57	170.92	153.48	150.6	134.84	129.76	142.03	141.67	159.14	167.95	180.01
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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=

184.35	162.57	170.92	153.48	150.6	134.84	129.76	142.03	141.67	159.14	167.95	180.01
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 1877.32 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

83.08	73.73	78.62	72.11	71.86	65.92	64.93	69.01	68.18	74.7	76.92	81.64
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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
105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79

 (66)

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

(67)m=

17.47	15.52	12.62	9.55	7.14	6.03	6.52	8.47	11.37	14.43	16.84	17.96
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 (67)

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

(68)m=

185.07	186.99	182.15	171.84	158.84	146.62	138.45	136.53	141.37	151.67	164.68	176.9
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (68)

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

(69)m=

33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

111.67	109.72	105.67	100.16	96.58	91.55	87.27	92.75	94.7	100.4	106.84	109.72
--------	--------	--------	--------	-------	-------	-------	-------	------	-------	--------	--------

 (72)

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

(73)m=

371.94	369.96	358.17	339.29	320.3	301.93	289.97	295.49	305.17	324.24	346.1	362.32
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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.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
Northeast 0.9x	0.77	1.95	11.28	0.63	0.7	13.45 (75)
Northeast 0.9x	0.77	5.75	11.28	0.63	0.7	19.83 (75)

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Northeast 0.9x	0.77	x	1.95	x	22.97	x	0.63	x	0.7	=	27.37	(75)
Northeast 0.9x	0.77	x	5.75	x	22.97	x	0.63	x	0.7	=	40.36	(75)
Northeast 0.9x	0.77	x	1.95	x	41.38	x	0.63	x	0.7	=	49.32	(75)
Northeast 0.9x	0.77	x	5.75	x	41.38	x	0.63	x	0.7	=	72.71	(75)
Northeast 0.9x	0.77	x	1.95	x	67.96	x	0.63	x	0.7	=	81	(75)
Northeast 0.9x	0.77	x	5.75	x	67.96	x	0.63	x	0.7	=	119.42	(75)
Northeast 0.9x	0.77	x	1.95	x	91.35	x	0.63	x	0.7	=	108.87	(75)
Northeast 0.9x	0.77	x	5.75	x	91.35	x	0.63	x	0.7	=	160.52	(75)
Northeast 0.9x	0.77	x	1.95	x	97.38	x	0.63	x	0.7	=	116.07	(75)
Northeast 0.9x	0.77	x	5.75	x	97.38	x	0.63	x	0.7	=	171.13	(75)
Northeast 0.9x	0.77	x	1.95	x	91.1	x	0.63	x	0.7	=	108.58	(75)
Northeast 0.9x	0.77	x	5.75	x	91.1	x	0.63	x	0.7	=	160.09	(75)
Northeast 0.9x	0.77	x	1.95	x	72.63	x	0.63	x	0.7	=	86.56	(75)
Northeast 0.9x	0.77	x	5.75	x	72.63	x	0.63	x	0.7	=	127.63	(75)
Northeast 0.9x	0.77	x	1.95	x	50.42	x	0.63	x	0.7	=	60.1	(75)
Northeast 0.9x	0.77	x	5.75	x	50.42	x	0.63	x	0.7	=	88.6	(75)
Northeast 0.9x	0.77	x	1.95	x	28.07	x	0.63	x	0.7	=	33.45	(75)
Northeast 0.9x	0.77	x	5.75	x	28.07	x	0.63	x	0.7	=	49.32	(75)
Northeast 0.9x	0.77	x	1.95	x	14.2	x	0.63	x	0.7	=	16.92	(75)
Northeast 0.9x	0.77	x	5.75	x	14.2	x	0.63	x	0.7	=	24.95	(75)
Northeast 0.9x	0.77	x	1.95	x	9.21	x	0.63	x	0.7	=	10.98	(75)
Northeast 0.9x	0.77	x	5.75	x	9.21	x	0.63	x	0.7	=	16.19	(75)

Solar gains in watts, calculated for each month

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

(83)m=	33.28	67.73	122.03	200.41	269.39	287.2	268.67	214.19	148.7	82.77	41.87	27.17	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	405.22	437.69	480.2	539.71	589.69	589.13	558.64	509.68	453.87	407.02	387.96	389.49	(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	(86)
	1	1	0.99	0.95	0.83	0.62	0.46	0.52	0.8	0.97	0.99	1	

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

(87)m=	20.08	20.19	20.4	20.69	20.91	20.99	21	21	20.94	20.67	20.33	20.07	(87)
--------	-------	-------	------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.14	20.14	20.14	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.15	20.15	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.93	0.78	0.54	0.37	0.43	0.74	0.96	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.9	19.06	19.37	19.79	20.07	20.16	20.17	20.17	20.12	19.77	19.29	18.89	(90)
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fLA = Living area ÷ (4) =

0.39 (91)

TER WorkSheet: New dwelling design stage

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

(92)m=	19.36	19.5	19.76	20.14	20.39	20.48	20.49	20.49	20.44	20.12	19.69	19.35	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.5	19.76	20.14	20.39	20.48	20.49	20.49	20.44	20.12	19.69	19.35	(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=	1	0.99	0.98	0.93	0.79	0.57	0.4	0.46	0.76	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	-----	------	------	------	------	---	------

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

(95)m=	403.43	434.32	470.88	502.8	467.7	336.72	225.58	235.89	344.99	389.5	384.43	388.11	(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 , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	915.72	884.25	800.47	666.11	513.42	341.82	226.09	237.01	370.65	562.16	748.85	907.37	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	381.14	302.35	245.22	117.58	34.02	0	0	0	0	128.46	262.38	386.33	
Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$												1857.48	(98)

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

28.63	(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

93.5	(206)
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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)

381.14	302.35	245.22	117.58	34.02	0	0	0	0	128.46	262.38	386.33	
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$$

407.64	323.37	262.26	125.75	36.38	0	0	0	0	137.39	280.62	413.18	
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

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

1986.6	(211)
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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	
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$$Total (kWh/year) = Sum(215)_{1...5,10...12} =$$

0	(215)
---	-------

Water heating

Output from water heater (calculated above)

184.35	162.57	170.92	153.48	150.6	134.84	129.76	142.03	141.67	159.14	167.95	180.01	
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Efficiency of water heater

79.8	(216)
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(217)m=	86.71	86.45	85.78	84.11	81.58	79.8	79.8	79.8	79.8	84.25	86	86.8	(217)
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Fuel for water heating, $kWh/month$

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	212.61	188.06	199.27	182.47	184.61	168.97	162.61	177.98	177.53	188.89	195.29	207.38	
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$$Total = Sum(219a)_{1...12} =$$

2245.67	(219)
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TER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		1986.6
Water heating fuel used		2245.67
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		308.56 (232)

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 =	429.11 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	485.06 (264)
Space and water heating	(261) + (262) + (263) + (264) =		914.17 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	160.14 (268)
Total CO2, kg/year		sum of (265)...(271) =	1113.24 (272)
TER =			17.16 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
 Printed on 02 June 2017 at 09:40:43

Project Information:

Assessed By: David Lloyd (STRO006228)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 64.88m²

Site Reference : GPV Ph 6

Plot Reference: 2B D Lwr (Comm Boiler NV PV)

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 20.36 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.57 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.1 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 39.3 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, TRVs	OK
Hot water controls:	No cylinder	
	No cylinder	

Regulations Compliance Report

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
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Based on:

Overshading:	Average or unknown	
Windows facing: North East	3.9m ²	
Windows facing: North East	5.75m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

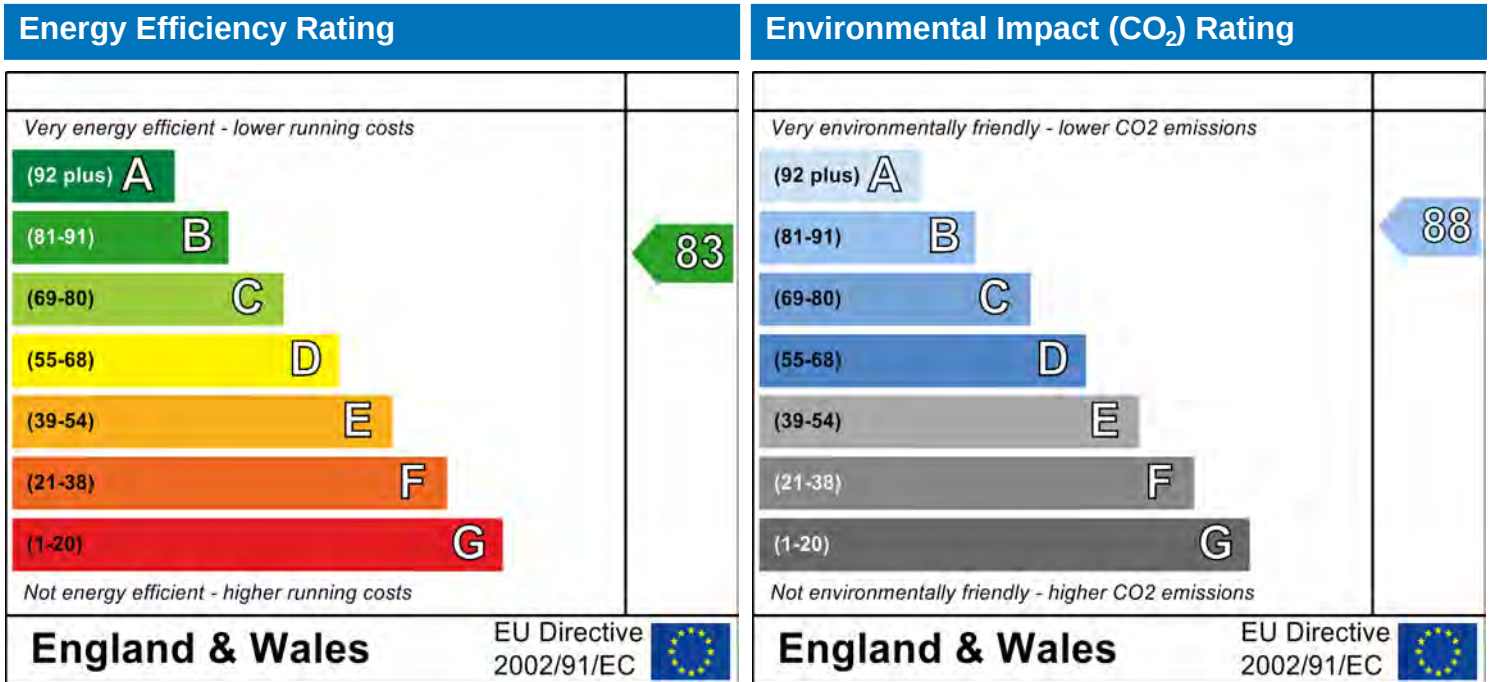
Air permeability	3.5 m ³ /m ² h	
Windows U-value	1 W/m ² K	
Doors U-value	1 W/m ² K	
Party Walls U-value	0 W/m ² K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

Predicted Energy Assessment

Dwelling type: Mid floor Flat
Date of assessment: 20 March 2017
Produced by: David Lloyd
Total floor area: 64.88 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B D Lwr (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64.88 (1a) x	2.5 (2a) =	162.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.88 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	162.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				3 x 10 =	30 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.18 (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 <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>		0 (11)
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		3.5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.36 (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) =	0.36 (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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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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DER WorkSheet: New dwelling design stage



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

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42
------	------	------	-----	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 0.6 0.58 0.57 0.56 0.56 0.56 0.56 0.57 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 0.57 0.56 0.56 0.56 0.56 0.57 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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x 1/[1/(1) + 0.04]	= 1.88		(27)
Windows Type 2			5.75	x 1/[1/(1) + 0.04]	= 5.53		(27)
Floor			64.88	x 0.15	= 9.732		(28)
Walls Type1	26.31	9.65	16.66	x 0.17	= 2.83		(29)
Walls Type2	31.59	1.95	29.64	x 0.19	= 5.74		(29)
Total area of elements, m²			122.78				(31)
Party wall			26.23	x 0	= 0		(32)
Party floor			64.88				(32a)
Party ceiling			64.88				(32b)
Internal wall **			129.5				(32c)

* 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) = 29.54 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 28343 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.1 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.4	32.18	31.97	30.96	30.77	29.89	29.89	29.73	30.23	30.77	31.15	31.55	(38)

Heat transfer coefficient, W/K

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

(39)m=	68.03	67.82	67.6	66.59	66.4	65.53	65.53	65.36	65.86	66.4	66.79	67.18	
Average = Sum(39) _{1...12} / 12 =												66.59	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.05	1.05	1.04	1.03	1.02	1.01	1.01	1.01	1.02	1.02	1.03	1.04	
Average = Sum(40) _{1...12} / 12 =												1.03	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

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	
(44)m=	92.89	89.52	86.14	82.76	79.38	76	76	79.38	82.76	86.14	89.52	92.89	
Total = Sum(44) _{1...12} =												1013.38	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	137.76	120.48	124.33	108.39	104.01	89.75	83.17	95.43	96.57	112.55	122.85	133.41	
Total = Sum(45) _{1...12} =												1328.7	(45)

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

(46)m=	20.66	18.07	18.65	16.26	15.6	13.46	12.47	14.32	14.49	16.88	18.43	20.01	(46)
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Water storage loss:

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

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):

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

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

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

If community heating see section 4.3

Volume factor from Table 2a

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

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

Water storage loss calculated for each month

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
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DER WorkSheet: New dwelling design stage

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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Primary circuit loss (annual) from Table 3	0	(58)
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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=	193.04	170.41	179.61	161.89	159.28	143.24	138.44	150.71	150.07	167.82	176.35	188.69	(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=	193.04	170.41	179.61	161.89	159.28	143.24	138.44	150.71	150.07	167.82	176.35	188.69	
Output from water heater (annual) _{1...12}												1979.54	(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=	90.03	80	85.56	78.84	78.8	72.64	71.87	75.95	74.91	81.64	83.64	88.58	(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=	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	(66)

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

(67)m=	17.47	15.52	12.62	9.55	7.14	6.03	6.52	8.47	11.37	14.43	16.84	17.96	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	185.07	186.99	182.15	171.84	158.84	146.62	138.45	136.53	141.37	151.67	164.68	176.9	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(69)m=	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	(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=	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	121	119.05	115	109.49	105.92	100.88	96.6	102.09	104.04	109.74	116.17	119.06	(72)
--------	-----	--------	-----	--------	--------	--------	------	--------	--------	--------	--------	--------	------

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

(73)m=	378.28	376.29	364.5	345.63	326.64	308.27	296.31	301.82	311.51	330.58	352.43	368.65	(73)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	1.95	x	11.28	x	0.76	x	0.7	=	16.22	(75)
Northeast 0.9x	0.77	x	5.75	x	11.28	x	0.76	x	0.7	=	23.92	(75)
Northeast 0.9x	0.77	x	1.95	x	22.97	x	0.76	x	0.7	=	33.02	(75)
Northeast 0.9x	0.77	x	5.75	x	22.97	x	0.76	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	1.95	x	41.38	x	0.76	x	0.7	=	59.5	(75)
Northeast 0.9x	0.77	x	5.75	x	41.38	x	0.76	x	0.7	=	87.72	(75)
Northeast 0.9x	0.77	x	1.95	x	67.96	x	0.76	x	0.7	=	97.71	(75)
Northeast 0.9x	0.77	x	5.75	x	67.96	x	0.76	x	0.7	=	144.06	(75)
Northeast 0.9x	0.77	x	1.95	x	91.35	x	0.76	x	0.7	=	131.34	(75)
Northeast 0.9x	0.77	x	5.75	x	91.35	x	0.76	x	0.7	=	193.64	(75)
Northeast 0.9x	0.77	x	1.95	x	97.38	x	0.76	x	0.7	=	140.02	(75)
Northeast 0.9x	0.77	x	5.75	x	97.38	x	0.76	x	0.7	=	206.44	(75)
Northeast 0.9x	0.77	x	1.95	x	91.1	x	0.76	x	0.7	=	130.99	(75)
Northeast 0.9x	0.77	x	5.75	x	91.1	x	0.76	x	0.7	=	193.12	(75)
Northeast 0.9x	0.77	x	1.95	x	72.63	x	0.76	x	0.7	=	104.43	(75)
Northeast 0.9x	0.77	x	5.75	x	72.63	x	0.76	x	0.7	=	153.96	(75)
Northeast 0.9x	0.77	x	1.95	x	50.42	x	0.76	x	0.7	=	72.5	(75)
Northeast 0.9x	0.77	x	5.75	x	50.42	x	0.76	x	0.7	=	106.89	(75)
Northeast 0.9x	0.77	x	1.95	x	28.07	x	0.76	x	0.7	=	40.36	(75)
Northeast 0.9x	0.77	x	5.75	x	28.07	x	0.76	x	0.7	=	59.5	(75)
Northeast 0.9x	0.77	x	1.95	x	14.2	x	0.76	x	0.7	=	20.41	(75)
Northeast 0.9x	0.77	x	5.75	x	14.2	x	0.76	x	0.7	=	30.1	(75)
Northeast 0.9x	0.77	x	1.95	x	9.21	x	0.76	x	0.7	=	13.25	(75)
Northeast 0.9x	0.77	x	5.75	x	9.21	x	0.76	x	0.7	=	19.53	(75)

Solar gains in watts, calculated for each month

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

(83)m=

40.14	81.71	147.21	241.77	324.98	346.47	324.11	258.39	179.38	99.86	50.51	32.78
-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------

 (83)

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

(84)m=

418.42	458	511.72	587.4	651.62	654.73	620.42	560.21	490.89	430.43	402.94	401.44
--------	-----	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

 (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
0.96	0.95	0.91	0.84	0.72	0.56	0.43	0.49	0.71	0.88	0.94	0.96

 (86)

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

(87)m=

18.9	19.12	19.53	20.1	20.57	20.85	20.95	20.92	20.69	20.1	19.42	18.87
------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------

 (87)

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

(88)m=

20.04	20.05	20.05	20.06	20.06	20.08	20.08	20.08	20.07	20.06	20.06	20.05
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

0.95	0.94	0.9	0.82	0.68	0.5	0.35	0.41	0.65	0.86	0.93	0.96
------	------	-----	------	------	-----	------	------	------	------	------	------

 (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=	17.23	17.55	18.14	18.95	19.58	19.94	20.04	20.02	19.76	18.97	18	17.2	(90)
$fLA = \text{Living area} \div (4) =$												0.39	(91)

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

(92)m=	17.88	18.15	18.68	19.4	19.96	20.29	20.39	20.37	20.12	19.41	18.55	17.84	(92)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.88	18.15	18.68	19.4	19.96	20.29	20.39	20.37	20.12	19.41	18.55	17.84	(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, h_m :

(94)m=	0.94	0.92	0.88	0.8	0.67	0.51	0.38	0.43	0.66	0.84	0.91	0.94	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(95)m=	391.45	420.37	449.76	468.42	437.36	335.98	236.82	242.97	321.8	360.71	368.17	377.83	(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, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	923.77	898.71	823.41	698.92	548.57	372.76	248.28	259.52	396.58	584.84	764.66	916.6	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	396.05	321.45	278	165.96	82.74	0	0	0	0	166.75	285.47	400.84	(98)
--------	--------	--------	-----	--------	-------	---	---	---	---	--------	--------	--------	------

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

2097.26

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

32.33

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0

Fraction of space heat from community system 1 – (301) =

1

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1

Fraction of total space heat from Community boilers

(302) $\times$ (303a) =

1

Factor for control and charging method (Table 4c(3)) for community heating system

1

Distribution loss factor (Table 12c) for community heating system

1.05

Space heating

Annual space heating requirement

kWh/year

2097.26

Space heat from Community boilers

(98) $\times$ (304a) $\times$ (305) $\times$ (306) =

2202.13

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0

Space heating requirement from secondary/supplementary system

(98) $\times$ (301) $\times$ 100 $\div$ (308) =

0

Water heating

Annual water heating requirement

1979.54

If DHW from community scheme:

Water heat from Community boilers

(64) $\times$ (303a) $\times$ (305) $\times$ (306) =

2078.52

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

42.81

DER WorkSheet: New dwelling design stage

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	0	(331)
Energy for lighting (calculated in Appendix L)		308.56	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-95.86	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	98.1	(367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	$=$ 942.53 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	$=$ 22.22 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		$=$ 964.74 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	$=$ 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	$=$ 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		964.74 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	$=$ 0 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	$=$ 160.14 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52 $\times 0.01 =$	-49.75 (380)
Total CO2, kg/year	sum of (376) ... (382) =		1075.13 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.57 (384)
EI rating (section 14)			86.89 (385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 2B D Lwr (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64.88 (1a) x	2.5 (2a) =	162.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.88 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	162.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				2 x 10 =	20 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20 ÷ (5) =	0.12 (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 <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>		0 (11)
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)		0.37 (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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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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TER WorkSheet: New dwelling design stage

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	0.35	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x1/[1/(1.4)+0.04]	= 2.59		(27)
Windows Type 2			5.75	x1/[1/(1.4)+0.04]	= 7.62		(27)
Floor			64.88	x 0.13	= 8.4344		(28)
Walls Type1	26.31	9.65	16.66	x 0.18	= 3		(29)
Walls Type2	31.59	1.95	29.64	x 0.18	= 5.34		(29)
Total area of elements, m²			122.78				(31)
Party wall			26.23	x 0	= 0		(32)
Party floor			64.88				(32a)
Party ceiling			64.88				(32b)
Internal wall **			129.5				(32c)

* 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) = 31.51 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 28343 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.37 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 43.88 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.83	32.59	32.36	31.28	31.07	30.13	30.13	29.95	30.49	31.07	31.48	31.91	(38)

Heat transfer coefficient, W/K

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.7	76.47	76.24	75.15	74.95	74.01	74.01	73.83	74.37	74.95	75.36	75.79	
Average = Sum(39) _{1...12} /12=												75.15	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.18	1.18	1.18	1.16	1.16	1.14	1.14	1.14	1.15	1.16	1.16	1.17	
Average = Sum(40) _{1...12} /12=												1.16	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

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	
(44)m=	92.89	89.52	86.14	82.76	79.38	76	76	79.38	82.76	86.14	89.52	92.89	
Total = Sum(44) _{1...12} =												1013.38	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	137.76	120.48	124.33	108.39	104.01	89.75	83.17	95.43	96.57	112.55	122.85	133.41	
Total = Sum(45) _{1...12} =												1328.7	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	20.66	18.07	18.65	16.26	15.6	13.46	12.47	14.32	14.49	16.88	18.43	20.01	(46)

Water storage loss:

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

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):

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

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

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

If community heating see section 4.3

Volume factor from Table 2a

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

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

Water storage loss calculated for each month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

TER WorkSheet: New dwelling design stage

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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	184.35	162.57	170.92	153.48	150.6	134.84	129.76	142.03	141.67	159.14	167.95	180.01	(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=	184.35	162.57	170.92	153.48	150.6	134.84	129.76	142.03	141.67	159.14	167.95	180.01	
Output from water heater (annual) _{1...12}												1877.32	(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=	83.08	73.73	78.62	72.11	71.86	65.92	64.93	69.01	68.18	74.7	76.92	81.64	(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=	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	(66)

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

(67)m=	17.47	15.52	12.62	9.55	7.14	6.03	6.52	8.47	11.37	14.43	16.84	17.96	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	185.07	186.99	182.15	171.84	158.84	146.62	138.45	136.53	141.37	151.67	164.68	176.9	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(69)m=	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	(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=	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	111.67	109.72	105.67	100.16	96.58	91.55	87.27	92.75	94.7	100.4	106.84	109.72	(72)
--------	--------	--------	--------	--------	-------	-------	-------	-------	------	-------	--------	--------	------

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

(73)m=	371.94	369.96	358.17	339.29	320.3	301.93	289.97	295.49	305.17	324.24	346.1	362.32	(73)
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	------

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)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

TER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	1.95	x	11.28	x	0.63	x	0.7	=	13.45	(75)
Northeast 0.9x	0.77	x	5.75	x	11.28	x	0.63	x	0.7	=	19.83	(75)
Northeast 0.9x	0.77	x	1.95	x	22.97	x	0.63	x	0.7	=	27.37	(75)
Northeast 0.9x	0.77	x	5.75	x	22.97	x	0.63	x	0.7	=	40.36	(75)
Northeast 0.9x	0.77	x	1.95	x	41.38	x	0.63	x	0.7	=	49.32	(75)
Northeast 0.9x	0.77	x	5.75	x	41.38	x	0.63	x	0.7	=	72.71	(75)
Northeast 0.9x	0.77	x	1.95	x	67.96	x	0.63	x	0.7	=	81	(75)
Northeast 0.9x	0.77	x	5.75	x	67.96	x	0.63	x	0.7	=	119.42	(75)
Northeast 0.9x	0.77	x	1.95	x	91.35	x	0.63	x	0.7	=	108.87	(75)
Northeast 0.9x	0.77	x	5.75	x	91.35	x	0.63	x	0.7	=	160.52	(75)
Northeast 0.9x	0.77	x	1.95	x	97.38	x	0.63	x	0.7	=	116.07	(75)
Northeast 0.9x	0.77	x	5.75	x	97.38	x	0.63	x	0.7	=	171.13	(75)
Northeast 0.9x	0.77	x	1.95	x	91.1	x	0.63	x	0.7	=	108.58	(75)
Northeast 0.9x	0.77	x	5.75	x	91.1	x	0.63	x	0.7	=	160.09	(75)
Northeast 0.9x	0.77	x	1.95	x	72.63	x	0.63	x	0.7	=	86.56	(75)
Northeast 0.9x	0.77	x	5.75	x	72.63	x	0.63	x	0.7	=	127.63	(75)
Northeast 0.9x	0.77	x	1.95	x	50.42	x	0.63	x	0.7	=	60.1	(75)
Northeast 0.9x	0.77	x	5.75	x	50.42	x	0.63	x	0.7	=	88.6	(75)
Northeast 0.9x	0.77	x	1.95	x	28.07	x	0.63	x	0.7	=	33.45	(75)
Northeast 0.9x	0.77	x	5.75	x	28.07	x	0.63	x	0.7	=	49.32	(75)
Northeast 0.9x	0.77	x	1.95	x	14.2	x	0.63	x	0.7	=	16.92	(75)
Northeast 0.9x	0.77	x	5.75	x	14.2	x	0.63	x	0.7	=	24.95	(75)
Northeast 0.9x	0.77	x	1.95	x	9.21	x	0.63	x	0.7	=	10.98	(75)
Northeast 0.9x	0.77	x	5.75	x	9.21	x	0.63	x	0.7	=	16.19	(75)

Solar gains in watts, calculated for each month

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

(83)m=	33.28	67.73	122.03	200.41	269.39	287.2	268.67	214.19	148.7	82.77	41.87	27.17	(83)
--------	-------	-------	--------	--------	--------	-------	--------	--------	-------	-------	-------	-------	------

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

(84)m=	405.22	437.69	480.2	539.71	589.69	589.13	558.64	509.68	453.87	407.02	387.96	389.49	(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	(86)
	1	1	0.99	0.97	0.89	0.73	0.57	0.64	0.88	0.98	1	1	

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

(87)m=	19.74	19.85	20.09	20.44	20.76	20.94	20.99	20.98	20.84	20.45	20.04	19.72	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.93	19.94	19.94	19.95	19.96	19.97	19.97	19.97	19.96	19.96	19.95	19.95	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.99	0.96	0.85	0.64	0.44	0.51	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)

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(90)m=	18.26	18.43	18.78	19.29	19.71	19.93	19.96	19.96	19.83	19.31	18.72	18.24	(90)
$fLA = \text{Living area} \div (4) =$													(91)
												0.39	

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

(92)m=	18.83	18.98	19.29	19.73	20.11	20.32	20.36	20.35	20.22	19.75	19.23	18.82	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.83	18.98	19.29	19.73	20.11	20.32	20.36	20.35	20.22	19.75	19.23	18.82	(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=	1	0.99	0.98	0.95	0.86	0.67	0.49	0.56	0.84	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	403.43	434.6	472.71	514.22	507.26	397.31	273.97	284.19	379.1	394.32	384.83	388.08	(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=	1114.48	1076.7	974.75	814.13	630.64	423.14	278.13	291.85	454.81	685.74	914.14	1107.74	(97)
--------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	529.02	431.49	373.52	215.94	91.79	0	0	0	0	216.81	381.1	535.43	
$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} =$													(98)
												2775.1	

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

(99)	42.77
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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 93.5 (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)

529.02	431.49	373.52	215.94	91.79	0	0	0	0	216.81	381.1	535.43
--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------

$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

565.8	461.49	399.48	230.95	98.17	0	0	0	0	231.88	407.59	572.65
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$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} =$ 2968.02 (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		
$\text{Total (kWh/year)} = \text{Sum}(215)_{1..5,10..12} =$													(215)
												0	

Water heating

Output from water heater (calculated above)

184.35	162.57	170.92	153.48	150.6	134.84	129.76	142.03	141.67	159.14	167.95	180.01
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Efficiency of water heater 79.8 (216)

TER WorkSheet: New dwelling design stage

(217)m=

87.47	87.3	86.84	85.72	83.54	79.8	79.8	79.8	79.8	85.64	86.93	87.55
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 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

210.76	186.23	196.82	179.04	180.27	168.97	162.61	177.98	177.53	185.83	193.19	205.61
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2224.84

 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

2968.02

Water heating fuel used

2224.84

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

308.56

 (232)

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 =	641.09 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	480.57 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1121.66 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	160.14 (268)
Total CO2, kg/year	sum of (265)...(271) =		1320.72 (272)

TER =

20.36

 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
Printed on 02 June 2017 at 09:40:53

Project Information:

Assessed By: David Lloyd (STRO006228)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 43.13m²

Site Reference : GPV Ph 6

Plot Reference: 1B A Mid (Comm Boiler NV PV)

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 18.33 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.50 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 35.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 27.6 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, TRVs	OK
Hot water controls:	No cylinder	
	No cylinder	

Regulations Compliance Report

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
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Based on:

Overshading:	Average or unknown	
Windows facing: South West	1.95m ²	
Windows facing: South West	5.75m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

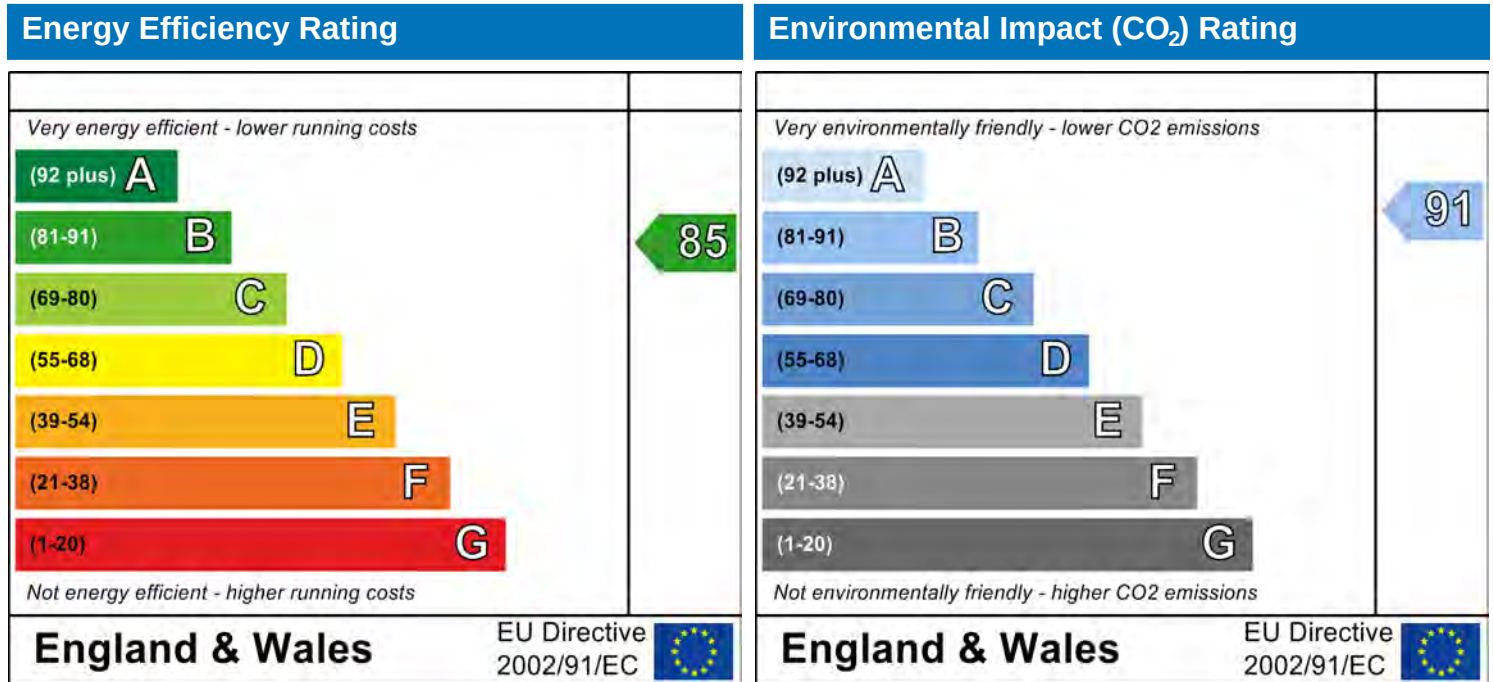
Air permeability	3.5 m ³ /m ² h	
Windows U-value	1 W/m ² K	
Doors U-value	1 W/m ² K	
Party Walls U-value	0 W/m ² K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

Predicted Energy Assessment

Dwelling type: Mid floor Flat
Date of assessment: 20 March 2017
Produced by: David Lloyd
Total floor area: 43.13 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 1B A Mid (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	43.13 (1a) x	2.5 (2a) =	107.83 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	43.13 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	107.83 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				2 x 10 =	20 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.19 (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 <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>			0 (11)
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			3.5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.36 (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) =		0.36 (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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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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DER WorkSheet: New dwelling design stage

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

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 0.6 0.58 0.58 0.56 0.56 0.56 0.56 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 0.56 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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x 1/[1/(1) + 0.04]	= 1.88		(27)
Windows Type 2			5.75	x 1/[1/(1) + 0.04]	= 5.53		(27)
Walls Type1	17.24	7.7	9.54	x 0.17	= 1.62		(29)
Walls Type2	17.24	1.95	15.29	x 0.19	= 2.96		(29)
Total area of elements, m²			34.48				(31)
Party wall			31.25	x 0	= 0		(32)
Party floor			43.09				(32a)
Party ceiling			43.09				(32b)
Internal wall **			129.5				(32c)

* 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) = 13.94 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 15826.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.26 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 18.2 (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
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DER WorkSheet: New dwelling design stage

(38)m=

21.55	21.4	21.26	20.59	20.46	19.88	19.88	19.77	20.1	20.46	20.72	20.98
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 (38)

Heat transfer coefficient, W/K

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

(39)m=

39.74	39.6	39.46	38.78	38.66	38.07	38.07	37.96	38.3	38.66	38.91	39.18
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Average = Sum(39)_{1...12} /12=

38.78

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.92	0.92	0.91	0.9	0.9	0.88	0.88	0.88	0.89	0.9	0.9	0.91
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Average = Sum(40)_{1...12} /12=

0.9

(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

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

1.49

(42)

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

69.63

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

(44)m=

76.59	73.81	71.02	68.24	65.45	62.67	62.67	65.45	68.24	71.02	73.81	76.59
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Total = Sum(44)_{1...12} =

835.56

(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=

113.59	99.34	102.51	89.37	85.76	74	68.57	78.69	79.63	92.8	101.3	110
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Total = Sum(45)_{1...12} =

1095.55

(45)

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

(46)m=

17.04	14.9	15.38	13.41	12.86	11.1	10.29	11.8	11.94	13.92	15.19	16.5
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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) =

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
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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=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
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 (57)

DER WorkSheet: New dwelling design stage

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
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 (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
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 (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=

168.86	149.27	157.79	142.87	141.03	127.49	123.85	133.96	133.12	148.07	154.79	165.28
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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
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 (63)

Output from water heater

(64)m=

168.86	149.27	157.79	142.87	141.03	127.49	123.85	133.96	133.12	148.07	154.79	165.28
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 1746.39 (64)

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

(65)m=

81.99	72.97	78.31	72.51	72.74	67.4	67.02	70.39	69.27	75.08	76.48	80.8
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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
74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59

 (66)

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

(67)m=

11.81	10.49	8.53	6.46	4.83	4.07	4.4	5.72	7.68	9.75	11.38	12.13
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 (67)

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

(68)m=

129.48	130.82	127.44	120.23	111.13	102.58	96.86	95.52	98.91	106.11	115.21	123.77
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 (68)

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

(69)m=

30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46
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 (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=

-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

110.2	108.59	105.25	100.71	97.76	93.61	90.08	94.6	96.21	100.91	106.22	108.6
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 (72)

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

(73)m=

296.86	295.27	286.59	272.77	259.09	245.64	236.73	241.22	248.17	262.15	278.19	289.87
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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.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
Southwest0.9x	0.77	1.95	36.79	0.76	0.7	26.45 (79)
Southwest0.9x	0.77	5.75	36.79	0.76	0.7	78 (79)

DER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	1.95	x	62.67	0.76	x	0.7	=	45.06	(79)
Southwest0.9x	0.77	x	5.75	x	62.67	0.76	x	0.7	=	132.86	(79)
Southwest0.9x	0.77	x	1.95	x	85.75	0.76	x	0.7	=	61.65	(79)
Southwest0.9x	0.77	x	5.75	x	85.75	0.76	x	0.7	=	181.79	(79)
Southwest0.9x	0.77	x	1.95	x	106.25	0.76	x	0.7	=	76.39	(79)
Southwest0.9x	0.77	x	5.75	x	106.25	0.76	x	0.7	=	225.24	(79)
Southwest0.9x	0.77	x	1.95	x	119.01	0.76	x	0.7	=	85.56	(79)
Southwest0.9x	0.77	x	5.75	x	119.01	0.76	x	0.7	=	252.29	(79)
Southwest0.9x	0.77	x	1.95	x	118.15	0.76	x	0.7	=	84.94	(79)
Southwest0.9x	0.77	x	5.75	x	118.15	0.76	x	0.7	=	250.46	(79)
Southwest0.9x	0.77	x	1.95	x	113.91	0.76	x	0.7	=	81.89	(79)
Southwest0.9x	0.77	x	5.75	x	113.91	0.76	x	0.7	=	241.47	(79)
Southwest0.9x	0.77	x	1.95	x	104.39	0.76	x	0.7	=	75.05	(79)
Southwest0.9x	0.77	x	5.75	x	104.39	0.76	x	0.7	=	221.3	(79)
Southwest0.9x	0.77	x	1.95	x	92.85	0.76	x	0.7	=	66.75	(79)
Southwest0.9x	0.77	x	5.75	x	92.85	0.76	x	0.7	=	196.84	(79)
Southwest0.9x	0.77	x	1.95	x	69.27	0.76	x	0.7	=	49.8	(79)
Southwest0.9x	0.77	x	5.75	x	69.27	0.76	x	0.7	=	146.84	(79)
Southwest0.9x	0.77	x	1.95	x	44.07	0.76	x	0.7	=	31.68	(79)
Southwest0.9x	0.77	x	5.75	x	44.07	0.76	x	0.7	=	93.42	(79)
Southwest0.9x	0.77	x	1.95	x	31.49	0.76	x	0.7	=	22.64	(79)
Southwest0.9x	0.77	x	5.75	x	31.49	0.76	x	0.7	=	66.75	(79)

Solar gains in watts, calculated for each month

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

(83)m=	104.45	177.92	243.43	301.63	337.85	335.4	323.37	296.34	263.59	196.64	125.11	89.39	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	401.31	473.19	530.03	574.4	596.94	581.04	560.09	537.57	511.76	458.79	403.3	379.26	(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 (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	(86)
	0.9	0.85	0.78	0.67	0.54	0.4	0.29	0.32	0.48	0.7	0.85	0.91	

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

(87)m=	19.64	19.94	20.28	20.62	20.84	20.95	20.99	20.98	20.92	20.64	20.1	19.59	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.17	20.17	20.18	20.18	20.18	20.18	20.17	20.17	20.16	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.89	0.83	0.76	0.64	0.51	0.36	0.24	0.26	0.43	0.67	0.83	0.9	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.35	18.77	19.25	19.72	20	20.14	20.17	20.17	20.1	19.75	19.02	18.28	(90)
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fLA = Living area ÷ (4) =

0.5 (91)

DER WorkSheet: New dwelling design stage

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

(92)m=	18.99	19.35	19.77	20.17	20.42	20.55	20.58	20.58	20.51	20.19	19.56	18.93	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.35	19.77	20.17	20.42	20.55	20.58	20.58	20.51	20.19	19.56	18.93	(93)
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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=	0.87	0.82	0.75	0.64	0.52	0.38	0.27	0.29	0.45	0.67	0.82	0.88	(94)
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Useful gains, $hmGm$, $W = (94)m \times (84)m$

(95)m=	349.12	386.78	395.8	369.53	308.92	218.84	149.6	156.06	231.53	306.91	329.79	334.81	(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)
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Heat loss rate for mean internal temperature, Lm , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	583.95	572.4	523.4	437.16	337.14	226.46	151.53	158.6	245.46	370.83	484.9	577.24	(97)
--------	--------	-------	-------	--------	--------	--------	--------	-------	--------	--------	-------	--------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	174.72	124.74	94.93	48.7	20.99	0	0	0	0	47.56	111.68	180.37	
--------	--------	--------	-------	------	-------	---	---	---	---	-------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$ 803.68 (98)

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

18.63 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

803.68

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

843.86 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

1746.39

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

1833.71 (310a)

Electricity used for heat distribution

$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$

26.78 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

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Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

0 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

0 (331)

Energy for lighting (calculated in Appendix L)

208.48 (332)

Electricity generated by PVs (Appendix M) (negative quantity)

-165.81 (333)

Electricity generated by wind turbine (Appendix M) (negative quantity)

0 (334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		98.1 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	= 589.56 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 13.9 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 603.45 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		603.45 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 0 (378)
CO2 associated with electricity for lighting	$(332)) \times$	0.52	= 108.2 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$ -86.06 (380)
Total CO2, kg/year	sum of (376)...(382) =		625.6 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.5 (384)
EI rating (section 14)			90.49 (385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 1B A Mid (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	43.13 (1a)	2.5 (2a)	107.83 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	43.13 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	107.83 (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				2	20 (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) =	20	÷ (5) =	0.19 (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 <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>			0 (11)
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)			0.44 (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) =		0.44 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

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

0.56	0.54	0.53	0.48	0.47	0.41	0.41	0.4	0.44	0.47	0.49	0.51
------	------	------	------	------	------	------	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.65 0.65 0.64 0.61 0.61 0.59 0.59 0.58 0.59 0.61 0.62 0.63 (24d)

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

(25)m= 0.65 0.65 0.64 0.61 0.61 0.59 0.59 0.58 0.59 0.61 0.62 0.63 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x1/[1/(1.4)+0.04]	= 2.59		(27)
Windows Type 2			5.75	x1/[1/(1.4)+0.04]	= 7.62		(27)
Walls Type1	17.24	7.7	9.54	x 0.18	= 1.72		(29)
Walls Type2	17.24	1.95	15.29	x 0.18	= 2.75		(29)
Total area of elements, m²			34.48				(31)
Party wall			31.25	x 0	= 0		(32)
Party floor			43.09				(32a)
Party ceiling			43.09				(32b)
Internal wall **			129.5				(32c)

* 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) = 16.63 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 15826.9 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.35 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 19.97 (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
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(38)m=

23.28	23.06	22.85	21.87	21.69	20.84	20.84	20.68	21.17	21.69	22.06	22.45
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (38)

Heat transfer coefficient, W/K

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

(39)m=

43.25	43.04	42.83	41.85	41.66	40.81	40.81	40.65	41.14	41.66	42.03	42.42
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

41.85

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1	1	0.99	0.97	0.97	0.95	0.95	0.94	0.95	0.97	0.97	0.98
---	---	------	------	------	------	------	------	------	------	------	------

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

0.97

(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

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

1.49

(42)

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

69.63

(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=

76.59	73.81	71.02	68.24	65.45	62.67	62.67	65.45	68.24	71.02	73.81	76.59
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

835.56

(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=

113.59	99.34	102.51	89.37	85.76	74	68.57	78.69	79.63	92.8	101.3	110
--------	-------	--------	-------	-------	----	-------	-------	-------	------	-------	-----

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

1095.55

(45)

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

(46)m=

17.04	14.9	15.38	13.41	12.86	11.1	10.29	11.8	11.94	13.92	15.19	16.5
-------	------	-------	-------	-------	------	-------	------	-------	-------	-------	------

 (46)

Water storage loss:

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

150

(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):

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.75

(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)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

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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=

160.18	141.43	149.11	134.46	132.35	119.09	115.17	125.28	124.72	139.39	146.39	156.6
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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=

160.18	141.43	149.11	134.46	132.35	119.09	115.17	125.28	124.72	139.39	146.39	156.6
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

1644.17

(64)

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

(65)m=

75.04	66.7	71.36	65.79	65.79	60.68	60.08	63.44	62.55	68.13	69.75	73.85
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59

(66)

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

(67)m=

11.81	10.49	8.53	6.46	4.83	4.07	4.4	5.72	7.68	9.75	11.38	12.13
-------	-------	------	------	------	------	-----	------	------	------	-------	-------

(67)

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

(68)m=

129.48	130.82	127.44	120.23	111.13	102.58	96.86	95.52	98.91	106.11	115.21	123.77
--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	--------	--------

(68)

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

(69)m=

30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

100.86	99.26	95.92	91.37	88.43	84.28	80.75	85.27	86.87	91.57	96.88	99.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

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

(73)m=

290.52	288.94	280.26	266.44	252.76	239.3	230.39	234.89	241.84	255.82	271.85	283.54
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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.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
Southwest0.9x	0.77	1.95	36.79	0.63	0.7	21.93
Southwest0.9x	0.77	5.75	36.79	0.63	0.7	64.66

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Southwest0.9x	0.77	x	1.95	x	62.67	0.63	x	0.7	=	37.35	(79)
Southwest0.9x	0.77	x	5.75	x	62.67	0.63	x	0.7	=	110.13	(79)
Southwest0.9x	0.77	x	1.95	x	85.75	0.63	x	0.7	=	51.1	(79)
Southwest0.9x	0.77	x	5.75	x	85.75	0.63	x	0.7	=	150.69	(79)
Southwest0.9x	0.77	x	1.95	x	106.25	0.63	x	0.7	=	63.32	(79)
Southwest0.9x	0.77	x	5.75	x	106.25	0.63	x	0.7	=	186.71	(79)
Southwest0.9x	0.77	x	1.95	x	119.01	0.63	x	0.7	=	70.92	(79)
Southwest0.9x	0.77	x	5.75	x	119.01	0.63	x	0.7	=	209.13	(79)
Southwest0.9x	0.77	x	1.95	x	118.15	0.63	x	0.7	=	70.41	(79)
Southwest0.9x	0.77	x	5.75	x	118.15	0.63	x	0.7	=	207.62	(79)
Southwest0.9x	0.77	x	1.95	x	113.91	0.63	x	0.7	=	67.88	(79)
Southwest0.9x	0.77	x	5.75	x	113.91	0.63	x	0.7	=	200.17	(79)
Southwest0.9x	0.77	x	1.95	x	104.39	0.63	x	0.7	=	62.21	(79)
Southwest0.9x	0.77	x	5.75	x	104.39	0.63	x	0.7	=	183.44	(79)
Southwest0.9x	0.77	x	1.95	x	92.85	0.63	x	0.7	=	55.33	(79)
Southwest0.9x	0.77	x	5.75	x	92.85	0.63	x	0.7	=	163.17	(79)
Southwest0.9x	0.77	x	1.95	x	69.27	0.63	x	0.7	=	41.28	(79)
Southwest0.9x	0.77	x	5.75	x	69.27	0.63	x	0.7	=	121.72	(79)
Southwest0.9x	0.77	x	1.95	x	44.07	0.63	x	0.7	=	26.26	(79)
Southwest0.9x	0.77	x	5.75	x	44.07	0.63	x	0.7	=	77.44	(79)
Southwest0.9x	0.77	x	1.95	x	31.49	0.63	x	0.7	=	18.77	(79)
Southwest0.9x	0.77	x	5.75	x	31.49	0.63	x	0.7	=	55.33	(79)

Solar gains in watts, calculated for each month

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

(83)m=	86.58	147.48	201.79	250.03	280.06	278.03	268.05	245.65	218.5	163	103.71	74.1	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-----	--------	------	------

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

(84)m=	377.11	436.42	482.05	516.47	532.82	517.34	498.44	480.54	460.34	418.82	375.56	357.64	(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	(86)
	0.99	0.97	0.93	0.84	0.69	0.5	0.36	0.39	0.6	0.87	0.97	0.99	

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

(87)m=	20.22	20.4	20.62	20.84	20.96	20.99	21	21	20.98	20.84	20.51	20.19	(87)
--------	-------	------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.08	20.09	20.09	20.11	20.11	20.13	20.13	20.13	20.12	20.11	20.1	20.1	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------

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

(89)m=	0.98	0.96	0.92	0.81	0.64	0.43	0.29	0.32	0.53	0.83	0.96	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	19.06	19.32	19.63	19.94	20.07	20.13	20.13	20.13	20.11	19.95	19.49	19.04	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.5 (91)

TER WorkSheet: New dwelling design stage

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

(92)m=	19.64	19.86	20.12	20.39	20.52	20.56	20.56	20.56	20.55	20.39	20	19.62	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------

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

(93)m=	19.64	19.86	20.12	20.39	20.52	20.56	20.56	20.56	20.55	20.39	20	19.62	(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	0.82	0.66	0.47	0.32	0.35	0.57	0.84	0.96	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	370.12	419.44	442.56	423.59	352.92	241.69	161.6	169.07	260.7	352.43	360.31	352.37	(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, Lm , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	663.36	643.77	583.46	480.79	367.29	243.21	161.75	169.3	265.26	408.09	542.18	654.03	(97)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	218.17	150.74	104.83	41.18	10.69	0	0	0	0	41.41	130.95	224.43	
Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$												922.41	(98)

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

21.39	(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

93.5	(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)

218.17	150.74	104.83	41.18	10.69	0	0	0	0	41.41	130.95	224.43	
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$$

233.33	161.22	112.12	44.05	11.44	0	0	0	0	44.29	140.05	240.03	
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

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

986.53	(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)

160.18	141.43	149.11	134.46	132.35	119.09	115.17	125.28	124.72	139.39	146.39	156.6	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--

Efficiency of water heater

79.8	(216)
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$$(217)m =$$

85.64	84.98	83.89	82.08	80.51	79.8	79.8	79.8	79.8	82.02	84.52	85.77	
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	--

Fuel for water heating, $kWh/month$

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	187.04	166.42	177.73	163.83	164.39	149.24	144.32	157	156.29	169.95	173.2	182.57	
Total = $Sum(219a)_{1...12} =$												1991.97	(219)

TER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		986.53
Water heating fuel used		1991.97
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		208.48 (232)

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 =	213.09 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	430.27 (264)
Space and water heating	(261) + (262) + (263) + (264) =		643.36 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	108.2 (268)
Total CO2, kg/year		sum of (265)...(271) =	790.49 (272)

TER = 18.33 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.7
 Printed on 02 June 2017 at 09:41:03

Project Information:

Assessed By: David Lloyd (STRO006228)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 43.13m²

Site Reference : GPV Ph 6

Plot Reference: 1B A Lwr (Comm Boiler NV PV)

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 21.47 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.10 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 51.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 36.0 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.00 (max. 2.00)	1.00 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, TRVs	OK
Hot water controls:	No cylinder	
	No cylinder	

Regulations Compliance Report

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
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Based on:

Overshading:	Average or unknown
Windows facing: South West	1.95m ²
Windows facing: South West	5.75m ²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

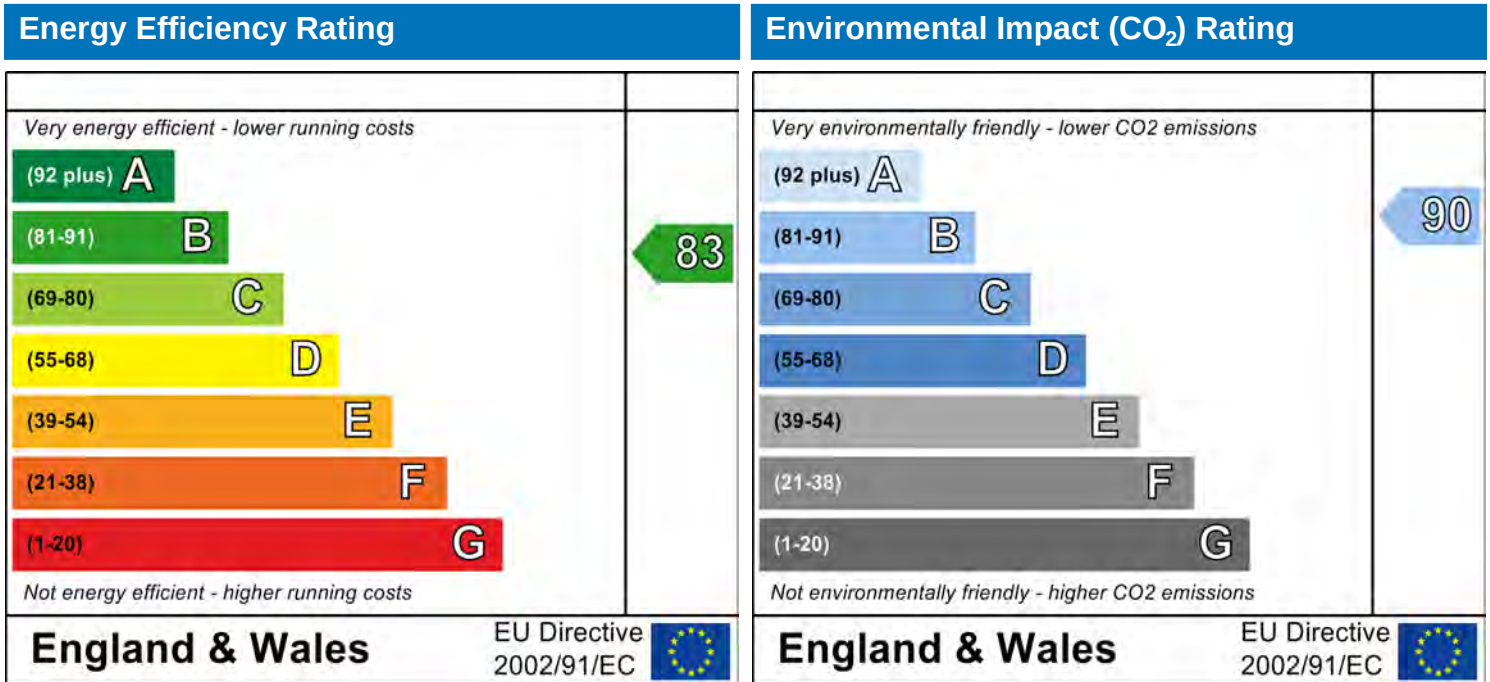
Air permeability	3.5 m ³ /m ² h
Windows U-value	1 W/m ² K
Doors U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Community heating, heat from boilers – mains gas	
Photovoltaic array	

Predicted Energy Assessment

Dwelling type: Mid floor Flat
Date of assessment: 20 March 2017
Produced by: David Lloyd
Total floor area: 43.13 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 1B A Lwr (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	43.13 (1a)	2.5 (2a)	107.83 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	43.13 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	107.83 (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				2	20 (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) =	20	÷ (5) =	0.19 (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 <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>			0 (11)
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			3.5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.36 (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) =		0.36 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage

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

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42
------	------	------	-----	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0.6 0.6 0.58 0.58 0.56 0.56 0.56 0.56 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 0.56 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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x 1/[1/(1) + 0.04]	= 1.88		(27)
Windows Type 2			5.75	x 1/[1/(1) + 0.04]	= 5.53		(27)
Floor			43.13	x 0.15	= 6.469501		(28)
Walls Type1	17.24	7.7	9.54	x 0.17	= 1.62		(29)
Walls Type2	17.24	1.95	15.29	x 0.19	= 2.96		(29)
Total area of elements, m²			77.61				(31)
Party wall			31.25	x 0	= 0		(32)
Party floor			43.09				(32a)
Party ceiling			43.09				(32b)
Internal wall **			129.5				(32c)

* 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) = 20.41 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19061.65 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.29 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 25.7 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.55	21.4	21.26	20.59	20.46	19.88	19.88	19.77	20.1	20.46	20.72	20.98	(38)

Heat transfer coefficient, W/K

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	47.25	47.1	46.96	46.29	46.16	45.58	45.58	45.47	45.8	46.16	46.42	46.68	
Average = Sum(39) _{1...12} /12=												46.29	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.1	1.09	1.09	1.07	1.07	1.06	1.06	1.05	1.06	1.07	1.08	1.08	
Average = Sum(40) _{1...12} /12=												1.07	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

1.49

(42)

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

69.63

(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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	76.59	73.81	71.02	68.24	65.45	62.67	62.67	65.45	68.24	71.02	73.81	76.59	
Total = Sum(44) _{1...12} =												835.56	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	113.59	99.34	102.51	89.37	85.76	74	68.57	78.69	79.63	92.8	101.3	110	
Total = Sum(45) _{1...12} =												1095.55	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	17.04	14.9	15.38	13.41	12.86	11.1	10.29	11.8	11.94	13.92	15.19	16.5	(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

$$(48) \times (49) =$$

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

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

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
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Primary circuit loss (annual) from Table 3	0	(58)
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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=	168.86	149.27	157.79	142.87	141.03	127.49	123.85	133.96	133.12	148.07	154.79	165.28	(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=	168.86	149.27	157.79	142.87	141.03	127.49	123.85	133.96	133.12	148.07	154.79	165.28	
Output from water heater (annual) _{1...12}												1746.39	(64)

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

(65)m=	81.99	72.97	78.31	72.51	72.74	67.4	67.02	70.39	69.27	75.08	76.48	80.8	(65)
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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=	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	(66)

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

(67)m=	11.81	10.49	8.53	6.46	4.83	4.07	4.4	5.72	7.68	9.75	11.38	12.13	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	129.48	130.82	127.44	120.23	111.13	102.58	96.86	95.52	98.91	106.11	115.21	123.77	(68)
--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	--------	--------	------

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

(69)m=	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	(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=	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	110.2	108.59	105.25	100.71	97.76	93.61	90.08	94.6	96.21	100.91	106.22	108.6	(72)
--------	-------	--------	--------	--------	-------	-------	-------	------	-------	--------	--------	-------	------

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

(73)m=	296.86	295.27	286.59	272.77	259.09	245.64	236.73	241.22	248.17	262.15	278.19	289.87	(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)
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DER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	1.95	x	36.79	0.76	x	0.7	=	26.45	(79)
Southwest0.9x	0.77	x	5.75	x	36.79	0.76	x	0.7	=	78	(79)
Southwest0.9x	0.77	x	1.95	x	62.67	0.76	x	0.7	=	45.06	(79)
Southwest0.9x	0.77	x	5.75	x	62.67	0.76	x	0.7	=	132.86	(79)
Southwest0.9x	0.77	x	1.95	x	85.75	0.76	x	0.7	=	61.65	(79)
Southwest0.9x	0.77	x	5.75	x	85.75	0.76	x	0.7	=	181.79	(79)
Southwest0.9x	0.77	x	1.95	x	106.25	0.76	x	0.7	=	76.39	(79)
Southwest0.9x	0.77	x	5.75	x	106.25	0.76	x	0.7	=	225.24	(79)
Southwest0.9x	0.77	x	1.95	x	119.01	0.76	x	0.7	=	85.56	(79)
Southwest0.9x	0.77	x	5.75	x	119.01	0.76	x	0.7	=	252.29	(79)
Southwest0.9x	0.77	x	1.95	x	118.15	0.76	x	0.7	=	84.94	(79)
Southwest0.9x	0.77	x	5.75	x	118.15	0.76	x	0.7	=	250.46	(79)
Southwest0.9x	0.77	x	1.95	x	113.91	0.76	x	0.7	=	81.89	(79)
Southwest0.9x	0.77	x	5.75	x	113.91	0.76	x	0.7	=	241.47	(79)
Southwest0.9x	0.77	x	1.95	x	104.39	0.76	x	0.7	=	75.05	(79)
Southwest0.9x	0.77	x	5.75	x	104.39	0.76	x	0.7	=	221.3	(79)
Southwest0.9x	0.77	x	1.95	x	92.85	0.76	x	0.7	=	66.75	(79)
Southwest0.9x	0.77	x	5.75	x	92.85	0.76	x	0.7	=	196.84	(79)
Southwest0.9x	0.77	x	1.95	x	69.27	0.76	x	0.7	=	49.8	(79)
Southwest0.9x	0.77	x	5.75	x	69.27	0.76	x	0.7	=	146.84	(79)
Southwest0.9x	0.77	x	1.95	x	44.07	0.76	x	0.7	=	31.68	(79)
Southwest0.9x	0.77	x	5.75	x	44.07	0.76	x	0.7	=	93.42	(79)
Southwest0.9x	0.77	x	1.95	x	31.49	0.76	x	0.7	=	22.64	(79)
Southwest0.9x	0.77	x	5.75	x	31.49	0.76	x	0.7	=	66.75	(79)

Solar gains in watts, calculated for each month

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

(83)m=	104.45	177.92	243.43	301.63	337.85	335.4	323.37	296.34	263.59	196.64	125.11	89.39	(83)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	401.31	473.19	530.03	574.4	596.94	581.04	560.09	537.57	511.76	458.79	403.3	379.26	(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 (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	(86)
	0.91	0.87	0.81	0.72	0.6	0.46	0.34	0.37	0.54	0.75	0.87	0.92	

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

(87)m=	19.22	19.54	19.94	20.38	20.7	20.9	20.97	20.96	20.84	20.42	19.75	19.16	(87)
--------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20	20.01	20.01	20.02	20.03	20.04	20.04	20.04	20.03	20.03	20.02	20.02	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.86	0.79	0.69	0.56	0.4	0.27	0.3	0.48	0.71	0.86	0.91	(89)
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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=	17.65	18.11	18.68	19.29	19.71	19.95	20.01	20.01	19.88	19.35	18.44	17.58	(90)
fLA = Living area ÷ (4) =												0.5	(91)

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

(92)m=	18.43	18.82	19.31	19.83	20.21	20.42	20.49	20.48	20.36	19.88	19.09	18.37	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.43	18.82	19.31	19.83	20.21	20.42	20.49	20.48	20.36	19.88	19.09	18.37	(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=	0.88	0.84	0.77	0.68	0.57	0.43	0.31	0.33	0.5	0.71	0.84	0.89	(94)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

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

(95)m=	353.29	395.19	410.33	392.75	338.47	247.78	172.14	179.08	257.55	324.12	337.13	338.23	(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=	667.84	655.9	601.57	506.09	392.64	265.39	177.32	185.69	286.54	428.52	556.75	661.39	(97)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(98)m=	234.02	175.2	142.28	81.6	40.3	0	0	0	0	77.67	158.13	240.44	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												1149.64	(98)

Space heating requirement in kWh/m²/year

26.66	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
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Fraction of space heat from community system 1 – (301) =

1	(302)
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The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)
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Fraction of total space heat from Community boilers

(302) x (303a) =

1	(304a)
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Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
---	-------

Distribution loss factor (Table 12c) for community heating system

1.05	(306)
------	-------

Space heating

Annual space heating requirement

kWh/year

1149.64

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

1207.13	(307a)
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Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)
---	-------

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0	(309)
---	-------

Water heating

Annual water heating requirement

1746.39

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

1833.71	(310a)
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Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

30.41	(313)
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DER WorkSheet: New dwelling design stage

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	0	(331)
Energy for lighting (calculated in Appendix L)		208.48	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-107.95	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	98.1	(367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	$=$ 669.54 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	$=$ 15.78 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		$=$ 685.32 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	$=$ 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	$=$ 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		685.32 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	$=$ 0 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	$=$ 108.2 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52 $\times 0.01 =$	-56.03 (380)
Total CO2, kg/year	sum of (376) ... (382) =		737.5 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.1 (384)
EI rating (section 14)			88.79 (385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: David Lloyd **Stroma Number:** STRO006228
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 1B A Lwr (Comm Boiler NV PV)

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	43.13 (1a) x	2.5 (2a) =	107.83 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	43.13 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	107.83 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				2 x 10 =	20 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.19 (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 <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>			0 (11)
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)			0.44 (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) =		0.44 (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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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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TER WorkSheet: New dwelling design stage

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

0.56	0.54	0.53	0.48	0.47	0.41	0.41	0.4	0.44	0.47	0.49	0.51
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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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.65 0.65 0.64 0.61 0.61 0.59 0.59 0.58 0.59 0.61 0.62 0.63 (24d)

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

(25)m= 0.65 0.65 0.64 0.61 0.61 0.59 0.59 0.58 0.59 0.61 0.62 0.63 (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			1.95	x 1	= 1.95		(26)
Windows Type 1			1.95	x 1/[1/(1.4)+0.04]	= 2.59		(27)
Windows Type 2			5.75	x 1/[1/(1.4)+0.04]	= 7.62		(27)
Floor			43.13	x 0.13	= 5.6069		(28)
Walls Type1	17.24	7.7	9.54	x 0.18	= 1.72		(29)
Walls Type2	17.24	1.95	15.29	x 0.18	= 2.75		(29)
Total area of elements, m²			77.61				(31)
Party wall			31.25	x 0	= 0		(32)
Party floor			43.09				(32a)
Party ceiling			43.09				(32b)
Internal wall **			129.5				(32c)

* 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) = 22.23 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19061.65 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.79 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 31.03 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	23.28	23.06	22.85	21.87	21.69	20.84	20.84	20.68	21.17	21.69	22.06	22.45	(38)

Heat transfer coefficient, W/K

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	54.3	54.09	53.88	52.9	52.72	51.86	51.86	51.71	52.19	52.72	53.09	53.48	
Average = Sum(39) _{1...12} /12=												52.9	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.26	1.25	1.25	1.23	1.22	1.2	1.2	1.2	1.21	1.22	1.23	1.24	
Average = Sum(40) _{1...12} /12=												1.23	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

1.49 (42)

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

69.63 (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 $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	76.59	73.81	71.02	68.24	65.45	62.67	62.67	65.45	68.24	71.02	73.81	76.59	
Total = Sum(44) _{1...12} =												835.56	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	113.59	99.34	102.51	89.37	85.76	74	68.57	78.69	79.63	92.8	101.3	110	
Total = Sum(45) _{1...12} =												1095.55	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	17.04	14.9	15.38	13.41	12.86	11.1	10.29	11.8	11.94	13.92	15.19	16.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

TER WorkSheet: New dwelling design stage

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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	160.18	141.43	149.11	134.46	132.35	119.09	115.17	125.28	124.72	139.39	146.39	156.6	(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=	160.18	141.43	149.11	134.46	132.35	119.09	115.17	125.28	124.72	139.39	146.39	156.6	
Output from water heater (annual) ^{1...12}												1644.17	(64)

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

(65)m=	75.04	66.7	71.36	65.79	65.79	60.68	60.08	63.44	62.55	68.13	69.75	73.85	(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=	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	74.59	(66)

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

(67)m=	11.81	10.49	8.53	6.46	4.83	4.07	4.4	5.72	7.68	9.75	11.38	12.13	(67)
--------	-------	-------	------	------	------	------	-----	------	------	------	-------	-------	------

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

(68)m=	129.48	130.82	127.44	120.23	111.13	102.58	96.86	95.52	98.91	106.11	115.21	123.77	(68)
--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	--------	--------	------

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

(69)m=	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	30.46	(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=	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	-59.67	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	100.86	99.26	95.92	91.37	88.43	84.28	80.75	85.27	86.87	91.57	96.88	99.26	(72)
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	290.52	288.94	280.26	266.44	252.76	239.3	230.39	234.89	241.84	255.82	271.85	283.54	(73)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	------

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)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

TER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	1.95	x	36.79	0.63	x	0.7	=	21.93	(79)
Southwest0.9x	0.77	x	5.75	x	36.79	0.63	x	0.7	=	64.66	(79)
Southwest0.9x	0.77	x	1.95	x	62.67	0.63	x	0.7	=	37.35	(79)
Southwest0.9x	0.77	x	5.75	x	62.67	0.63	x	0.7	=	110.13	(79)
Southwest0.9x	0.77	x	1.95	x	85.75	0.63	x	0.7	=	51.1	(79)
Southwest0.9x	0.77	x	5.75	x	85.75	0.63	x	0.7	=	150.69	(79)
Southwest0.9x	0.77	x	1.95	x	106.25	0.63	x	0.7	=	63.32	(79)
Southwest0.9x	0.77	x	5.75	x	106.25	0.63	x	0.7	=	186.71	(79)
Southwest0.9x	0.77	x	1.95	x	119.01	0.63	x	0.7	=	70.92	(79)
Southwest0.9x	0.77	x	5.75	x	119.01	0.63	x	0.7	=	209.13	(79)
Southwest0.9x	0.77	x	1.95	x	118.15	0.63	x	0.7	=	70.41	(79)
Southwest0.9x	0.77	x	5.75	x	118.15	0.63	x	0.7	=	207.62	(79)
Southwest0.9x	0.77	x	1.95	x	113.91	0.63	x	0.7	=	67.88	(79)
Southwest0.9x	0.77	x	5.75	x	113.91	0.63	x	0.7	=	200.17	(79)
Southwest0.9x	0.77	x	1.95	x	104.39	0.63	x	0.7	=	62.21	(79)
Southwest0.9x	0.77	x	5.75	x	104.39	0.63	x	0.7	=	183.44	(79)
Southwest0.9x	0.77	x	1.95	x	92.85	0.63	x	0.7	=	55.33	(79)
Southwest0.9x	0.77	x	5.75	x	92.85	0.63	x	0.7	=	163.17	(79)
Southwest0.9x	0.77	x	1.95	x	69.27	0.63	x	0.7	=	41.28	(79)
Southwest0.9x	0.77	x	5.75	x	69.27	0.63	x	0.7	=	121.72	(79)
Southwest0.9x	0.77	x	1.95	x	44.07	0.63	x	0.7	=	26.26	(79)
Southwest0.9x	0.77	x	5.75	x	44.07	0.63	x	0.7	=	77.44	(79)
Southwest0.9x	0.77	x	1.95	x	31.49	0.63	x	0.7	=	18.77	(79)
Southwest0.9x	0.77	x	5.75	x	31.49	0.63	x	0.7	=	55.33	(79)

Solar gains in watts, calculated for each month

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

(83)m=	86.58	147.48	201.79	250.03	280.06	278.03	268.05	245.65	218.5	163	103.71	74.1	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-----	--------	------	------

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

(84)m=	377.11	436.42	482.05	516.47	532.82	517.34	498.44	480.54	460.34	418.82	375.56	357.64	(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	(86)
	0.99	0.98	0.96	0.9	0.79	0.61	0.45	0.49	0.71	0.92	0.98	0.99	

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

(87)m=	19.86	20.05	20.32	20.63	20.85	20.97	20.99	20.99	20.93	20.65	20.21	19.84	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.87	19.88	19.88	19.9	19.9	19.92	19.92	19.92	19.91	19.9	19.9	19.89	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

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

(89)m=	0.99	0.97	0.94	0.87	0.73	0.52	0.34	0.38	0.63	0.89	0.97	0.99	(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=	18.39	18.67	19.05	19.49	19.77	19.9	19.92	19.92	19.86	19.53	18.91	18.37	(90)
fLA = Living area ÷ (4) =												0.5	(91)

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

(92)m=	19.13	19.36	19.68	20.06	20.31	20.43	20.45	20.45	20.4	20.09	19.56	19.1	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	------

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

(93)m=	19.13	19.36	19.68	20.06	20.31	20.43	20.45	20.45	20.4	20.09	19.56	19.1	(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
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Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.94	0.88	0.75	0.57	0.4	0.43	0.67	0.89	0.97	0.99	(94)
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Useful gains, hmGm, W = (94)m x (84)m

(95)m=	371.26	423.47	453.98	452.95	402.27	292.77	198.48	207.51	307.17	373.45	364.15	353.15	(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=	805.12	782.25	710.27	590.14	453.87	302.5	199.91	209.62	328.69	500.1	661.31	796.83	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	322.8	241.1	190.68	98.78	38.4	0	0	0	0	94.23	213.96	330.1	
Total per year (kWh/year) = Sum(98) _{1..5,9..12} =												1530.04	(98)

Space heating requirement in kWh/m²/year

35.47	(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) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (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)

322.8	241.1	190.68	98.78	38.4	0	0	0	0	94.23	213.96	330.1
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

345.24	257.86	203.94	105.64	41.06	0	0	0	0	100.78	228.83	353.05		
Total (kWh/year) =Sum(211) _{1..5,10..12} =												1636.4	(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)

160.18	141.43	149.11	134.46	132.35	119.09	115.17	125.28	124.72	139.39	146.39	156.6
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Efficiency of water heater 79.8 (216)

TER WorkSheet: New dwelling design stage

(217)m=

86.65	86.23	85.47	84.01	81.98	79.8	79.8	79.8	79.8	83.8	85.83	86.76
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 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

184.87	164.02	174.45	160.06	161.44	149.24	144.32	157	156.29	166.35	170.57	180.5
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Total = Sum(219a)_{1...12} =

1969.1

 (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

208.48

(232)

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	= 353.46 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 425.33 (264)
Space and water heating	(261) + (262) + (263) + (264) =		778.79 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 108.2 (268)
Total CO2, kg/year		sum of (265)...(271) =	925.92 (272)

TER =

21.47

(273)



Appendix 2

SBEM Reports (Block H Commercial Unit)

SBEM Main Calculation Output Document

Thu Mar 23 10:36:30 2017

v5.3.a.0

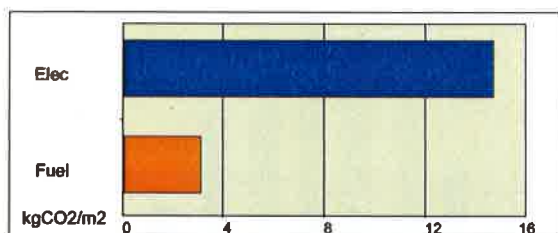
Building name

Green Park Village Blk H Comm

Building type: A1/A2 Retail and Financial/Professional services

SBEM is an energy calculation tool for the purpose of assessing and demonstrating compliance with Building Regulations (Part L for England and Wales, Section 6 for Scotland, Part F for Northern Ireland, Part L for Republic of Ireland, and Building Bye-laws Jersey Part 11) and to produce Energy Performance Certificates and Building Energy Ratings. Although the data produced by the tool may be of use in the design process, **SBEM is not intended as a building design tool.**

Building Energy Performance and CO2 emissions

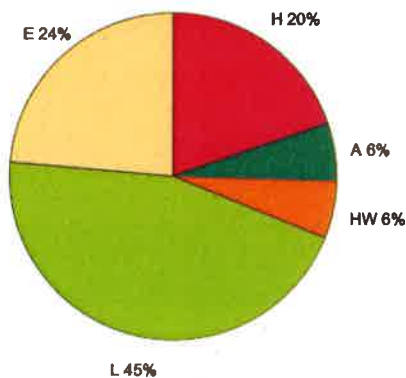


0 kgCO2/m2 displaced by the use of renewable sources.

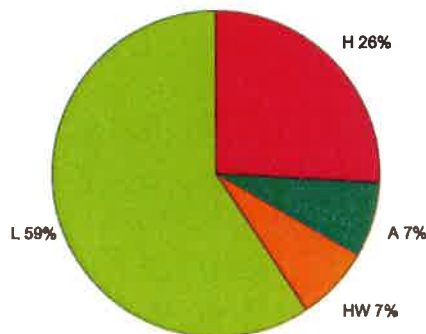
Building area is 333.6 m2

Annual Energy Consumption

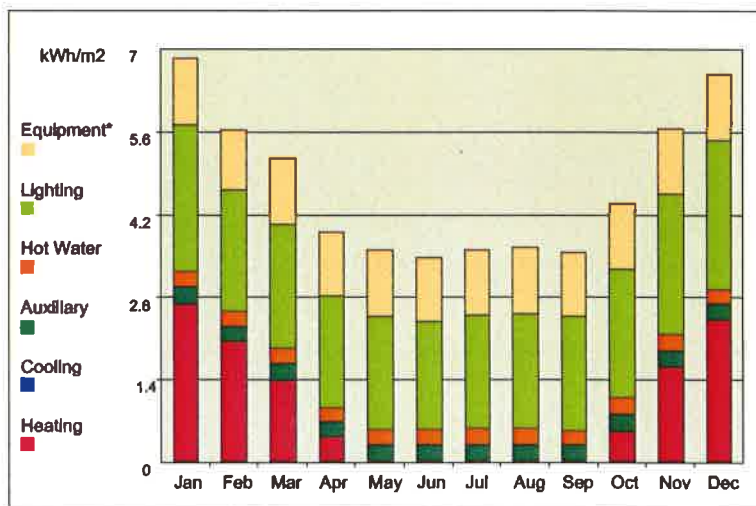
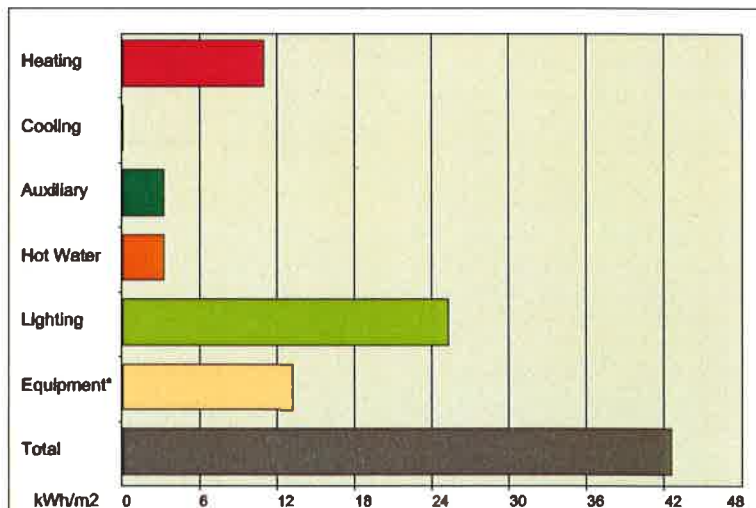
(Pie chart including Equipment end-use)



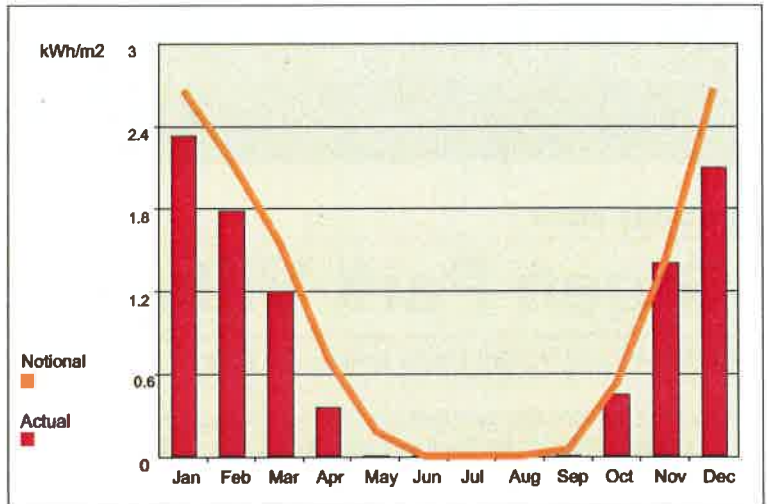
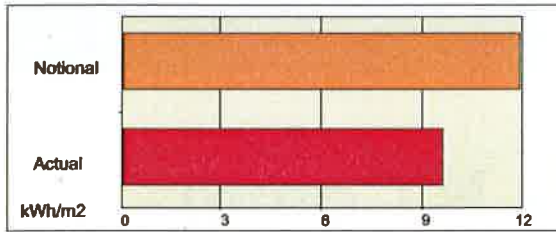
(Pie chart excluding Equipment end-use)



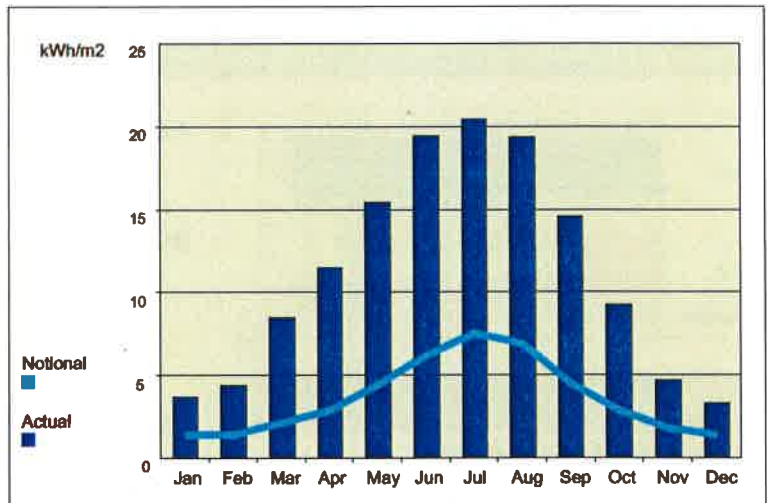
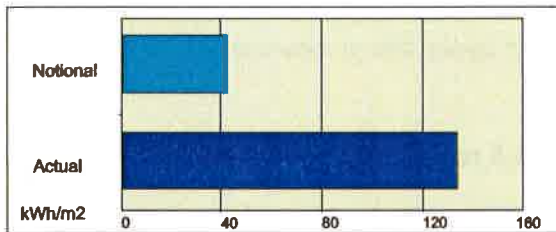
(*) Although energy consumption by equipment is shown in the graphs, the CO2 emissions associated with this end-use have not been taken into account when producing the rating.



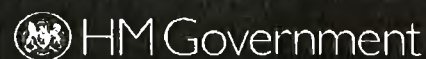
Annual Heating Demand



Annual Cooling Demand



BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name

Green Park Village Blk H Comm Boilers

As designed

Date: Thu Mar 23 10:36:30 2017

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: iSBEM

Interface to calculation engine version: v5.3.a

BRUKL compliance check version: v5.3.a.0

Owner Details

Name: Information not provided by the user

Telephone number: Information not provided by the user

Address: Information not provided by the user, Information not provided by the user, Information not provided by the user

Certifier details

Name: David Lloyd

Telephone number: 0224 7650 5600

Address: Abbey Park, Humber Road, Coventry, CV4 4AQ

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	23
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	17.7
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.19	0.2	Retail.1/wi
Floor	0.25	0.11	0.12	Community.1/f
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1	1	Retail.1/s/g
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]

U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (Inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the [Non-Domestic Building Services Compliance Guide](#) for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.98	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- HWS

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	-
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
Retail.1		-	0.2	-	-	-	-	-	-	-	-	N/A
Retail.2		-	0.2	-	-	-	-	-	-	-	-	N/A
Community.1		-	0.2	-	-	-	-	-	-	-	-	N/A
Community.2		-	0.2	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
	Standard value	60	60	22
Retail.1		-	360	15
Retail.2		-	340	15
Community.1		-	178	-
Community.2		-	177	-

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Retail.1	YES (+136.4%)	NO
Retail.2	YES (+193.9%)	NO
Community.1	YES (+203.6%)	NO
Community.2	YES (+193.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	333.6	333.6
External area [m ²]	776.5	776.5
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	266.71	318.75
Average U-value [W/m ² K]	0.34	0.41
Alpha value* [%]	16.29	11.59

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

54 A1/A2 Retail/Financial and Professional services

A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
 B1 Offices and Workshop businesses
 B2 to B7 General Industrial and Special Industrial Groups
 B8 Storage or Distribution
 C1 Hotels
 C2 Residential Institutions: Hospitals and Care Homes
 C2 Residential Institutions: Residential schools
 C2 Residential Institutions: Universities and colleges
 C2A Secure Residential Institutions
 Residential spaces

46 D1 Non-residential Institutions: Community/Day Centre

D1 Non-residential Institutions: Libraries, Museums, and Galleries
 D1 Non-residential Institutions: Education
 D1 Non-residential Institutions: Primary Health Care Building
 D1 Non-residential Institutions: Crown and County Courts
 D2 General Assembly and Leisure, Night Clubs, and Theatres
 Others: Passenger terminals
 Others: Emergency services
 Others: Miscellaneous 24hr activities
 Others: Car Parks 24 hrs
 Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	10.97	14.52
Cooling	0	0
Auxiliary	3.13	4.62
Lighting	25.18	33.13
Hot water	3.15	3.4
Equipment*	13.15	13.15
TOTAL**	42.43	55.66

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	515.65	196.14
Primary energy* [kWh/m ²]	104.13	134.84
Total emissions [kg/m ²]	17.7	23

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	34.5	481.1	11	0	3.1	0.87	0	0.98	0
Notional	42.8	153.3	14.5	0	4.6	0.82	0	—	—

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{I-Typ}	U _{I-Min}	Surface where the minimum value occurs*
Wall	0.23	0.17	Retail.1/s
Floor	0.2	0.11	Retail.2/f
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1	Retail.1/s/g
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{I-Typ} = Typical individual element U-values [W/(m²K)]			U _{I-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

SBEM Data Reflection Report — Actual Building

Date: Thu Mar 23 10:36:29 2017

Project name: Green Park Village Blk H Comm Building type: A1/A2 Retail and Financial/Professional services

Building area [m2]: 334

General		Energy assessor / Certifier		Owner	
Building address		Name	David Lloyd	Name	Information not provided by the user
		Telephone number	0224 7650 5800	Telephone number	Information not provided by the user
		Address	Abbey Park, Humber Road Coventry CV4 4AQ	Address	Information not provided by the user
		Assessor number	-		Information not provided by the user
Building area [m2]	334	Qualification	-		
Weather	LON	Accreditation scheme	-		
Building rotation [degrees]	0	Employer name	-		
Special conservation status	NO	Employer address	-		
Project complexity	-				

Analysis	
Compliance checked with	England Building Regulations Part L 2013
Asset rating	None
Stage	As designed
Shell & core building	NO

Software	
SBEM version	v5.3.a.0
Interface to SBEM	SBEM
Interface version	v5.3.a

Envelope/Door constructions				
Name	U-value [W/m2K]	Adjusted U-value	Km [kJ/m2K]	Metal clad
External	0.17	NO	129	NO
Access	0.2	NO	129	NO
Ground	0.15	NO	36	NO
Upper	0.1	NO	36	NO

Window/Rooflight constructions			
Name	U-value [W/m2K]	Solar transmittance	Light transmittance
Windows	1	0.76	0.9

Summary of objects		
Object type	Total number	Total related area [m2]
Envelope/Door constructions	4	-
Window/Rooflight constructions	1	-
HW systems	1	-
SE systems	0	0
PV systems	0	0
Wind generators	0	-
CHP generators	0	-
HVAC systems	1	-
Zones	4	333.6
Envelopes	21	1110.11
Doors	0	0
Windows/Rooflights	6	177.176

Project building services	
Electric power factor	<0.9
Submetering and M&T for lighting systems	NO
Emission factor for district heating [kgCO2/kWh]	0.293
Primary energy factor for district heating [kWh/kWh]	1.2

Notes

Hot water systems	
Name	HWS
Generator Type	Using Central Heating boiler
Fuel type	Natural Gas
Seasonal efficiency	0.98
Uses CHP	NO
Storage system	NO
Storage volume [litres]	-
Insulation thickness [mm]	-
Secondary circulation	-
Circulation losses [W/m]	-
Pump power [kW]	-
Loop length [m]	-

Notes

Heating, ventilation, and air conditioning systems		
Name	Heating	
Type	Central heating using water: floor heating	
Heat source	LTHW boiler	
Heating fuel type	Natural Gas	
Heating seasonal efficiency	0.96	
Uses CHP	NO	
Variable speed pumping type	-	
Generator radiant efficiency	-	
Cooling generator type	-	
Cooling fuel type	-	
Cooling seasonal energy efficiency ratio	-	
Cooling nominal energy efficiency ratio	-	
Mixed-mode cooling operation	-	
Heat recovery system	-	
Heat recovery seasonal efficiency	-	
Variable heat recovery efficiency	-	
Specific fan power [W/(l/s)]	-	
Submetering and M&T for this system	NO	
Heating - Central time control	-	
Heating - Optimum start/stop control	-	
Heating - Local time control	-	
Heating - Local temperature control	-	
Heating - Weather compensation control	-	

Notes

HVAC system, ventilation, and exhaust									
Name	Heating								
Desatification fans	NO								
Ventilation type	Mechanical								
SFP for local mechanical supply & extract [W/(l/s)]	0.18								
Heat Recovery system	No heat recovery								
Heat recovery seasonal efficiency	0								
Variable heat recovery efficiency	NO								
Local mechanical exhaust	NO								
Exhaust air flow rate [l/s m2]	-								
SFP for mechanical exhaust [W/(l/s)]	-								
Exhaust fans location	-								
SFP for system terminal units [W/(l/s)]	-								
Demand-controlled ventilation	None								
Flow regulation type for ventilation control	-								
Night cooling maximum hours [hours/month]	-								
Night cooling maximum air flow rate [l/s m2]	-								
SFP for night cooling [W/(l/s)]	-								

General Lighting and controls			
Total wattage [W]	450		
Design illuminance [Lux]	800		
Lamp and ballast efficacy [lumens/W]	-		
Light output ratio	-		
Lamp type	-		
Air-extracting luminaires	NO		
Controls	BOTH		
Type of photoelectric control	PH-DIMMING		
Different sensor for back of zone	YES		
Photoelectric control parasitic power [W/m2]	0.3		
Automatic zoning for daylight	YES		
Occupancy sensing	NONE		
Occupancy sensing parasitic power [W/m2]	-		

Hot water system		
Name	HWS	
Dead leg length in this zone [m]	0	

Display lighting		
Efficient lamps	NO	
Lumens per circuit wattage	-	
Time switching	NO	

Thermal bridges Psi values [W/mK]		
Junction type	Metal clad	Not metal clad
Roof-wall	0.42	0.18
Wall-ground floor	1.725	0.24
Wall-wall (corner)	0.375	0.135
Wall-not ground floor	0.04	0.11
Lintel (window/door)	1.905	0.45
Sill (window)	1.905	0.06
Lamb (window/door)	1.905	0.09

Shell & core	
Shell area for fit-out	-

Envelopes					
(Multiplier) Name	(1) Retail.1/e	(1) Retail.1/f	(1) Retail.1/g	(1) Retail.1/h	(1) Retail.1/i
Type	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling
Area [m2]	21.44	50.23	21.44	23	87.9
Orientation	South	East	North	West	Horizontal
Adjacent space	Exterior	Exterior	Exterior	Unheated	Conditioned
Construction name	External	External	External	Access	Upper

Windows & rooflights			
(Multiplier) Name	(1) Retail.1/e/g	(1) Retail.1/f/h	(1) Retail.1/i
In envelope	Retail.1/s	Retail.1/e	Retail.1/e
Area [m2]	17.152	40.184	40.184
Glazing name	Windows	Windows	Windows
Shading position	None (no shading)	None (no shading)	None (no shading)
Shading colour	-	-	-
Shading translucency	-	-	-
Transmission factor	1	1	1
Frame / Aspect ratios	0.1 / 0.7	0.1 / 0.7	0.1 / 0.7

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting						
Name	Heating			Total wattage [W]	500			Efficient lamps	NO					
Desatratification fans	NO			Design illuminance [Lux]	800			Lumens per circuit wattage	-					
Ventilation type	Mechanical			Lamp and ballast efficacy [Lumens/W]	-			Time switching	NO					
SFP for local mechanical supply & extract [W/(l/s)]	0.18			Light output ratio	-			Thermal bridges Psi values [W/mK]						
Heat Recovery system	No heat recovery			Lamp type	-									
Heat recovery seasonal efficiency	0			Air-extracting luminaires	NO							Junction type	Metal clad	Not metal clad
Variable heat recovery efficiency	NO			Controls	BOTH							Roof-wall	0.42	0.18
Local mechanical exhaust	NO			Type of photoelectric control	PH-DIMMING							Wall-ground floor	1.725	0.24
Exhaust air flow rate [l/s.m2]	-			Different sensor for back of zone	YES							Wall-wall (corner)	0.375	0.135
SFP for mechanical exhaust [W/(l/s)]	-			Photoelectric control parasitic power [W/m2]	0.3							Wall-not ground floor	0.04	0.11
Exhaust fans location	-			Automatic zoning for daylight	YES							Lintel (window/door)	1.905	0.45
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	NONE			Sill (window)	1.905	0.08				
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	-			Jamb (window/door)	1.905	0.09				
Hot water system				Shell & core										
				Shell area for fit-out										
				-										
				-										
				-										

Envelopes				
(Multiplier) Name	(1) Retail.2/s	(1) Retail.2/nl	(1) Retail.2/d	(1) Retail.2/f
Type	Wall	Wall	Floor or Ceiling	Floor or Ceiling
Area [m2]	41.9	41.9	93.1	93.1
Orientation	South	North	Horizontal	Horizontal
Adjacent space	Exterior	Unheated	Conditioned	Underground
Construction name	External	Access	Upper	Ground

Windows & rooflights	
(Multiplier) Name	(1) Retail.2/s/g
In envelope	Retail.2/s
Area [m2]	33.52
Glazing name	Windows
Shading position	None (no shading)
Shading colour	-
Shading translucency	-
Transmission factor	1
Frame / Aspect ratios	0.1 / 0.7

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting					
Name	Heating			Total wattage [W]	200			Efficient lamps	NO				
Deastratification fans	NO			Design illuminance [Lux]	300			Lumens per circuit wattage	-				
Ventilation type	Mechanical			Lamp and ballast efficacy [Lumens/W]	-			Time switching	NO				
SFP for local mechanical supply & extract [W/(l/s)]	0.18			Light output ratio	-			Thermal bridges Psi values [W/mK]					
Heat Recovery system	No heat recovery			Lamp type	-								
Heat recovery seasonal efficiency	0			Air-extracting luminaires	NO								
Variable heat recovery efficiency	NO			Controls	BOTH								
Local mechanical exhaust	NO			Type of photoelectric control	PH-DIMMING								
Exhaust air flow rate [l/s.m2]	-			Different sensor for back of zone	YES								
SFP for mechanical exhaust [W/(l/s)]	-			Photoelectric control parasitic power [W/m2]	0.3								
Exhaust fans location	-			Automatic zoning for daylight	YES								
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	NONE								
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	-								
Flow regulation type for ventilation control				-				Jamb (window/door) 1.905					
Night cooling maximum hours [hours/month]				-				Jamb (window/door) 1.905					
Night cooling maximum air flow rate [l/s.m2]				-				Jamb (window/door) 1.905					
SFP for night cooling [W/(l/s)]				-				Jamb (window/door) 1.905					
				Hot water system				Shell & core					
				Name				Shell area for fit-out					
				Dead leg length in this zone [m]				-					

Envelopes				
(Multiplier) Name	(1) Community.1/s	(1) Community.1/s	(1) Community.1/d	(1) Community.1/h
Type	Wall	Wall	Floor or Ceiling	Floor or Ceiling
Area [m2]	21	21.7	37.2	37.2
Orientation	South	East	Horizontal	Horizontal
Adjacent space	Exterior	Exterior	Conditioned	Underground
Construction name	External	External	Upper	Ground

Windows & rooflights			
(Multiplier) Name	(1) Community.1/s/g	(1) Community.1/s/g	(1) Community.1/s/g
In envelope	Community.1/s	Community.1/s	Community.1/s
Area [m2]	16.8	16.8	17.36
Glazing name	Windows	Windows	Windows
Shading position	None (no shading)	None (no shading)	None (no shading)
Shading colour	-	-	-
Shading translucency	-	-	-
Transmission factor	1	1	1
Frame / Aspect ratios	0.1 / 0.7	0.1 / 0.7	0.1 / 0.7

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting			
Name	Heating			Total wattage [W]	800			Efficient lamps	NO		
Deaerification fans	NO			Design illuminance [lux]	300			Lumens per circuit wattage	-		
Ventilation type	Mechanical			Lamp and ballast efficacy [Lumens/W]	-			Time switching	NO		
SFP for local mechanical supply & extract [W/(l/s)]	0.18			Light output ratio	-						
Heat Recovery system	No heat recovery			Lamp type	-						
Heat recovery seasonal efficiency	0			Air-extracting luminaires	NO						
Variable heat recovery efficiency	NO			Controls	BOTH						
Local mechanical exhaust	NO			Type of photoelectric control	PH-DIMMING						
Exhaust air flow rate [l/s.m2]	-			Different sensor for back of zone	YES						
SFP for mechanical exhaust [W/(l/s)]	-			Photoelectric control parasitic power [W/m2]	0.3						
Exhaust fans location	-			Automatic zoning for daylight	YES						
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	NONE						
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	-						
Flow regulation type for ventilation control	-										
Night cooling maximum hours [hours/month]	-										
Night cooling maximum air flow rate [l/s.m2]	-										
SFP for night cooling [W/(l/s)]	-										
Hot water system				Name	HWS			Shell & core			
				Dead leg length in this zone [m]	0			Shell area for fit-out			

Envelopes					
(Multiplier) Name	(1) Community.2/e	(1) Community.2/h	(1) Community.2/w	(1) Community.2/d	(1) Community.2/f
Type	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling
Area [m2]	85.2	85.2	21.7	115.4	115.4
Orientation	South	North	West	Horizontal	Horizontal
Adjacent space	Exterior	Unheated	Unheated	Conditioned	Underground
Construction name	External	Access	Access	Upper	Ground

Windows & rooflights	
(Multiplier) Name	(1) Community.2/h/g
In envelope	Community.2/e
Area [m2]	52.16
Glazing name	Windows
Shading position	None (no shading)
Shading colour	-
Shading translucency	-
Transmission factor	1
Frame / Aspect ratio	0.1 / 0.7

Appendix 3

Water Calculator Tool

Part G Water Calculator - Code 2009

Installation Type	Unit of Measurement	Capacity/Flow Rate	Use Factor	Fixed Use (litres/person/day)	Litres per Person day.
WC (Single Flush)	Full Flush (litres)		4.42	0	0
WC (Dual Flush)	Full Flush (litres)	4	1.46	0	5.84
	Part Flush (litres)	2	2.96	0	5.92
WC (Multiple Fittings)	Average effective flushing volume (litres)		4.42	0	0
Taps (excluding kitchen tap)	Flow rate (litres/min)	4	1.58	1.58	7.9
Bath (where shower present)	Capacity to overflow (litres)	230	0.11	0	25.3
Shower (where bath present)	Flow rate (litres/min)	8	4.37	0	34.96
Bath only	Capacity to overflow (litres)		0.5	0	0
Shower only	Flow rate (litres/min)		5.6	0	0
Kitchen/utility room sink taps	Flow rate (litres/min)	6	0.44	10.36	13
Washing machine	Litres/kg dry load	9	2.1	0	18.90
Dishwasher	Litres/place setting	0.833	3.6	0	2.9988
Waste disposal unit	Litres/use	0	3.08	0	
Water softener	Litres/person/day		1	0	
TOTAL					114.82

Normalisation Factor 0.91
Code for Sustainable Homes Consumption **104.49**
External water use 5
Total Water Consumption (Building Regs 17.K) **109.49**