



Discharge Condition 6 Energy Statement

Swansea Road

28 – 32 Northfield Road and,
26 – 30 Swansea Road,
Reading,
Berkshire

Helix Ltd

Report No: DC-ES-HX-SR-21-01

Report Date: January 2021

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1. ASSESSMENT INFORMATION

Nature of Assessment:	Discharging of Planning Condition 6
Project Name	Swansea Road
Project Address	28 - 32 Northfield Road and, 26 - 30 Swansea Road, Reading, Berkshire
Developer	Helix Ltd
Developer Address	Liberty House, Greenham Business Park, Newbury, Berkshire, RG19 6HS
Architect	DHA Architecture Ltd
Architect's Address	Brooklands Farm Business Park, Bottle Lane, Binfield, Berkshire, RG42 5QX
Author	Mike Hassett
Position	Sustainability Consultant
Company	Abbey Consultants (Southern) Ltd
Address	2 Dronken House, 43A High Street, Kings Langley. WD4 8FG
Contact No	01923 274 427
Web	www.abbeyconsultants.co.uk
Project Description	The demolition of the existing 2-bedroom dwelling and garages, and erection of nine dwellings, including eight three-bedroom houses and one three-bedroom coach house, with access and parking from Swansea Road, and associated landscaping.

Issue Number	Date	Reason	Author
01	27/01/21	For Issue	MH
02			
03			

2. EXECUTIVE SUMMARY

In keeping with requirements of planning, this statement comprises:

- A Building Regulation baseline energy assessment for the proposed development.
- Energy conservation measures to be undertaken in the design of the development.
- A calculation of CO₂ savings that are to be achieved as a result of energy efficient measures.
- A proposal to include 4.50 kWp of solar photovoltaic cells (PV) to designated roof elevations.

The energy and carbon policies requirements are proposed to be met using a fabric and renewable energy strategy.

Helix Ltd has placed considerable emphasis on utilising passive design measures and targeting fabric efficiency in order to mitigate energy use. In conjunction with high levels of air tightness and proposed Accredited Construction Details (ACD) to all wall junctions; energy consumption for heating will be dramatically reduced, providing home owners with a comfortable, efficient and cost effective dwelling. Highly efficient mechanical ventilation will ensure the dwellings will remain well ventilated and provide a comfortable living environment for home owners.

The overall fabric energy efficiency specification significantly improves on the requirements of Part L1A 2013 , and shows that the development will reduce CO₂ requirements and supply energy efficiently. The proposal demonstrates that all units will achieve a reduction in Dwelling Emission Rates **6.49 %** better than a Part L1A 2013 baseline.

In addition, the total reduction in CO₂ over a Part L1A 2013 baseline is **19.39 %** through fabric and use of renewables.

The reduction in carbon emissions demonstrated in the following report is in line with the reductions sought by Reading Borough Council within Planning Condition 6 (application no. 191924).

Table 1: Key Figures

Energy and CO ₂ Savings			
	Description	Amount	Unit
Baseline	Total development CO ₂ demand Part L1A 2013 (TER)	14,903	KGCO ₂ /Year
	Total development energy demand Part L1A 2013 (TER)	63,100	kWh/Year
Improved fabric	Actual development CO ₂ demand (DER) Part L1A 2013	13,936	KGCO ₂ /Year
	Actual development CO ₂ demand (DER) Part L1A 2013	57,724	kWh/Year
Energy and CO ₂ savings	CO ₂ saved through fabric/control	967	KGCO ₂ /Year
	Energy saved through fabric/control	5,376	kWh/Year
	CO ₂ saved through renewables	1,923	KGCO ₂ /Year
	Energy saved through renewables	3,705	kWh/Year
Sitewide CO ₂ and energy Summary	Percentage CO ₂ improvement through fabric/control	6.49	%
	Percentage energy improvement through fabric/control	8.52	%
	CO ₂ abatement through renewables	12.90	%
	Energy abatement through renewables	5.87	%
	Total CO₂ Improvement over baseline	19.39	%
	Total Energy Improvement over baseline	14.39	%

3. INTRODUCTION

This document has been prepared by Abbey Consultants (Southern) Ltd, a specialist environmental and energy consultancy on behalf of Helix Ltd in support of the discharging of planning condition 6 for the development at Swansea Road located in Reading Borough Council.

The following report establishes a baseline assessment of the energy demands and associated CO₂ emissions for the residential units. The Energy Hierarchy approach of Be Lean, Be Clean and Be Green is then followed to enable the maximum viable reductions in Regulated CO₂ emissions to be achieved.

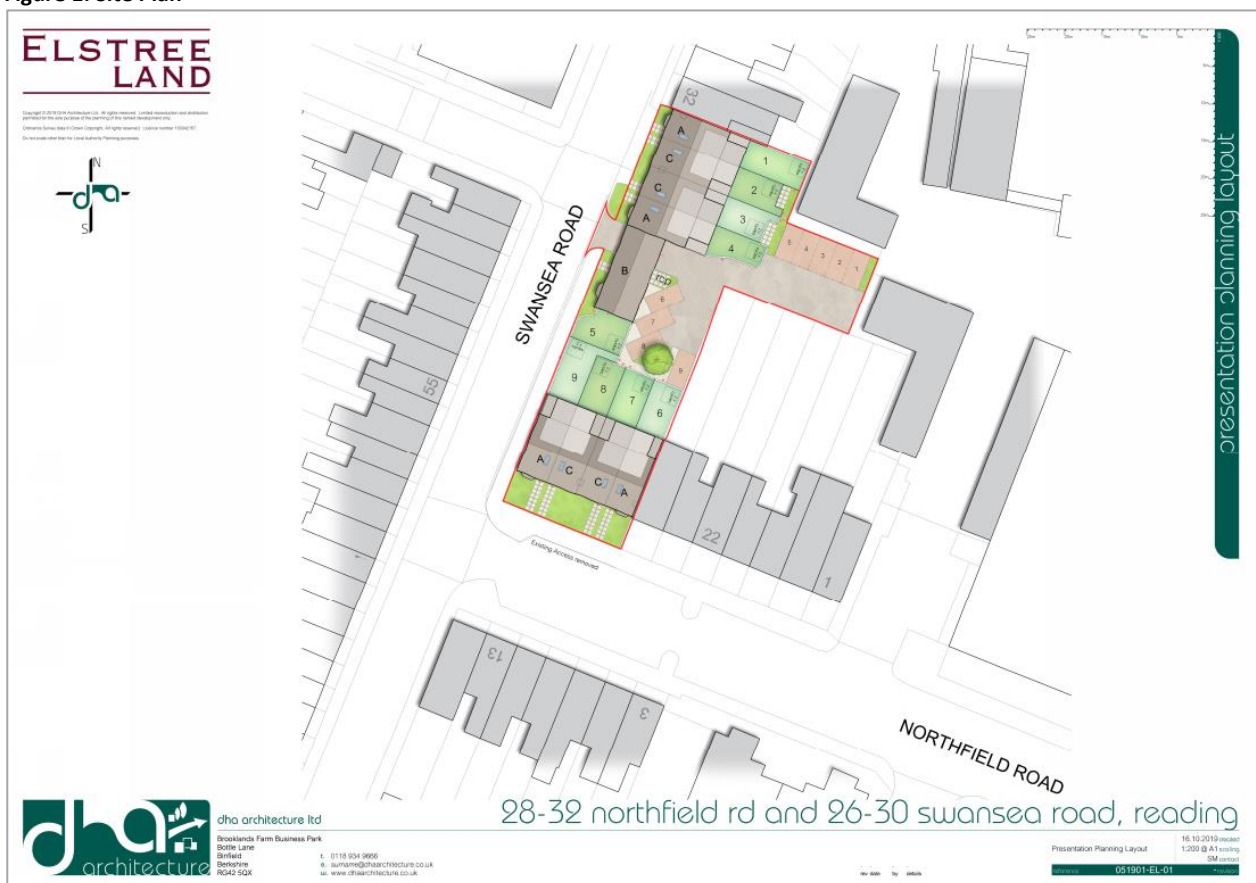
The proposed application is described as:

The demolition of the existing 2-bedroom dwelling and garages, and erection of nine dwellings, including eight three-bedroom houses and one three-bedroom coach house, with access and parking from Swansea Road, and associated landscaping.

The above proposal has been subject to a formally approved planning application (application no. 191924) by Reading Borough Council on the condition that, regarding energy, condition 6 on the Planning Decision Notice are adhered to.

Figure 1 presents the proposed site layout.

Figure 1: Site Plan



4. PLANNING CONDITION

The following report sets out the intentions of Helix Ltd with regards to energy and water efficiency to discharge condition 6 of planning application no. 191924.

The condition reads as below:

Condition 6

No development shall commence on site until written verification has been submitted to and approved in writing by the Local Planning Authority demonstrating that the dwellings hereby permitted have achieved a minimum of a 19% improvement in the dwelling emission rate over the target emission rate as defined in the Building Regulations for England Approved Document L1a: Conservation of Fuel and Power in New Dwellings (2013 edition), and built to the higher water efficiency standard under regulation 36(3). Such evidence shall be in the form of a 'design stage' Standard Assessment Procedure (SAP), produced by an accredited energy assessor.

Reason: To ensure that the development is carried out in accordance with sustainable building standards in accordance with Policy CC2 and H5 of the Reading Borough Local Plan 2019.

5. BASELINE ENERGY CALCULATIONS

A baseline total energy demand has been established for the proposed development. Reductions in demand due to energy conservation measures are considered and form the basis of the renewable energy strategy which follows.

Floor plans for the development have been used in conjunction with an outline accommodation schedule and building specifications to prepare preliminary SAP Calculations on all unit types. SAP calculations have been carried out to Approved Document Part L1A 2013. The relevant energy loads have been collated from the full SAP calculation sheets and entered into a spread sheet that can be found in the appendices, which calculates the total energy and CO₂ demand.

Regulated Energy Demand is calculated from the energy associated with space heating, hot water and fixed electrical demands (for lights, fans and pumps).

Unregulated energy is the annual electrical energy demand from appliances and would be calculated using the methodology as suggested by SAP2012. SAP calculations are extended to allow for CO₂ emissions associated with appliances and cooking, and to allow for site-wide electricity generation technologies.

Total Energy Demand for the development is calculated from the regulated energy demand figures given above and an additional energy demand associated with unregulated energy.

CO₂ emissions from appliances use equation L14

$$L14 = E_A \times E_{\text{Electricity}} / TFA$$

Where $E_{\text{Electricity}}$ is the emission factor for electricity (SAP 2012 Table 12)

CO₂ emissions from cooking uses equation L16

$$L16 = (119 + 24N) / TFA$$

$$\text{Where } N = 1 + 1.76 \times \{1 - \exp(-0.000349 \times (TFA - 13.9)^2)\} + 0.0013 \times (TFA - 13.9)$$

Total Energy Demand is used in the final analysis to determine the contribution which renewable energy technology makes to total energy requirements for the development once energy conservation measures have been considered.

Energy savings are measured in terms of a reduction in CO₂ emissions and kWh, which are calculated from their association with a particular fuel source. CO₂ Conversion Factors have been taken from Table 2, Building Regulations Part L1A 2013:

Table 2: Fuel Conversion factors

Fuel Source	CO ₂ Conversion Factor (Kg/kWh)
Electricity	0.519 (Displaced 0.519)
Gas	0.216

5.1 CALCULATION OF BASELINE ENERGY AND CO₂ EMISSIONS

Thermal insulation levels and air tightness standards for the baseline case are assumed to just meet the requirements Part L1A 2013 of Building Regulations. The baseline specification as determined by SAP12 is detailed below.

Table 3: Baseline design specification 2013

Element	Baseline Design Specification
Ground Floor	0.13 W/m ² K
Exposed Floor	0.13 W/m ² K
External Wall	0.18 W/m ² K
Party Wall	0.00 W/m ² K
Roof – insulated at ceiling	0.13 W/m ² K
Roof – insulated at slope	0.13 W/m ² K
Roof – flat	0.13 W/m ² K
Glazing U-Value	1.40 W/m ² K
Door U-Value	1.2 W/m ² K
Design Air Permeability	5.00
Space Heating	Mains Gas 88.6% efficient
Heating Controls	Heating System controls
Domestic Hot water	Mains Gas
Ventilation	Natural ventilation with intermittent fans
Low Energy Lighting	100%
Thermal Bridging	Appendix R values

Using the above specification, the baseline energy and carbon figures for the site are as detailed in the table below.

Table 4: Predicted Carbon Emissions: Part L1A 2013 Compliant Unit (TER) including non-domestic where applicable

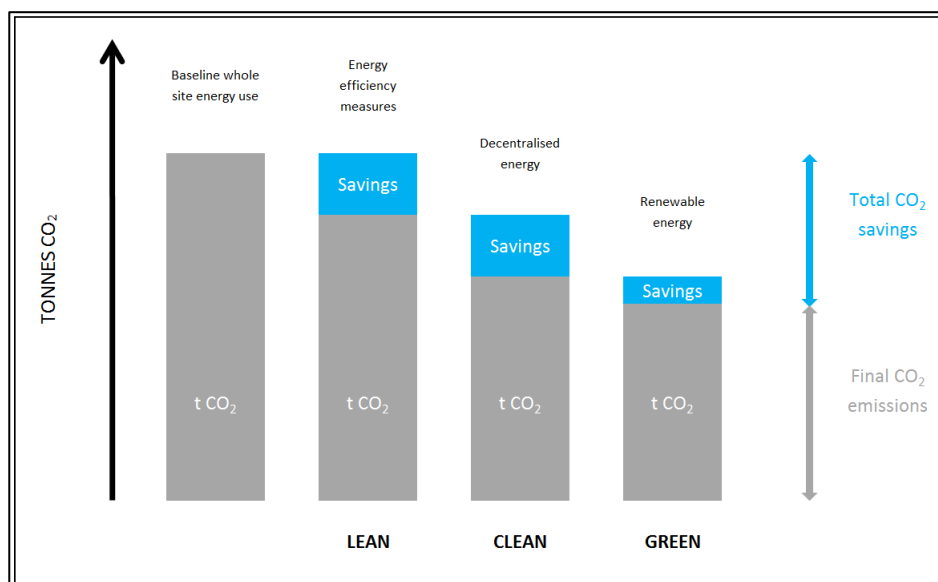
	Space Heating Demand (kWh/a)	Secondary Heating Demand (kWh/a)	Hot Water demand (kWh/a)	Energy from pumps and fans (kWh/a)	Energy from Lighting (kWh/a)	Energy from Appliances (kWh/a)	Totals
Part L1A 2013 Compliant Units	36,488	0	22,404	675	3,533	0	63,100
CO₂ Associated with total Energy Demand (kg/a)	7,881	0	4,839	350	1,833	0	14,903

6. BE LEAN

The accepted standard approach to reducing carbon dioxide emissions in the built environment is as follows;

1. Reduce energy demand (be lean)
2. Supply energy efficiently (be clean)
3. Use renewable energy (be green)

Figure 2: Energy Hierarchy



6.1 USE LESS ENERGY

Energy demand reduction provides the greatest opportunity for minimising a building's potential CO₂ emissions. Design strategies typically include building form and fabric measures (passive design) and energy efficient building services (active design). Focusing on form and fabric, in particular at an early stage in the building process, is often the most cost effective way to reduce energy and consequently CO₂ emissions.

As required by the energy hierarchy, the overall energy demand for the development will be reduced by implementing energy efficiency measures as far as practically and economically possible.

6.2 REGULATED ENERGY

To reduce demand for space heating, emphasis has been placed on providing a very high standard of fabric and reducing heat loss through the building envelope. Approved Document Part L1A 2013 sets out the limiting fabric parameters for each of the building elements. Each stated value represents the area-weighted average U-value. Table 5 details the proposed U-values for the development compared to the baseline U-values as determined by Part L1A 2013. A strong emphasis has been placed on improving the building fabric with the minimum improvement over the average weighted U value being at least 25% to ensure the development's heating and cooling demands are reduced.

To further minimise heat loss through the building envelope, air leakage will be made a priority. The airtightness of the dwellings will be set to a level of 4.65m³/h/m². Such a level of airtightness, along with the proposed enhanced fabric measures, will increase comfort and warmth as well as save future residents money on energy bills.

Repeated thermal bridges such as timber studs or mortar joints are already covered by U value calculations. Non-repeating thermal bridges are intermittent and occur at specific points in the construction. They are often caused by discontinuities in the thermal envelope. They commonly occur around openings and other instances where materials of different thermal conductivities form part of the external envelope, as illustrated in Figure 3.

Accredited construction details for all wall junctions will be specified to minimise the effects of non-repeating thermal bridging and reduce heat loss further. By specifying and ensuring that ACDs are designed into the build, CO₂ emissions can be reduced by up to 5%.

The use of ACDs will provide a continuous 'blanket' around the dwellings, minimising gaps in the insulation.

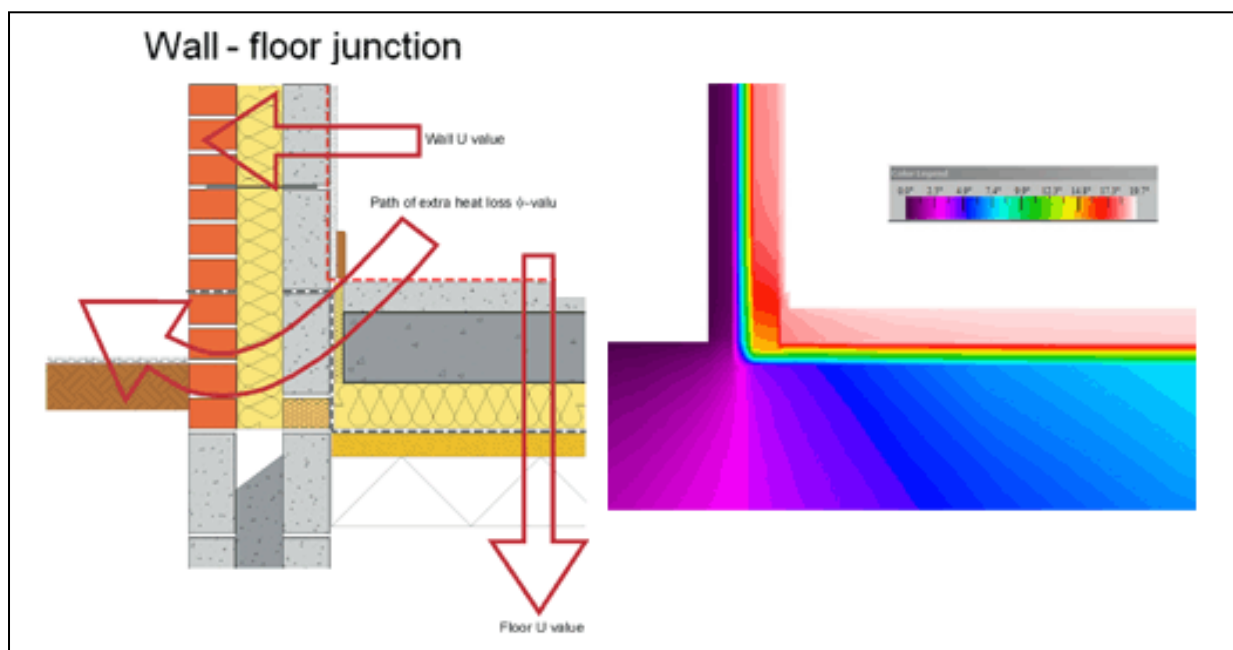
All dwellings will be specified to have 100% of their lighting outlets classed as low energy, thus reducing the future homeowner's electricity bill. Orientation and layout have also been given consideration to help limit heat loss in winter and maximise the potential for free cooling in summer, to limit the risk of overheating.

Overall, the proposed passive design measures for this development will provide households with a resource to reduce their energy demand and heat their homes to a satisfactory standard at an affordable cost.

The proposed specification will provide a robust long term solution, future proofing the dwelling for years to come.

This image, alongside showing the temperature distribution for the same junction, is taken directly from thermal modelling software

Figure 3: Wall-Floor Junction Detail



6.3 FABRIC SPECIFICATION

The indicative U Values for the scheme are shown in the table below and are compared against the baseline U values used within Part L1A 2013.

Table 5: Proposed U Values

Element	Baseline Design Specification	Proposed Design Stage Specification
Ground Floor	0.13 W/m ² K	0.11 W/m ² K
Exposed Floor	0.13 W/m ² K	0.15 W/m ² K
External Wall Houses	0.18 W/m ² K	0.25 W/m ² K
External Walls Flats	0.18 W/m ² K	N/A
Communal Walls	0.18 W/m ² K	N/A
Party Wall	0.00 W/m ² K	0.00 W/m ² K
Roof – insulated at ceiling	0.13 W/m ² K	0.11 W/m ² K
Roof – insulated at slope	0.13 W/m ² K	0.15W/m ² K
Roof – flat	0.13 W/m ² K	0.15 W/m ² K
Glazing U-Value	1.40 W/m ² K	U = 1.40 W/m ² K G = 0.43 BFRC Certificate
Door U-Value	1.2 W/m ² K	1.2 W/m ² K
Design Air Permeability	5.00	4.65

7. BE CLEAN SUPPLY ENERGY EFFICIENTLY

CHP

There are many benefits of decentralised heat generation and Combined Heat and Power (CHP) in terms of cost and CO₂ emissions savings. However, technology such as this is more significant for larger developments, ideally complimented with some non-residential use of heat and electricity. The proposed development size of 9 dwellings is at the low end of what the industry tends to view as viable for such systems. The development is for residential dwellings only and this will result in 'peaky' thermal demands with little anchor load to enable efficient operation of gas fired CHP. This option also risks the potential to increase costs to residents.

The site is neither sufficiently dense nor large enough to warrant investment from 3rd party managing agents or Energy Supply Companies (ESCOs). The proposed development would need to be run by an independent agent/company and there would be very little if any interest among existing ESCOs in servicing such a small-scale system. Even if it was possible, the cost of managing fuel procurement, customer billing, operation and maintenance would lead to disproportionally and unnecessary high service charges to residents compared to the provision of heat from individual gas boilers.

Multiple Connections from the primary heat main to each house would increase the distribution losses on the heat network as well as increase capital costs for the energy infrastructure. The Installation of a communal heating system would also risk the site becoming isolated limiting any potential connection to a larger district network in the near future to deliver low carbon heat more cost effectively.

Overall this option has been discounted because communal gas boilers do not offer any efficiency gains over individual gas condensing boilers once distribution losses are accounted for.

Individual Gas Boilers

Individual gas condensing boilers have many advantages. They can be highly efficient, have much lower Nox emissions and lower installation costs. Reliability and maintenance requirements are well understood ensuring low costs of installation, operation and maintenance. Homeowners are also very familiar with the concept of gas central heating.

Air Source Heat Pumps

An air source heat pump (ASHP) is a system which transfers heat from outside to inside a building, or vice versa. Under the principles of vapor compression refrigeration, an ASHP uses a refrigerant system involving a compressor and a condenser to absorb heat at one place and release it at another. They can be used as a space heater or cooler, and are sometimes called "reverse-cycle air conditioners".

In domestic heating use, an ASHP absorbs heat from outside air and releases it inside the building, as hot air, hot water-filled radiators, underfloor heating and/or domestic hot water supply. The same system can often do the reverse in summer, cooling the inside of the house. When correctly specified, an ASHP can offer a full central heating solution and domestic hot water up to 80 °C.

Proposed Heating Strategy

It is proposed that highly efficient mains gas condensing boilers with efficiencies of circa 89.1% SEDBUK2009 are to be installed. The system will incorporate optimum start and full zone controls to ensure efficient operation.

If it is deemed that hot water cylinders are required as the design progresses, they will be highly insulated to ensure that the heat loss per day is kept to a minimum.

7.1 SUMMARY PROPOSED HEATING AND VENTILATION SYSTEMS

The following specification for the heating and ventilation is proposed:

Apartments	
Heating:	Combination gas boiler – Potterton Promax Ultra Combi Efficiency 89.1% SEDBUK 2009
Secondary Heating:	None
Heating Hot Water Controls:	Time and Temperature Zone Control Delayed Start Stat No Weather Compensation
Flue Gas Heat Recovery:	No
Cylinder:	N/A
Heat Loss:	N/A
Ventilation:	System 3 fans Decentralised MEV Greenwood CV2 GIP
Waste Water Heat Recovery:	None

Unregulated energy

Unregulated energy will be reduced across the site by ensuring:

- All white goods, where supplied by Helix Ltd will conform to EU energy labelling scheme.
- All external lighting will be low energy and will have daylight and/or PIR sensors to avoid wastage.

7.2 SITEWIDE ENERGY AND CO₂ DEMAND

Using the energy efficiency improvement measures as indicated, a revised predicted energy and CO₂ demand can be calculated to show:

Table 6: Predicted Total Energy Demand: Improved building fabric, controls, and gas boilers

	Space Heating Demand (kWh/a)	Secondary Heating Demand (kWh/a)	Hot Water demand (kWh/a)	Energy from pumps and fans (kWh/a)	Energy from Lighting (kWh/a)	Energy from Appliances (kWh/a)	Totals
Energy Part L1A 2013 Compliant Units (TER)	36,488	0	22,404	675	3,533	0	63,100
CO ₂ Associated with total Energy Demand (kg/a)	7,881	0	4,839	350	1,833	0	14,903
Part L1A 2013 Actual Unit (DER)	34,585	0	18,294	1,312	3,533	0	57,724
CO ₂ Associated with total Energy Demand (kg/a)	7,470	0	3,952	681	1,833	0	13,936

When compared against Part L1A 2013 Building Regulations not including unregulated energy:

- Total CO₂ demand for the residential units is calculated to be **13,936** kg per annum. This represents a saving of **6.49 %** over the part L1A 2013 compliant figure of **14,903** kg per annum.
- Total Energy demand for the residential units is calculated to be **57,724** kWh per annum. This represents a saving of **8.52 %** over the part L1A 2013 compliant figure of **63,100** kWh per annum.

8. BE GREEN – LOW CARBON AND RENEWABLE ENERGY GENERATION OPTIONS

The following alternative options to supply low carbon and renewable energy generation have been explored and utilised, or discounted, based upon the following reasons:

Wind Turbines

Wind turbines have been discounted due to concerns over reliable wind resources. The use of wind turbines is likely to present aesthetic as well as nuisance issues.

Biomass Boilers

Unsuitable for this development due to fuel storage issues and increased traffic of heavy vehicles supplying biomass. Individual biomass boilers in the houses are technically feasible but would be commercially unviable when compared to alternative solutions at the required level of energy abatement.

Air Source Heat Pumps (ASHP)

Air source heat pumps could be utilised but would require outdoor space for the fan-coil units to each dwelling. These outdoor units would be difficult to conceal without affecting the aesthetics of the building facades.

Ground Source Heat Pumps (GSHP)

Discounted on the grounds of costs and available space. Incompatible with individual gas boilers and blocks of apartments.

Solar Thermal

Unsuitable for blocks of flats and low carbon reduction efficiency compared to photovoltaic systems. Solar hot water systems for flat blocks are only suitable where a central boiler plant room is provided to accommodate a central thermal store.

Solar Photovoltaics (PV)

Due to the density and scale of the development, and the ability to integrate the technology easily within the scheme, Solar PV is to be considered.

8.1 PROPOSED LOW CARBON AND RENEWABLE OPTIONS

The Low and Zero carbon energy solution proposed to meet the planning condition is to utilise solar photovoltaic panels.

It is proposed that 4.50 KWp (15 No.) photovoltaic cells to be laid at between 15 - 37.5 degrees on the designated south east/south west roof elevations. The proposal for the installation of the PV panels is detailed in the following section.

Typical 300w Panel



- Height 1.98m
- Width 0.95m

Solar PV technology offers advantages over other low carbon and renewable energy technologies for the following reasons:

Density/scale

- Solar technologies are modular and can be sized to available space constraints and would easily be integrated into the roofscape of the proposed development.
- Solar PV technologies typically require 2-3 times more space to generate the equivalent energy or abate similar emissions as solar thermal panels, but they can be sized to the maximum available roof space.

Technology Integration

- Solar technologies can be easily integrated into the built environment using available roof space. Since they are modular and easily fixed to buildings they can access solar irradiation in almost any location. The technologies can be integrated on almost any roof structure or vertical façade without compromising structural or aesthetic requirements.
- Solar PV systems are generally connected to the dwelling or block via an inverter and any excess generation not utilised on-site is exported seamlessly to the local grid.

Cost-effectiveness

- Solar PV costs have reduced dramatically in the last 2-3 years in the UK, due to increasing demand for the technology driven by sustainability requirements and the Government's stimulus package known as the Feed-In Tariffs (FiTs) scheme which rewards renewable electricity generation with premium tariffs.

CO₂ Abatement Capacity

- Solar PV generates electricity and abates ~2.5 – 3 times more CO₂ than an alternative renewable energy technology that displaces use of gas (e.g. solar hot water technology and/or biomass boilers). Solar PV is well proven with good historical data showing that its performance credentials generally match or exceed manufacturers' claims/modelled generation profiles.

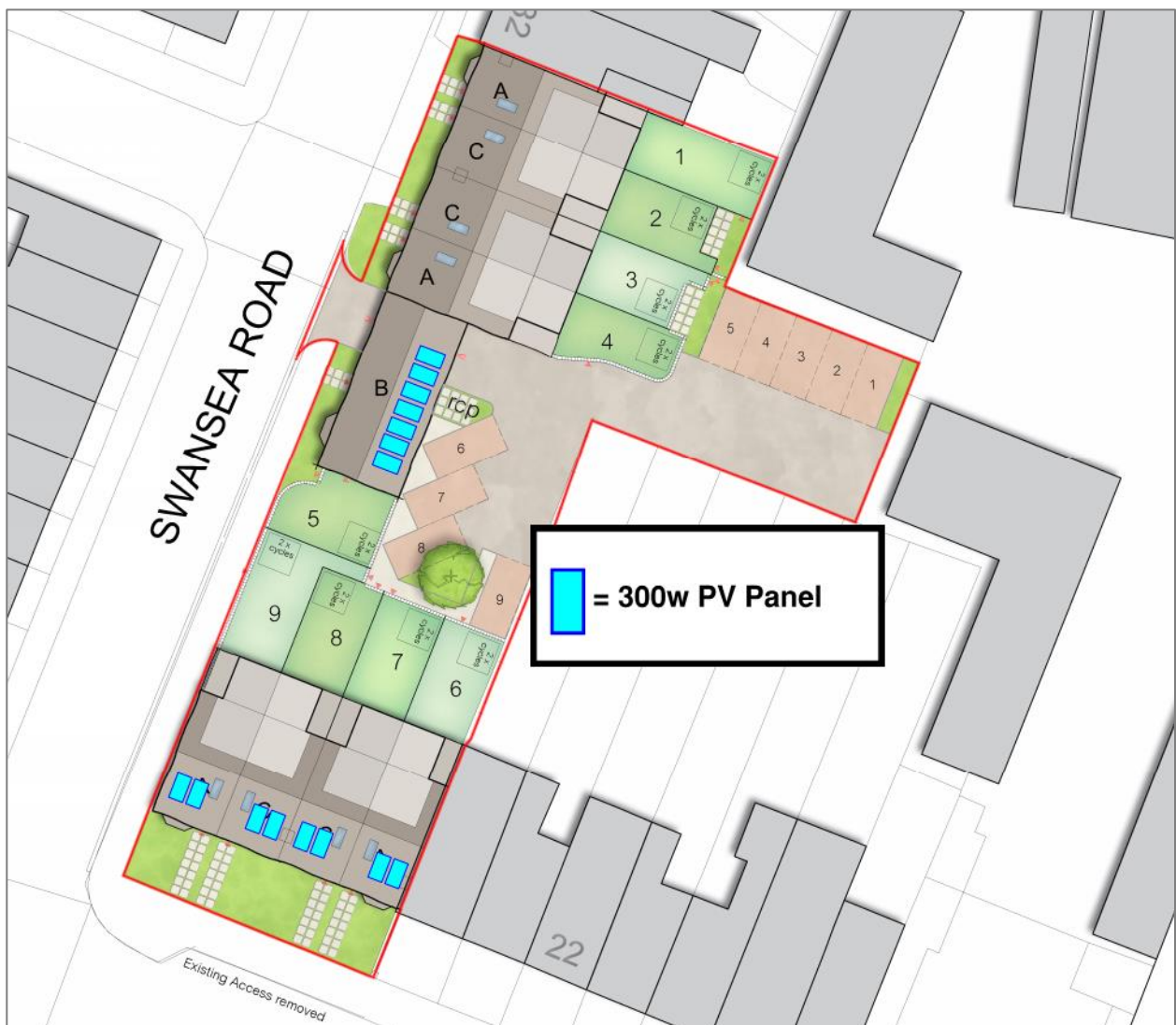
The predicted CO₂ and energy savings by the introduction of the photovoltaic panels can be summarised as detailed in the table below and will abate the following in terms of energy and CO₂.

Table 7: Energy and CO₂ abatement

Item	Amount	Metric
Energy	3,705	kWh/year
CO ₂	1,923	kgCO ₂ /year

The figure below details the most appropriate roof areas set aside for the installation of PV panels.

Figure 4: Proposed space allocated for PV Panels



9. WATER SAVING MEASURES

The following devices will be incorporated within each home:

- Water efficient taps.
- Water efficient cisterns.
- Low output showers.
- Flow restrictors to manage water pressures to achieve optimum levels.
- Water meters to all premises with guidance on water consumption and savings.

Advice will be provided by the developer to the residents through a comprehensive Home Owners Pack, detailing how to make optimum use of the devices installed around the home. Further, in marketing the scheme sustainable elements such as water reduction will be promoted.

The following specification or similar will be adopted on the development to ensure that the internal water use is reduced to a maximum of 125 litres per head per day in line with Planning Condition 6 sought by Reading Borough Council.

Table 8: Specification of flow rates and volumes for water using appliances

Water using Appliance	Comment
WC Cisterns	Dual Flush to be limited to maximum of 6/3
Baths	Capacity no greater than 190 litres
Basin taps	Flow rates to be no greater than 5 litres/minute
Kitchen taps	Flow rates to be no greater than 10 litres/minute
Shower	Flow rates to be no greater than 11 litres/minute
Water softener	Not to be installed
Washing Machine	Water usage to be limited to 17.16 Litres per KG
Dishwasher	Water Usage to be limited to 4.5 litres per place setting

Table 9: Water Calculations

Water Calculations – Houses					
Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	6.00	1.46	0.00	8.76
	Pt Flush (l)	3.00	2.96	0.00	8.88
WC's (Multiple)	Volume (l)	0.00	4.42	0.00	0.00
Taps Exc. Kitchen	Flow Rate	5.00	1.58	1.58	9.48
Bath (shower present)	(l/s)	190.00	0.11	0.00	20.90
Shower (bath present)	(l/s)	11.00	4.37	0.00	48.07
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	6.00	0.44	10.36	13.00
Washing Machines	(l/kgdry)	8.17	2.10	0.00	17.16
Dishwashers	(l/place)	1.25	3.60	0.00	4.50
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softener	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					130.70
Grey/Rain Water Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Internal Consumption (l/p/day)					119.00
External Water Use Allowance (l)					5.00
Total Consumption Part G (l/p/day)					124.00

10. CONCLUSIONS

Renewable and low carbon technologies have been considered and the developer has elected for a fabric and renewable energy approach to meet the necessary CO₂ reduction targets as sought by Reading Borough Council.

The fabric specification has been enhanced significantly. Emphasis has been placed on the attention to detail around non repeating thermal bridges to ensure that heat loss is further reduced and that an airtight dwelling is achieved.

An efficient mechanical ventilation system is proposed that will introduce fresh air to the building to ensure the internal comfort of the building is maintained.

The available options for delivery of energy have been appraised and highly efficient individual condensing gas boilers are the optimal method of supplying the homeowners with efficient, cost effective space heating and hot water.

The heating design will be enhanced by specifying full zone and optimum start controls to ensure that the homeowners have an effective, easy to control system.

A high percentage of internal lights will be low energy which will reduce energy and CO₂ emissions further.

Total Energy and CO₂ savings across the site – Regulated Energy only, are summarised in the table below.

Table 10: Predicted CO₂ and Energy Savings

Energy and CO ₂ Savings			
	Description	Amount	Unit
Baseline	Total development CO ₂ demand Part L1A 2013 (TER)	14,903	KGCO ₂ /Year
	Total development energy demand Part L1A 2013 (TER)	63,100	kWh/Year
Improved fabric	Actual development CO ₂ demand (DER) Part L1A 2013	13,936	KGCO ₂ /Year
	Actual development CO ₂ energy (DER) Part L1A 2013	57,724	kWh/Year
Energy and CO ₂ savings	CO ₂ saved through fabric/control	967	KGCO ₂ /Year
	Energy saved through fabric/control	5,376	kWh/Year
	CO ₂ saved through renewables	1,923	KGCO ₂ /Year
	Energy saved through renewables	3,705	kWh/Year
Sitewide CO ₂ and energy Summary	Percentage CO ₂ improvement through fabric/control	6.49	%
	Percentage energy improvement through fabric/control	8.52	%
	CO ₂ abatement through renewables	12.90	%
	Energy abatement through renewables	5.87	%
	Total CO₂ Improvement over baseline	19.39	%
	Total Energy Improvement over baseline	14.39	%

The total reduction in CO₂ over a Part L1A 2013 baseline unit is 19.39% through fabric and use of renewables.

The reduction in carbon emissions demonstrated in the below table is in line with the reductions sought by Reading Borough Council in their Planning Condition 6.

11. APPENDICES

The following pages detail, the energy and CO₂ outputs from each unit type.

12. THE PREDICTED ENERGY AND CO2 DEMAND

Table 11: Predicted Energy Demand

Energy	Include Unregulated Energy			No	2013	Predicted Energy Demand				
Type	Dwelling Name	TFA	No of Types	Main Heating Fuel Requirement (DER)	Water Fuel Requirement (DER)	Electricity Pumps Fans Requirement (DER)	Electricity Lighting Requirement (DER)	Unit Total	Unregulated Energy Demand	Development Total
Type A (Plot 1)	House	94.53	1	4,242	2,034	146	391	6,813		6,813
Type C (Plot 2)	House	93.89	1	3,282	2,034	146	397	5,859		5,859
Type C (Plot 3)	House	93.89	1	3,282	2,034	146	397	5,859		5,859
Type A (Plot 4)	House	94.53	1	4,242	2,034	146	391	6,813		6,813
Type B (Plot 5)	House	92.03	1	4,739	2,020	145	382	7,286		7,286
Type A (Plot 6)	House	94.53	1	3,952	2,035	146	391	6,524		6,524
Type C (Plot 7)	House	93.89	1	3,447	2,034	146	397	6,023		6,023
Type C (Plot 8)	House	93.89	1	3,447	2,034	146	397	6,023		6,023
Type A (Plot 9)	House	94.53	1	3,952	2,035	146	391	6,524		6,524
Totals			9	34,585	18,294	1,312	3,533	57,724	-	57,724

Table 12: Predicted CO₂ Demand

CO ₂	Include Unregulated Energy			No	2013	Predicted CO ₂ Demand				
Type	Dwelling Name	TFA	No of Types	Main Heating Fuel Requirement (DER)	Water Fuel Requirement (DER)	Electricity Pumps Fans Requirement (DER)	Electricity Lighting Requirement (DER)	Unit Total	Unregulated Energy Demand	Development Total
Type A (Plot 1)	House	94.53	1	916	439	76	203	1,634		1,634
Type C (Plot 2)	House	93.89	1	709	439	76	206	1,430		1,430
Type C (Plot 3)	House	93.89	1	709	439	76	206	1,430		1,430
Type A (Plot 4)	House	94.53	1	916	439	76	203	1,634		1,634
Type B (Plot 5)	House	92.03	1	1,024	436	75	198	1,734		1,734
Type A (Plot 6)	House	94.53	1	854	440	76	203	1,572		1,572
Type C (Plot 7)	House	93.89	1	745	439	76	206	1,465		1,465
Type C (Plot 8)	House	93.89	1	745	439	76	206	1,465		1,465
Type A (Plot 9)	House	94.53	1	854	440	76	203	1,572		1,572
Totals			9	7,470	3,952	681	1,833	13,936		13,936

The following pages show the out puts from SAP used within the energy strategy.

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 27 January 2021 at 16:34:18

Project Information:

Assessed By: ()

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 94.53m²

Site Reference : Swansea Road

Plot Reference: Type A (Plot 1)

Address : Type A (Plot 1)

Client Details:

Name: Helix

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

18.34 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

17.29 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

56.7 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

49.9 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.25 (max. 0.30)

0.25 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

0.11 (max. 0.25)

0.11 (max. 0.70)

Roof

0.12 (max. 0.20)

0.15 (max. 0.35)

Openings

1.37 (max. 2.00)

1.40 (max. 3.30)

OK

OK

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

4.65 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Database: (rev 471, product index 017616):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Potterton

Model: Promax Ultra

Model qualifier: Combi 33 ErP
(Combi)

Efficiency 89.1 % SEDBUK2009

Minimum 88.0 %

OK

Secondary heating system:

None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (South East England): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 4.32m²
 Windows facing: North 0.9m²
 Windows facing: West 0.9m²
 Windows facing: North East 3.02m²
 Windows facing: South West 7.47m²
 Roof windows facing: North West 0.59m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type A (Plot 1)

Address : Type A (Plot 1)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.97 (1a)	x	2.5 (2a)	=	102.43 (3a)
First floor	36.08 (1b)	x	2.7 (2b)	=	97.42 (3b)
Second floor	17.48 (1c)	x	2.54 (2c)	=	44.35 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.53 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	244.19 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
---	---	---------	-------

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration	[(9)-1]x0.1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4.65000009536743 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.2 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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			2.12	1.2	2.544		(26)
Windows Type 1			4.32	$\times 1/[1/(1.4) + 0.04]$	5.73		(27)
Windows Type 2			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 3			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 4			3.02	$\times 1/[1/(1.4) + 0.04]$	4		(27)
Windows Type 5			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Rooflights			0.59	$\times 1/[1/(1.2) + 0.04]$	0.708		(27b)
Floor			40.97	0.11	4.5067	75	3072.75 (28)
Walls Type1	104.26	18.73	85.53	0.25	21.38	60	5131.8 (29)
Walls Type2	23.4	0	23.4	0.25	5.85	9	210.6 (29)
Walls Type3	3.97	0	3.97	0.25	0.99	9	35.73 (29)
Roof Type1	9.62	0	9.62	0.11	1.06	9	86.58 (30)
Roof Type2	0.61	0	0.61	0.11	0.07	9	5.49 (30)
Roof Type3	4.28	0	4.28	0.15	0.64	9	38.52 (30)
Roof Type4	18.58	0	18.58	0.11	2.04	9	167.22 (30)
Roof Type5	8.33	0.59	7.74	0.15	1.16	9	69.66 (30)
Roof Type6	1.98	0	1.98	0.15	0.3	9	17.82 (30)

DER WorkSheet: New dwelling design stage

Total area of elements, m²	216						(31)
Party wall	67.21	x	0	=	0	110	7393.1 (32)
Internal wall **	176.01					9	1584.09 (32c)
Internal floor	53.56					18	964.08 (32d)
Internal ceiling	53.56					9	482.04 (32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 63.24 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19259.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 203.74 (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 9.91 (36)

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

Total fabric heat loss (33) + (36) = 73.15 (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=	40.45	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	(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=	113.6	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	
Average = Sum(39) _{1...12} /12=												113.46	(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=	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Average = Sum(40) _{1...12} /12=												1.2	(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 2.68 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.92 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.71	103.79	99.87	95.96	92.04	88.12	88.12	92.04	95.96	99.87	103.79	107.71	
Total = Sum(44) _{1...12} =												1175	(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=	159.73	139.7	144.16	125.68	120.59	104.06	96.43	110.65	111.97	130.5	142.45	154.69	
Total = Sum(45) _{1...12} =												1540.61	(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=	23.96	20.95	21.62	18.85	18.09	15.61	14.46	16.6	16.8	19.57	21.37	23.2	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

DER WorkSheet: New dwelling design stage

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 (56)

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

(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 (57)

Primary circuit loss (annual) from Table 3

0 (58)

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

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

(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 (59)

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

(61)m= 21.97 19.82 21.9 21.11 21.75 20.98 21.63 21.71 21.05 21.84 21.21 21.95 (61)

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

(62)m= 181.7 159.52 166.05 146.79 142.34 125.04 118.06 132.36 133.02 152.33 163.65 176.63 (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= 181.7 159.52 166.05 146.79 142.34 125.04 118.06 132.36 133.02 152.33 163.65 176.63

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

1797.5 (64)

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

(65)m= 58.6 51.41 53.41 47.07 45.53 39.84 37.47 42.22 42.49 48.85 52.66 56.92 (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=	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14

(66)

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

(67)m= 22.13 19.66 15.99 12.1 9.05 7.64 8.25 10.73 14.4 18.28 21.34 22.75 (67)

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

(68)m= 247.17 249.73 243.27 229.51 212.14 195.82 184.91 182.35 188.81 202.57 219.94 236.26 (68)

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

DER WorkSheet: New dwelling design stage

(69)m=

36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

78.77	76.5	71.78	65.37	61.2	55.34	50.36	56.75	59.02	65.66	73.15	76.51
-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

414.31	412.13	397.28	373.22	348.63	325.04	309.77	316.06	328.47	352.75	380.66	401.76
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)							
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>10.63</td></tr></table>	10.63	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>3.17</td></tr></table>	3.17	(74)
0.77																			
0.9																			
10.63																			
0.43																			
1.11																			
3.17																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>20.32</td></tr></table>	20.32	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>6.06</td></tr></table>	6.06	(74)
0.77																			
0.9																			
20.32																			
0.43																			
1.11																			
6.06																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>34.53</td></tr></table>	34.53	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>10.29</td></tr></table>	10.29	(74)
0.77																			
0.9																			
34.53																			
0.43																			
1.11																			
10.29																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>55.46</td></tr></table>	55.46	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>16.53</td></tr></table>	16.53	(74)
0.77																			
0.9																			
55.46																			
0.43																			
1.11																			
16.53																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>74.72</td></tr></table>	74.72	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>22.26</td></tr></table>	22.26	(74)
0.77																			
0.9																			
74.72																			
0.43																			
1.11																			
22.26																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>79.99</td></tr></table>	79.99	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>23.83</td></tr></table>	23.83	(74)
0.77																			
0.9																			
79.99																			
0.43																			
1.11																			
23.83																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>74.68</td></tr></table>	74.68	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>22.25</td></tr></table>	22.25	(74)
0.77																			
0.9																			
74.68																			
0.43																			
1.11																			
22.25																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>59.25</td></tr></table>	59.25	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>17.65</td></tr></table>	17.65	(74)
0.77																			
0.9																			
59.25																			
0.43																			
1.11																			
17.65																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>41.52</td></tr></table>	41.52	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>12.37</td></tr></table>	12.37	(74)
0.77																			
0.9																			
41.52																			
0.43																			
1.11																			
12.37																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>24.19</td></tr></table>	24.19	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>7.21</td></tr></table>	7.21	(74)
0.77																			
0.9																			
24.19																			
0.43																			
1.11																			
7.21																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>13.12</td></tr></table>	13.12	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>3.91</td></tr></table>	3.91	(74)
0.77																			
0.9																			
13.12																			
0.43																			
1.11																			
3.91																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>8.86</td></tr></table>	8.86	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>2.64</td></tr></table>	2.64	(74)
0.77																			
0.9																			
8.86																			
0.43																			
1.11																			
2.64																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>11.28</td></tr></table>	11.28	(75)
0.77																			
3.02																			
11.28																			
0.43																			
1.11																			
11.28																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>22.96</td></tr></table>	22.96	(75)
0.77																			
3.02																			
22.97																			
0.43																			
1.11																			
22.96																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>41.38</td></tr></table>	41.38	(75)
0.77																			
3.02																			
41.38																			
0.43																			
1.11																			
41.38																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>67.95</td></tr></table>	67.95	(75)
0.77																			
3.02																			
67.96																			
0.43																			
1.11																			
67.95																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>91.34</td></tr></table>	91.34	(75)
0.77																			
3.02																			
91.35																			
0.43																			
1.11																			
91.34																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>97.38</td></tr></table>	97.38	(75)
0.77																			
3.02																			
97.38																			
0.43																			
1.11																			
97.38																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>91.09</td></tr></table>	91.09	(75)
0.77																			
3.02																			
91.1																			
0.43																			
1.11																			
91.09																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>72.62</td></tr></table>	72.62	(75)
0.77																			
3.02																			
72.63																			
0.43																			
1.11																			
72.62																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>50.42</td></tr></table>	50.42	(75)
0.77																			
3.02																			
50.42																			
0.43																			
1.11																			
50.42																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>28.06</td></tr></table>	28.06	(75)
0.77																			
3.02																			
28.07																			
0.43																			
1.11																			
28.06																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>14.2</td></tr></table>	14.2	(75)
0.77																			
3.02																			
14.2																			
0.43																			
1.11																			
14.2																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.02</td></tr></table>	3.02	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>9.21</td></tr></table>	9.21	(75)
0.77																			
3.02																			
9.21																			
0.43																			
1.11																			
9.21																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>91</td></tr></table>	91	(79)
0.77																			
7.47																			
36.79																			
0.43																			
1.11																			
91																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>155.01</td></tr></table>	155.01	(79)
0.77																			
7.47																			
62.67																			
0.43																			
1.11																			
155.01																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>212.09</td></tr></table>	212.09	(79)
0.77																			
7.47																			
85.75																			
0.43																			
1.11																			
212.09																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>262.79</td></tr></table>	262.79	(79)
0.77																			
7.47																			
106.25																			
0.43																			
1.11																			
262.79																			

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	7.47	x	119.01	0.43	x	1.11	=	294.35	(79)
Southwest	0.9x	0.77	x	7.47	x	118.15	0.43	x	1.11	=	292.22	(79)
Southwest	0.9x	0.77	x	7.47	x	113.91	0.43	x	1.11	=	281.73	(79)
Southwest	0.9x	0.77	x	7.47	x	104.39	0.43	x	1.11	=	258.19	(79)
Southwest	0.9x	0.77	x	7.47	x	92.85	0.43	x	1.11	=	229.65	(79)
Southwest	0.9x	0.77	x	7.47	x	69.27	0.43	x	1.11	=	171.32	(79)
Southwest	0.9x	0.77	x	7.47	x	44.07	0.43	x	1.11	=	109	(79)
Southwest	0.9x	0.77	x	7.47	x	31.49	0.43	x	1.11	=	77.88	(79)
West	0.9x	0.77	x	0.9	x	19.64	0.43	x	1.11	=	5.85	(80)
West	0.9x	0.77	x	0.9	x	38.42	0.43	x	1.11	=	11.45	(80)
West	0.9x	0.77	x	0.9	x	63.27	0.43	x	1.11	=	18.85	(80)
West	0.9x	0.77	x	0.9	x	92.28	0.43	x	1.11	=	27.5	(80)
West	0.9x	0.77	x	0.9	x	113.09	0.43	x	1.11	=	33.7	(80)
West	0.9x	0.77	x	0.9	x	115.77	0.43	x	1.11	=	34.5	(80)
West	0.9x	0.77	x	0.9	x	110.22	0.43	x	1.11	=	32.84	(80)
West	0.9x	0.77	x	0.9	x	94.68	0.43	x	1.11	=	28.21	(80)
West	0.9x	0.77	x	0.9	x	73.59	0.43	x	1.11	=	21.93	(80)
West	0.9x	0.77	x	0.9	x	45.59	0.43	x	1.11	=	13.59	(80)
West	0.9x	0.77	x	0.9	x	24.49	0.43	x	1.11	=	7.3	(80)
West	0.9x	0.77	x	0.9	x	16.15	0.43	x	1.11	=	4.81	(80)
Northwest	0.9x	0.77	x	4.32	x	11.28	0.43	x	1.11	=	16.14	(81)
Northwest	0.9x	0.77	x	4.32	x	22.97	0.43	x	1.11	=	32.85	(81)
Northwest	0.9x	0.77	x	4.32	x	41.38	0.43	x	1.11	=	59.19	(81)
Northwest	0.9x	0.77	x	4.32	x	67.96	0.43	x	1.11	=	97.2	(81)
Northwest	0.9x	0.77	x	4.32	x	91.35	0.43	x	1.11	=	130.66	(81)
Northwest	0.9x	0.77	x	4.32	x	97.38	0.43	x	1.11	=	139.29	(81)
Northwest	0.9x	0.77	x	4.32	x	91.1	0.43	x	1.11	=	130.31	(81)
Northwest	0.9x	0.77	x	4.32	x	72.63	0.43	x	1.11	=	103.88	(81)
Northwest	0.9x	0.77	x	4.32	x	50.42	0.43	x	1.11	=	72.12	(81)
Northwest	0.9x	0.77	x	4.32	x	28.07	0.43	x	1.11	=	40.15	(81)
Northwest	0.9x	0.77	x	4.32	x	14.2	0.43	x	1.11	=	20.31	(81)
Northwest	0.9x	0.77	x	4.32	x	9.21	0.43	x	1.11	=	13.18	(81)
Rooflights	0.9x	1	x	0.59	x	16.37	0.63	x	0.7	=	3.83	(82)
Rooflights	0.9x	1	x	0.59	x	33.68	0.63	x	0.7	=	7.89	(82)
Rooflights	0.9x	1	x	0.59	x	62.13	0.63	x	0.7	=	14.55	(82)
Rooflights	0.9x	1	x	0.59	x	104.87	0.63	x	0.7	=	24.56	(82)
Rooflights	0.9x	1	x	0.59	x	143.66	0.63	x	0.7	=	33.64	(82)
Rooflights	0.9x	1	x	0.59	x	154.33	0.63	x	0.7	=	36.14	(82)
Rooflights	0.9x	1	x	0.59	x	143.9	0.63	x	0.7	=	33.7	(82)
Rooflights	0.9x	1	x	0.59	x	113.05	0.63	x	0.7	=	26.47	(82)
Rooflights	0.9x	1	x	0.59	x	76.56	0.63	x	0.7	=	17.93	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.59	x	41.49	x	0.63	x	0.7	=	9.72	(82)
Rooflights 0.9x	1	x	0.59	x	20.65	x	0.63	x	0.7	=	4.83	(82)
Rooflights 0.9x	1	x	0.59	x	13.34	x	0.63	x	0.7	=	3.12	(82)

Solar gains in watts, calculated for each month

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

(83)m=	131.28	236.22	356.35	496.53	605.95	623.37	591.93	507.03	404.42	270.04	159.54	110.85	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	545.59	648.35	753.63	869.75	954.59	948.4	901.7	823.1	732.89	622.79	540.21	512.61	(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	0.98	0.94	0.84	0.69	0.53	0.6	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=	19.44	19.64	19.95	20.36	20.71	20.91	20.98	20.96	20.8	20.33	19.8	19.39	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.99	0.97	0.92	0.8	0.6	0.41	0.47	0.76	0.95	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=	17.84	18.13	18.59	19.16	19.63	19.86	19.91	19.9	19.75	19.14	18.37	17.77	(90)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.08	18.35	18.79	19.34	19.79	20.01	20.07	20.06	19.9	19.31	18.58	18.02	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(93)m=	17.93	18.2	18.64	19.19	19.64	19.86	19.92	19.91	19.75	19.16	18.43	17.87	(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	0.98	0.96	0.9	0.78	0.59	0.41	0.47	0.75	0.94	0.98	0.99	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(95)m=	540.86	637.05	724.27	785.77	746.06	561.36	370.57	387.84	548.61	583.38	531.49	509.1	(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=	1548.49	1509.07	1377.37	1167.3	900.79	597.22	376.52	398.24	641.47	971.56	1285.59	1550.21	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	749.68	586	485.91	274.7	115.12	0	0	0	0	288.8	542.95	774.58	(98)
--------	--------	-----	--------	-------	--------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)1...5,9...12 = 3817.75 (98)

Space heating requirement in kWh/m²/year

40.39 (99)

DER WorkSheet: New dwelling design stage

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

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

Space heating requirement (calculated above)

749.68	586	485.91	274.7	115.12	0	0	0	0	288.8	542.95	774.58
--------	-----	--------	-------	--------	---	---	---	---	-------	--------	--------

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

832.97	651.11	539.9	305.23	127.91	0	0	0	0	320.89	603.28	860.65
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 4241.94 (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)

181.7	159.52	166.05	146.79	142.34	125.04	118.06	132.36	133.02	152.33	163.65	176.63
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Efficiency of water heater 86.7 (216)

(217)m=	89.34	89.27	89.14	88.82	88.15	86.7	86.7	86.7	86.7	88.83	89.21	89.37	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.38	178.69	186.29	165.26	161.49	144.22	136.17	152.67	153.43	171.48	183.44	197.65	Total = Sum(219a) _{1...12} = 2034.17 (219)
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Annual totals

Space heating fuel used, main system 1	4241.94
Water heating fuel used	2034.17

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside	71.07	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 146.07 (231)

Electricity for lighting 390.85 (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	= 916.26 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 439.38 (264)

DER WorkSheet: New dwelling design stage

Space and water heating	$(261) + (262) + (263) + (264) =$			1355.64	(265)
Electricity for pumps, fans and electric keep-hot	$(231) \times$	0.519	=	75.81	(267)
Electricity for lighting	$(232) \times$	0.519	=	202.85	(268)
Total CO2, kg/year	sum of (265)...(271) =			1634.3	(272)
Dwelling CO2 Emission Rate	$(272) \div (4) =$			17.29	(273)
El rating (section 14)				84	(274)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type A (Plot 1)

Address : Type A (Plot 1)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.97 (1a)	x	2.5 (2a)	=	102.43 (3a)
First floor	36.08 (1b)	x	2.7 (2b)	=	97.42 (3b)
Second floor	17.48 (1c)	x	2.54 (2c)	=	44.35 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.53 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	244.19 (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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 ÷ (5) = 0.12 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)

Additional infiltration

[(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

0.25 - [0.2 x (14) ÷ 100] =

Infiltration rate

(8) + (10) + (11) + (12) + (13) + (15) =

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered

Shelter factor

(20) = 1 - [0.075 x (19)] =

Infiltration rate incorporating shelter factor

(21) = (18) x (20) =

Infiltration rate modified for monthly wind speed

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

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

Wind Factor (22a)m = (22)m ÷ 4

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

	0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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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=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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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			2.12	1.2	2.544		(26)
Windows Type 1			4.32	$\times 1/[1/(1.4) + 0.04]$	5.73		(27)
Windows Type 2			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 3			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 4			3.02	$\times 1/[1/(1.4) + 0.04]$	4		(27)
Windows Type 5			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Rooflights			0.59	$\times 1/[1/(1.7) + 0.04]$	1.003		(27b)
Floor			40.97	0.13	5.3261		(28)
Walls Type1	104.26	18.73	85.53	0.18	15.4		(29)
Walls Type2	23.4	0	23.4	0.18	4.21		(29)
Walls Type3	3.97	0	3.97	0.18	0.71		(29)
Roof Type1	9.62	0	9.62	0.13	1.25		(30)
Roof Type2	0.61	0	0.61	0.13	0.08		(30)
Roof Type3	4.28	0	4.28	0.13	0.56		(30)
Roof Type4	18.58	0	18.58	0.13	2.42		(30)
Roof Type5	8.33	0.59	7.74	0.13	1.01		(30)
Roof Type6	1.98	0	1.98	0.13	0.26		(30)

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Total area of elements, m²	216					(31)	
Party wall	67.21	x	0	=	0		(32)
Internal wall **	176.01						(32c)
Internal floor	53.56						(32d)
Internal ceiling	53.56						(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) =	56.72	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	19259.48	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	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	12.96	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	69.68	(37)
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Ventilation heat loss calculated monthly	(38)m = 0.33 x (25)m x (5)	
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	46.87	46.61	46.36	45.19	44.97	43.94	43.94	43.75	44.34	44.97	45.41	45.88	(38)

Heat transfer coefficient, W/K												(39)m = (37) + (38)m	
(39)m=	116.55	116.29	116.04	114.87	114.65	113.62	113.62	113.43	114.02	114.65	115.09	115.56	
Average = Sum(39) _{1...12} /12=												114.87	(39)

Heat loss parameter (HLP), W/m ² K											(40)m = (39)m ÷ (4)		
(40)m=	1.23	1.23	1.23	1.22	1.21	1.2	1.2	1.2	1.21	1.21	1.22	1.22	
Average = Sum(40) _{1...12} /12=												1.22	(40)

Number of days in month (Table 1a)													
(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	2.68	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9) ²)] + 0.0013 x (TFA -13.9)		
if TFA ≤ 13.9, N = 1		

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	97.92	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.71	103.79	99.87	95.96	92.04	88.12	88.12	92.04	95.96	99.87	103.79	107.71	
	Total = Sum(44) _{1...12} =											1175	(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=	159.73	139.7	144.16	125.68	120.59	104.06	96.43	110.65	111.97	130.5	142.45	154.69		
Total = Sum(45) _{1...12} =													1540.61	(45)

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

(46)m=	23.96	20.95	21.62	18.85	18.09	15.61	14.46	16.6	16.8	19.57	21.37	23.2	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
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TER WorkSheet: New dwelling design stage

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) = 0 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) = 0 (54)

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

0 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 (56)

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

(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 (57)

Primary circuit loss (annual) from Table 3

0 (58)

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

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

(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 (59)

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

(61)m= 50.96 46.03 50.9 47.32 46.9 43.46 44.91 46.9 47.32 50.9 49.32 50.96 (61)

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

(62)m= 210.69 185.73 195.05 173 167.5 147.52 141.34 157.56 159.3 181.39 191.76 205.65 (62)

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

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

(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater

(64)m= 210.69 185.73 195.05 173 167.5 147.52 141.34 157.56 159.3 181.39 191.76 205.65
Output from water heater (annual)_{1...12} 2116.47 (64)

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

(65)m= 65.85 57.96 60.66 53.62 51.82 45.47 43.29 48.52 49.06 56.11 59.69 64.17 (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=	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14

(66)

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

(67)m=	22.13	19.66	15.99	12.1	9.05	7.64	8.25	10.73	14.4	18.28	21.34	22.75
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(67)

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

(68)m=	247.17	249.73	243.27	229.51	212.14	195.82	184.91	182.35	188.81	202.57	219.94	236.26
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(68)

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

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(69)m=

36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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 (70)

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

(71)m=

-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31
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 (71)

Water heating gains (Table 5)

(72)m=

88.51	86.25	81.53	74.47	69.65	63.15	58.18	65.21	68.14	75.42	82.91	86.25
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 (72)

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

(73)m=

424.05	421.88	407.03	382.33	357.09	332.84	317.59	324.53	337.59	362.52	390.42	411.51
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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 _l Table 6b		FF Table 6c	=	Gains (W)		
North	0.9x	0.77	x	0.9	x	10.63	x	0.63	x	0.7	=	2.92	(74)
North	0.9x	0.77	x	0.9	x	20.32	x	0.63	x	0.7	=	5.59	(74)
North	0.9x	0.77	x	0.9	x	34.53	x	0.63	x	0.7	=	9.5	(74)
North	0.9x	0.77	x	0.9	x	55.46	x	0.63	x	0.7	=	15.26	(74)
North	0.9x	0.77	x	0.9	x	74.72	x	0.63	x	0.7	=	20.55	(74)
North	0.9x	0.77	x	0.9	x	79.99	x	0.63	x	0.7	=	22	(74)
North	0.9x	0.77	x	0.9	x	74.68	x	0.63	x	0.7	=	20.54	(74)
North	0.9x	0.77	x	0.9	x	59.25	x	0.63	x	0.7	=	16.3	(74)
North	0.9x	0.77	x	0.9	x	41.52	x	0.63	x	0.7	=	11.42	(74)
North	0.9x	0.77	x	0.9	x	24.19	x	0.63	x	0.7	=	6.65	(74)
North	0.9x	0.77	x	0.9	x	13.12	x	0.63	x	0.7	=	3.61	(74)
North	0.9x	0.77	x	0.9	x	8.86	x	0.63	x	0.7	=	2.44	(74)
Northeast	0.9x	0.77	x	3.02	x	11.28	x	0.63	x	0.7	=	10.41	(75)
Northeast	0.9x	0.77	x	3.02	x	22.97	x	0.63	x	0.7	=	21.2	(75)
Northeast	0.9x	0.77	x	3.02	x	41.38	x	0.63	x	0.7	=	38.19	(75)
Northeast	0.9x	0.77	x	3.02	x	67.96	x	0.63	x	0.7	=	62.72	(75)
Northeast	0.9x	0.77	x	3.02	x	91.35	x	0.63	x	0.7	=	84.31	(75)
Northeast	0.9x	0.77	x	3.02	x	97.38	x	0.63	x	0.7	=	89.88	(75)
Northeast	0.9x	0.77	x	3.02	x	91.1	x	0.63	x	0.7	=	84.08	(75)
Northeast	0.9x	0.77	x	3.02	x	72.63	x	0.63	x	0.7	=	67.03	(75)
Northeast	0.9x	0.77	x	3.02	x	50.42	x	0.63	x	0.7	=	46.54	(75)
Northeast	0.9x	0.77	x	3.02	x	28.07	x	0.63	x	0.7	=	25.9	(75)
Northeast	0.9x	0.77	x	3.02	x	14.2	x	0.63	x	0.7	=	13.1	(75)
Northeast	0.9x	0.77	x	3.02	x	9.21	x	0.63	x	0.7	=	8.5	(75)
Southwest	0.9x	0.77	x	7.47	x	36.79		0.63	x	0.7	=	84	(79)
Southwest	0.9x	0.77	x	7.47	x	62.67		0.63	x	0.7	=	143.08	(79)
Southwest	0.9x	0.77	x	7.47	x	85.75		0.63	x	0.7	=	195.77	(79)
Southwest	0.9x	0.77	x	7.47	x	106.25		0.63	x	0.7	=	242.56	(79)

TER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	7.47	x	119.01	0.63	x	0.7	=	271.69	(79)
Southwest	0.9x	0.77	x	7.47	x	118.15	0.63	x	0.7	=	269.73	(79)
Southwest	0.9x	0.77	x	7.47	x	113.91	0.63	x	0.7	=	260.05	(79)
Southwest	0.9x	0.77	x	7.47	x	104.39	0.63	x	0.7	=	238.32	(79)
Southwest	0.9x	0.77	x	7.47	x	92.85	0.63	x	0.7	=	211.97	(79)
Southwest	0.9x	0.77	x	7.47	x	69.27	0.63	x	0.7	=	158.13	(79)
Southwest	0.9x	0.77	x	7.47	x	44.07	0.63	x	0.7	=	100.61	(79)
Southwest	0.9x	0.77	x	7.47	x	31.49	0.63	x	0.7	=	71.88	(79)
West	0.9x	0.77	x	0.9	x	19.64	0.63	x	0.7	=	5.4	(80)
West	0.9x	0.77	x	0.9	x	38.42	0.63	x	0.7	=	10.57	(80)
West	0.9x	0.77	x	0.9	x	63.27	0.63	x	0.7	=	17.4	(80)
West	0.9x	0.77	x	0.9	x	92.28	0.63	x	0.7	=	25.38	(80)
West	0.9x	0.77	x	0.9	x	113.09	0.63	x	0.7	=	31.11	(80)
West	0.9x	0.77	x	0.9	x	115.77	0.63	x	0.7	=	31.84	(80)
West	0.9x	0.77	x	0.9	x	110.22	0.63	x	0.7	=	30.32	(80)
West	0.9x	0.77	x	0.9	x	94.68	0.63	x	0.7	=	26.04	(80)
West	0.9x	0.77	x	0.9	x	73.59	0.63	x	0.7	=	20.24	(80)
West	0.9x	0.77	x	0.9	x	45.59	0.63	x	0.7	=	12.54	(80)
West	0.9x	0.77	x	0.9	x	24.49	0.63	x	0.7	=	6.74	(80)
West	0.9x	0.77	x	0.9	x	16.15	0.63	x	0.7	=	4.44	(80)
Northwest	0.9x	0.77	x	4.32	x	11.28	0.63	x	0.7	=	14.9	(81)
Northwest	0.9x	0.77	x	4.32	x	22.97	0.63	x	0.7	=	30.32	(81)
Northwest	0.9x	0.77	x	4.32	x	41.38	0.63	x	0.7	=	54.63	(81)
Northwest	0.9x	0.77	x	4.32	x	67.96	0.63	x	0.7	=	89.72	(81)
Northwest	0.9x	0.77	x	4.32	x	91.35	0.63	x	0.7	=	120.6	(81)
Northwest	0.9x	0.77	x	4.32	x	97.38	0.63	x	0.7	=	128.57	(81)
Northwest	0.9x	0.77	x	4.32	x	91.1	0.63	x	0.7	=	120.28	(81)
Northwest	0.9x	0.77	x	4.32	x	72.63	0.63	x	0.7	=	95.89	(81)
Northwest	0.9x	0.77	x	4.32	x	50.42	0.63	x	0.7	=	66.57	(81)
Northwest	0.9x	0.77	x	4.32	x	28.07	0.63	x	0.7	=	37.06	(81)
Northwest	0.9x	0.77	x	4.32	x	14.2	0.63	x	0.7	=	18.74	(81)
Northwest	0.9x	0.77	x	4.32	x	9.21	0.63	x	0.7	=	12.17	(81)
Rooflights	0.9x	1	x	0.59	x	16.37	0.63	x	0.7	=	3.83	(82)
Rooflights	0.9x	1	x	0.59	x	33.68	0.63	x	0.7	=	7.89	(82)
Rooflights	0.9x	1	x	0.59	x	62.13	0.63	x	0.7	=	14.55	(82)
Rooflights	0.9x	1	x	0.59	x	104.87	0.63	x	0.7	=	24.56	(82)
Rooflights	0.9x	1	x	0.59	x	143.66	0.63	x	0.7	=	33.64	(82)
Rooflights	0.9x	1	x	0.59	x	154.33	0.63	x	0.7	=	36.14	(82)
Rooflights	0.9x	1	x	0.59	x	143.9	0.63	x	0.7	=	33.7	(82)
Rooflights	0.9x	1	x	0.59	x	113.05	0.63	x	0.7	=	26.47	(82)
Rooflights	0.9x	1	x	0.59	x	76.56	0.63	x	0.7	=	17.93	(82)

TER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.59	x	41.49	x	0.63	x	0.7	=	9.72	(82)
Rooflights 0.9x	1	x	0.59	x	20.65	x	0.63	x	0.7	=	4.83	(82)
Rooflights 0.9x	1	x	0.59	x	13.34	x	0.63	x	0.7	=	3.12	(82)

Solar gains in watts, calculated for each month

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

(83)m=	121.47	218.64	330.04	460.2	561.9	578.16	548.96	470.04	374.67	250	147.63	102.56	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	545.52	640.52	737.06	842.53	918.98	911.01	866.55	794.57	712.26	612.52	538.06	514.07	(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	0.96	0.88	0.72	0.56	0.62	0.87	0.98	1	1	(86)

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

(87)m=	19.63	19.79	20.07	20.43	20.75	20.93	20.98	20.98	20.83	20.42	19.96	19.6	(87)
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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=	1	0.99	0.98	0.95	0.84	0.63	0.43	0.49	0.8	0.97	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=	18.07	18.31	18.71	19.24	19.66	19.87	19.91	19.91	19.78	19.23	18.56	18.03	(90)
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fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.3	18.53	18.91	19.42	19.83	20.03	20.07	20.07	19.94	19.41	18.77	18.27	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.3	18.53	18.91	19.42	19.83	20.03	20.07	20.07	19.94	19.41	18.77	18.27	(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=	1	0.99	0.98	0.94	0.83	0.64	0.45	0.51	0.8	0.96	0.99	1	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	543.53	635.4	722.02	791.13	766.13	583.7	389.82	407.38	569.34	589.57	534.05	512.64	(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=	1631.83	1585.04	1440.22	1207.92	931.56	617.25	394.59	416.14	665.39	1009.58	1342.62	1625.52	(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=	809.69	638.16	534.34	300.09	123.07	0	0	0	0	312.49	582.17	827.98	(98)
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Total per year (kWh/year) = Sum(98)1...5,9...12 = 4127.99 (98)

Space heating requirement in kWh/m²/year

43.67 (99)

TER WorkSheet: New dwelling design stage

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

Space heating:

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

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

809.69	638.16	534.34	300.09	123.07	0	0	0	0	312.49	582.17	827.98
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(211)m = {[[(98)m x (204)] } x 100 ÷ (206) (211)

866.91	683.25	572.1	321.29	131.77	0	0	0	0	334.57	623.31	886.49
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 4419.69 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

210.69	185.73	195.05	173	167.5	147.52	141.34	157.56	159.3	181.39	191.76	205.65
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Efficiency of water heater 80.3 (216)

(217)m= 88.11 87.91 87.46 86.42 84.29 80.3 80.3 80.3 80.3 86.41 87.67 88.19 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

239.11	211.27	223.02	200.18	198.72	183.71	176.01	196.21	198.38	209.92	218.74	233.18
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Total = Sum(219a)_{1...12} = 2488.45 (219)

Annual totals

Space heating fuel used, main system 1	4419.69	kWh/year	kWh/year
Water heating fuel used	2488.45		

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 390.85 (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	= 954.65 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 537.51 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1492.16 (265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.85	(268)
Total CO2, kg/year		sum of (265)...(271) =		1733.94	(272)
TER	=			18.34	(273)

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 27 January 2021 at 16:34:17

Project Information:

Assessed By: () **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 94.53m²

Site Reference : Swansea Road

Plot Reference: Type A (Plot 4)

Address : Type A (Plot 4)

Client Details:

Name: Helix

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.34 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.29 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 56.7 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 49.9 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.65 (design value)
Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Database: (rev 471, product index 017616):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Potterton
Model: Promax Ultra
Model qualifier: Combi 33 ErP (Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (South East England): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 4.32m²
 Windows facing: North 0.9m²
 Windows facing: West 0.9m²
 Windows facing: North East 3.02m²
 Windows facing: South West 7.47m²
 Roof windows facing: North West 0.59m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type A (Plot 4)

Address : Type A (Plot 4)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.97 (1a)	x	2.5 (2a)	=	102.43 (3a)
First floor	36.08 (1b)	x	2.7 (2b)	=	97.42 (3b)
Second floor	17.48 (1c)	x	2.54 (2c)	=	44.35 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.53 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	244.19 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)

Additional infiltration

[(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

0.25 - [0.2 x (14) ÷ 100] =

Infiltration rate

(8) + (10) + (11) + (12) + (13) + (15) =

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

4.65000009536743 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered

2 (19)

Shelter factor

(20) = 1 - [0.075 x (19)] =

0.85 (20)

Infiltration rate incorporating shelter factor

(21) = (18) x (20) =

0.2 (21)

Infiltration rate modified for monthly wind speed

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

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

Wind Factor (22a)m = (22)m ÷ 4

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
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(24c)

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
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(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	1.2	2.544		(26)
Windows Type 1			4.32	$\times 1/[1/(1.4) + 0.04]$	5.73		(27)
Windows Type 2			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 3			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 4			3.02	$\times 1/[1/(1.4) + 0.04]$	4		(27)
Windows Type 5			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Rooflights			0.59	$\times 1/[1/(1.2) + 0.04]$	0.708		(27b)
Floor			40.97	0.11	4.5067	75	3072.75 (28)
Walls Type1	104.26	18.73	85.53	0.25	21.38	60	5131.8 (29)
Walls Type2	23.4	0	23.4	0.25	5.85	9	210.6 (29)
Walls Type3	3.97	0	3.97	0.25	0.99	9	35.73 (29)
Roof Type1	9.62	0	9.62	0.11	1.06	9	86.58 (30)
Roof Type2	0.61	0	0.61	0.11	0.07	9	5.49 (30)
Roof Type3	4.28	0	4.28	0.15	0.64	9	38.52 (30)
Roof Type4	18.58	0	18.58	0.11	2.04	9	167.22 (30)
Roof Type5	8.33	0.59	7.74	0.15	1.16	9	69.66 (30)
Roof Type6	1.98	0	1.98	0.15	0.3	9	17.82 (30)

DER WorkSheet: New dwelling design stage

Total area of elements, m²	216							(31)
Party wall	67.21	x	0	=	0	110	7393.1	(32)
Internal wall **	176.01					9	1584.09	(32c)
Internal floor	53.56					18	964.08	(32d)
Internal ceiling	53.56					9	482.04	(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) =	63.24	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	19259.48	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	= (34) ÷ (4) =	203.74	(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	9.91	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	73.15	(37)
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Ventilation heat loss calculated monthly	(38)m = 0.33 x (25)m x (5)	
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.45	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	(38)

Heat transfer coefficient, W/K											(39)m = (37) + (38)m		
(39)m=	113.6	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	
Average = Sum(39) _{1...12} /12=											113.46	(39)	

Heat loss parameter (HLP), W/m²K	(40)m = (39)m ÷ (4)												
(40)m=	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2		
	Average = Sum(40) _{1...12} /12=											1.2	(40)

Number of days in month (Table 1a)													
(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	2.68	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9) ²)] + 0.0013 x (TFA -13.9)		
if TFA ≤ 13.9, N = 1		

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	97.92	(43)
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Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.71	103.79	99.87	95.96	92.04	88.12	88.12	92.04	95.96	99.87	103.79	107.71	
	Total = Sum(44) _{1...12} =											1175	(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=	159.73	139.7	144.16	125.68	120.59	104.06	96.43	110.65	111.97	130.5	142.45	154.69	
	Total = Sum(45) _{1...12} =											1540.61	(45)

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

(46)m=	23.96	20.95	21.62	18.85	18.09	15.61	14.46	16.6	16.8	19.57	21.37	23.2	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
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DER WorkSheet: New dwelling design stage

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 (56)

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

(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 (57)

Primary circuit loss (annual) from Table 3

0 (58)

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

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

(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 (59)

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

(61)m= 21.97 19.82 21.9 21.11 21.75 20.98 21.63 21.71 21.05 21.84 21.21 21.95 (61)

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

(62)m= 181.7 159.52 166.05 146.79 142.34 125.04 118.06 132.36 133.02 152.33 163.65 176.63 (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= 181.7 159.52 166.05 146.79 142.34 125.04 118.06 132.36 133.02 152.33 163.65 176.63

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

1797.5 (64)

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

(65)m= 58.6 51.41 53.41 47.07 45.53 39.84 37.47 42.22 42.49 48.85 52.66 56.92 (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=	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14

(66)

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

(67)m= 22.13 19.66 15.99 12.1 9.05 7.64 8.25 10.73 14.4 18.28 21.34 22.75 (67)

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

(68)m= 247.17 249.73 243.27 229.51 212.14 195.82 184.91 182.35 188.81 202.57 219.94 236.26 (68)

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

DER WorkSheet: New dwelling design stage

(69)m=

36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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 (70)

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

(71)m=

-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31
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 (71)

Water heating gains (Table 5)

(72)m=

78.77	76.5	71.78	65.37	61.2	55.34	50.36	56.75	59.02	65.66	73.15	76.51
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 (72)

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

(73)m=

414.31	412.13	397.28	373.22	348.63	325.04	309.77	316.06	328.47	352.75	380.66	401.76
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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)	
North	0.9x	0.77	x	0.9	x	10.63	x	0.43	x	1.11	=	3.17	(74)
North	0.9x	0.77	x	0.9	x	20.32	x	0.43	x	1.11	=	6.06	(74)
North	0.9x	0.77	x	0.9	x	34.53	x	0.43	x	1.11	=	10.29	(74)
North	0.9x	0.77	x	0.9	x	55.46	x	0.43	x	1.11	=	16.53	(74)
North	0.9x	0.77	x	0.9	x	74.72	x	0.43	x	1.11	=	22.26	(74)
North	0.9x	0.77	x	0.9	x	79.99	x	0.43	x	1.11	=	23.83	(74)
North	0.9x	0.77	x	0.9	x	74.68	x	0.43	x	1.11	=	22.25	(74)
North	0.9x	0.77	x	0.9	x	59.25	x	0.43	x	1.11	=	17.65	(74)
North	0.9x	0.77	x	0.9	x	41.52	x	0.43	x	1.11	=	12.37	(74)
North	0.9x	0.77	x	0.9	x	24.19	x	0.43	x	1.11	=	7.21	(74)
North	0.9x	0.77	x	0.9	x	13.12	x	0.43	x	1.11	=	3.91	(74)
North	0.9x	0.77	x	0.9	x	8.86	x	0.43	x	1.11	=	2.64	(74)
Northeast	0.9x	0.77	x	3.02	x	11.28	x	0.43	x	1.11	=	11.28	(75)
Northeast	0.9x	0.77	x	3.02	x	22.97	x	0.43	x	1.11	=	22.96	(75)
Northeast	0.9x	0.77	x	3.02	x	41.38	x	0.43	x	1.11	=	41.38	(75)
Northeast	0.9x	0.77	x	3.02	x	67.96	x	0.43	x	1.11	=	67.95	(75)
Northeast	0.9x	0.77	x	3.02	x	91.35	x	0.43	x	1.11	=	91.34	(75)
Northeast	0.9x	0.77	x	3.02	x	97.38	x	0.43	x	1.11	=	97.38	(75)
Northeast	0.9x	0.77	x	3.02	x	91.1	x	0.43	x	1.11	=	91.09	(75)
Northeast	0.9x	0.77	x	3.02	x	72.63	x	0.43	x	1.11	=	72.62	(75)
Northeast	0.9x	0.77	x	3.02	x	50.42	x	0.43	x	1.11	=	50.42	(75)
Northeast	0.9x	0.77	x	3.02	x	28.07	x	0.43	x	1.11	=	28.06	(75)
Northeast	0.9x	0.77	x	3.02	x	14.2	x	0.43	x	1.11	=	14.2	(75)
Northeast	0.9x	0.77	x	3.02	x	9.21	x	0.43	x	1.11	=	9.21	(75)
Southwest	0.9x	0.77	x	7.47	x	36.79		0.43	x	1.11	=	91	(79)
Southwest	0.9x	0.77	x	7.47	x	62.67		0.43	x	1.11	=	155.01	(79)
Southwest	0.9x	0.77	x	7.47	x	85.75		0.43	x	1.11	=	212.09	(79)
Southwest	0.9x	0.77	x	7.47	x	106.25		0.43	x	1.11	=	262.79	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	7.47	x	119.01	0.43	x	1.11	=	294.35	(79)
Southwest	0.9x	0.77	x	7.47	x	118.15	0.43	x	1.11	=	292.22	(79)
Southwest	0.9x	0.77	x	7.47	x	113.91	0.43	x	1.11	=	281.73	(79)
Southwest	0.9x	0.77	x	7.47	x	104.39	0.43	x	1.11	=	258.19	(79)
Southwest	0.9x	0.77	x	7.47	x	92.85	0.43	x	1.11	=	229.65	(79)
Southwest	0.9x	0.77	x	7.47	x	69.27	0.43	x	1.11	=	171.32	(79)
Southwest	0.9x	0.77	x	7.47	x	44.07	0.43	x	1.11	=	109	(79)
Southwest	0.9x	0.77	x	7.47	x	31.49	0.43	x	1.11	=	77.88	(79)
West	0.9x	0.77	x	0.9	x	19.64	0.43	x	1.11	=	5.85	(80)
West	0.9x	0.77	x	0.9	x	38.42	0.43	x	1.11	=	11.45	(80)
West	0.9x	0.77	x	0.9	x	63.27	0.43	x	1.11	=	18.85	(80)
West	0.9x	0.77	x	0.9	x	92.28	0.43	x	1.11	=	27.5	(80)
West	0.9x	0.77	x	0.9	x	113.09	0.43	x	1.11	=	33.7	(80)
West	0.9x	0.77	x	0.9	x	115.77	0.43	x	1.11	=	34.5	(80)
West	0.9x	0.77	x	0.9	x	110.22	0.43	x	1.11	=	32.84	(80)
West	0.9x	0.77	x	0.9	x	94.68	0.43	x	1.11	=	28.21	(80)
West	0.9x	0.77	x	0.9	x	73.59	0.43	x	1.11	=	21.93	(80)
West	0.9x	0.77	x	0.9	x	45.59	0.43	x	1.11	=	13.59	(80)
West	0.9x	0.77	x	0.9	x	24.49	0.43	x	1.11	=	7.3	(80)
West	0.9x	0.77	x	0.9	x	16.15	0.43	x	1.11	=	4.81	(80)
Northwest	0.9x	0.77	x	4.32	x	11.28	0.43	x	1.11	=	16.14	(81)
Northwest	0.9x	0.77	x	4.32	x	22.97	0.43	x	1.11	=	32.85	(81)
Northwest	0.9x	0.77	x	4.32	x	41.38	0.43	x	1.11	=	59.19	(81)
Northwest	0.9x	0.77	x	4.32	x	67.96	0.43	x	1.11	=	97.2	(81)
Northwest	0.9x	0.77	x	4.32	x	91.35	0.43	x	1.11	=	130.66	(81)
Northwest	0.9x	0.77	x	4.32	x	97.38	0.43	x	1.11	=	139.29	(81)
Northwest	0.9x	0.77	x	4.32	x	91.1	0.43	x	1.11	=	130.31	(81)
Northwest	0.9x	0.77	x	4.32	x	72.63	0.43	x	1.11	=	103.88	(81)
Northwest	0.9x	0.77	x	4.32	x	50.42	0.43	x	1.11	=	72.12	(81)
Northwest	0.9x	0.77	x	4.32	x	28.07	0.43	x	1.11	=	40.15	(81)
Northwest	0.9x	0.77	x	4.32	x	14.2	0.43	x	1.11	=	20.31	(81)
Northwest	0.9x	0.77	x	4.32	x	9.21	0.43	x	1.11	=	13.18	(81)
Rooflights	0.9x	1	x	0.59	x	16.37	0.63	x	0.7	=	3.83	(82)
Rooflights	0.9x	1	x	0.59	x	33.68	0.63	x	0.7	=	7.89	(82)
Rooflights	0.9x	1	x	0.59	x	62.13	0.63	x	0.7	=	14.55	(82)
Rooflights	0.9x	1	x	0.59	x	104.87	0.63	x	0.7	=	24.56	(82)
Rooflights	0.9x	1	x	0.59	x	143.66	0.63	x	0.7	=	33.64	(82)
Rooflights	0.9x	1	x	0.59	x	154.33	0.63	x	0.7	=	36.14	(82)
Rooflights	0.9x	1	x	0.59	x	143.9	0.63	x	0.7	=	33.7	(82)
Rooflights	0.9x	1	x	0.59	x	113.05	0.63	x	0.7	=	26.47	(82)
Rooflights	0.9x	1	x	0.59	x	76.56	0.63	x	0.7	=	17.93	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.59	x	41.49	x	0.63	x	0.7	=	9.72	(82)
Rooflights 0.9x	1	x	0.59	x	20.65	x	0.63	x	0.7	=	4.83	(82)
Rooflights 0.9x	1	x	0.59	x	13.34	x	0.63	x	0.7	=	3.12	(82)

Solar gains in watts, calculated for each month

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

(83)m=	131.28	236.22	356.35	496.53	605.95	623.37	591.93	507.03	404.42	270.04	159.54	110.85	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	545.59	648.35	753.63	869.75	954.59	948.4	901.7	823.1	732.89	622.79	540.21	512.61	(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	0.69	0.53	0.6	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=	19.44	19.64	19.95	20.36	20.71	20.91	20.98	20.96	20.8	20.33	19.8	19.39	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------	------

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

(88)m=	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.99	0.97	0.92	0.8	0.6	0.41	0.47	0.76	0.95	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=	17.84	18.13	18.59	19.16	19.63	19.86	19.91	19.9	19.75	19.14	18.37	17.77	(90)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.08	18.35	18.79	19.34	19.79	20.01	20.07	20.06	19.9	19.31	18.58	18.02	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(93)m=	17.93	18.2	18.64	19.19	19.64	19.86	19.92	19.91	19.75	19.16	18.43	17.87	(93)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.9	0.78	0.59	0.41	0.47	0.75	0.94	0.98	0.99	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(95)m=	540.86	637.05	724.27	785.77	746.06	561.36	370.57	387.84	548.61	583.38	531.49	509.1	(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=	1548.49	1509.07	1377.37	1167.3	900.79	597.22	376.52	398.24	641.47	971.56	1285.59	1550.21	(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=	749.68	586	485.91	274.7	115.12	0	0	0	0	288.8	542.95	774.58	(98)
--------	--------	-----	--------	-------	--------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)1...5,9...12 = 3817.75 (98)

Space heating requirement in kWh/m²/year

40.39 (99)

DER WorkSheet: New dwelling design stage

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

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

Space heating requirement (calculated above)

749.68	586	485.91	274.7	115.12	0	0	0	0	288.8	542.95	774.58
--------	-----	--------	-------	--------	---	---	---	---	-------	--------	--------

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

832.97	651.11	539.9	305.23	127.91	0	0	0	0	320.89	603.28	860.65
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 4241.94 (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)
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Water heating

Output from water heater (calculated above)

181.7	159.52	166.05	146.79	142.34	125.04	118.06	132.36	133.02	152.33	163.65	176.63
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Efficiency of water heater 86.7 (216)

(217)m= 89.34 89.27 89.14 88.82 88.15 86.7 86.7 86.7 86.7 88.83 89.21 89.37 (217)

89.34	89.27	89.14	88.82	88.15	86.7	86.7	86.7	86.7	88.83	89.21	89.37
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.38	178.69	186.29	165.26	161.49	144.22	136.17	152.67	153.43	171.48	183.44	197.65	Total = Sum(219a) _{1...12} = 2034.17 (219)
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---

Annual totals

Space heating fuel used, main system 1	4241.94
Water heating fuel used	2034.17

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 71.07 (230a)

central heating pump: 30 (230c)

boiler with a fan-assisted flue 45 (230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 146.07 (231)

Electricity for lighting 390.85 (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	= 916.26 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 439.38 (264)

DER WorkSheet: New dwelling design stage

Space and water heating	$(261) + (262) + (263) + (264) =$			1355.64	(265)
Electricity for pumps, fans and electric keep-hot	$(231) \times$	0.519	=	75.81	(267)
Electricity for lighting	$(232) \times$	0.519	=	202.85	(268)
Total CO2, kg/year	sum of (265)...(271) =			1634.3	(272)
Dwelling CO2 Emission Rate	$(272) \div (4) =$			17.29	(273)
El rating (section 14)				84	(274)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type A (Plot 4)

Address : Type A (Plot 4)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.97 (1a)	x	2.5 (2a)	=	102.43 (3a)
First floor	36.08 (1b)	x	2.7 (2b)	=	97.42 (3b)
Second floor	17.48 (1c)	x	2.54 (2c)	=	44.35 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.53 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	244.19 (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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration	[(9)-1]x0.1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

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

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)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.32 (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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TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

	0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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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=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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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			2.12	1.2	2.544		(26)
Windows Type 1			4.32	$\times 1/[1/(1.4) + 0.04]$	5.73		(27)
Windows Type 2			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 3			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 4			3.02	$\times 1/[1/(1.4) + 0.04]$	4		(27)
Windows Type 5			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Rooflights			0.59	$\times 1/[1/(1.7) + 0.04]$	1.003		(27b)
Floor			40.97	0.13	5.3261		(28)
Walls Type1	104.26	18.73	85.53	0.18	15.4		(29)
Walls Type2	23.4	0	23.4	0.18	4.21		(29)
Walls Type3	3.97	0	3.97	0.18	0.71		(29)
Roof Type1	9.62	0	9.62	0.13	1.25		(30)
Roof Type2	0.61	0	0.61	0.13	0.08		(30)
Roof Type3	4.28	0	4.28	0.13	0.56		(30)
Roof Type4	18.58	0	18.58	0.13	2.42		(30)
Roof Type5	8.33	0.59	7.74	0.13	1.01		(30)
Roof Type6	1.98	0	1.98	0.13	0.26		(30)

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Total area of elements, m²	216					(31)	
Party wall	67.21	x	0	=	0		(32)
Internal wall **	176.01						(32c)
Internal floor	53.56						(32d)
Internal ceiling	53.56						(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) =	56.72	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	19259.48	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	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	12.96	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	69.68	(37)
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Ventilation heat loss calculated monthly	(38)m = 0.33 x (25)m x (5)	
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	46.87	46.61	46.36	45.19	44.97	43.94	43.94	43.75	44.34	44.97	45.41	45.88	(38)

Heat transfer coefficient, W/K	(39)m = (37) + (38)m													
(39)m=	116.55	116.29	116.04	114.87	114.65	113.62	113.62	113.43	114.02	114.65	115.09	115.56		
	Average = Sum(39) _{1...12} /12=												114.87	(39)

Heat loss parameter (HLP), W/m ² K												(40)m = (39)m ÷ (4)		
(40)m=	1.23	1.23	1.23	1.22	1.21	1.2	1.2	1.2	1.21	1.21	1.22	1.22		
Average = Sum(40) _{1...12} /12=												1.22	(40)	

Number of days in month (Table 1a)													
(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	2.68	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9) ²)] + 0.0013 x (TFA -13.9)		
if TFA ≤ 13.9, N = 1		

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	97.92	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.71	103.79	99.87	95.96	92.04	88.12	88.12	92.04	95.96	99.87	103.79	107.71	
	Total = Sum(44) _{1...12} =											1175	(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=	159.73	139.7	144.16	125.68	120.59	104.06	96.43	110.65	111.97	130.5	142.45	154.69	
Total = Sum(45) _{1...12} =												1540.61	(45)

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

(46)m=	23.96	20.95	21.62	18.85	18.09	15.61	14.46	16.6	16.8	19.57	21.37	23.2	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
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TER WorkSheet: New dwelling design stage

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 (56)

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

(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 (57)

Primary circuit loss (annual) from Table 3

0 (58)

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

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

(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 (59)

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

(61)m= 50.96 46.03 50.9 47.32 46.9 43.46 44.91 46.9 47.32 50.9 49.32 50.96 (61)

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

(62)m= 210.69 185.73 195.05 173 167.5 147.52 141.34 157.56 159.3 181.39 191.76 205.65 (62)

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

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

(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater

(64)m= 210.69 185.73 195.05 173 167.5 147.52 141.34 157.56 159.3 181.39 191.76 205.65
Output from water heater (annual)_{1...12} 2116.47 (64)

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

(65)m= 65.85 57.96 60.66 53.62 51.82 45.47 43.29 48.52 49.06 56.11 59.69 64.17 (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=	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14

(66)

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

(67)m= 22.13 19.66 15.99 12.1 9.05 7.64 8.25 10.73 14.4 18.28 21.34 22.75 (67)

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

(68)m= 247.17 249.73 243.27 229.51 212.14 195.82 184.91 182.35 188.81 202.57 219.94 236.26 (68)

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

TER WorkSheet: New dwelling design stage

(69)m=

36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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 (70)

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

(71)m=

-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31
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 (71)

Water heating gains (Table 5)

(72)m=

88.51	86.25	81.53	74.47	69.65	63.15	58.18	65.21	68.14	75.42	82.91	86.25
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 (72)

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

(73)m=

424.05	421.88	407.03	382.33	357.09	332.84	317.59	324.53	337.59	362.52	390.42	411.51
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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 _l Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.9	x	10.63	x	0.63	x	0.7	=	2.92	(74)
North	0.9x	0.77	x	0.9	x	20.32	x	0.63	x	0.7	=	5.59	(74)
North	0.9x	0.77	x	0.9	x	34.53	x	0.63	x	0.7	=	9.5	(74)
North	0.9x	0.77	x	0.9	x	55.46	x	0.63	x	0.7	=	15.26	(74)
North	0.9x	0.77	x	0.9	x	74.72	x	0.63	x	0.7	=	20.55	(74)
North	0.9x	0.77	x	0.9	x	79.99	x	0.63	x	0.7	=	22	(74)
North	0.9x	0.77	x	0.9	x	74.68	x	0.63	x	0.7	=	20.54	(74)
North	0.9x	0.77	x	0.9	x	59.25	x	0.63	x	0.7	=	16.3	(74)
North	0.9x	0.77	x	0.9	x	41.52	x	0.63	x	0.7	=	11.42	(74)
North	0.9x	0.77	x	0.9	x	24.19	x	0.63	x	0.7	=	6.65	(74)
North	0.9x	0.77	x	0.9	x	13.12	x	0.63	x	0.7	=	3.61	(74)
North	0.9x	0.77	x	0.9	x	8.86	x	0.63	x	0.7	=	2.44	(74)
Northeast	0.9x	0.77	x	3.02	x	11.28	x	0.63	x	0.7	=	10.41	(75)
Northeast	0.9x	0.77	x	3.02	x	22.97	x	0.63	x	0.7	=	21.2	(75)
Northeast	0.9x	0.77	x	3.02	x	41.38	x	0.63	x	0.7	=	38.19	(75)
Northeast	0.9x	0.77	x	3.02	x	67.96	x	0.63	x	0.7	=	62.72	(75)
Northeast	0.9x	0.77	x	3.02	x	91.35	x	0.63	x	0.7	=	84.31	(75)
Northeast	0.9x	0.77	x	3.02	x	97.38	x	0.63	x	0.7	=	89.88	(75)
Northeast	0.9x	0.77	x	3.02	x	91.1	x	0.63	x	0.7	=	84.08	(75)
Northeast	0.9x	0.77	x	3.02	x	72.63	x	0.63	x	0.7	=	67.03	(75)
Northeast	0.9x	0.77	x	3.02	x	50.42	x	0.63	x	0.7	=	46.54	(75)
Northeast	0.9x	0.77	x	3.02	x	28.07	x	0.63	x	0.7	=	25.9	(75)
Northeast	0.9x	0.77	x	3.02	x	14.2	x	0.63	x	0.7	=	13.1	(75)
Northeast	0.9x	0.77	x	3.02	x	9.21	x	0.63	x	0.7	=	8.5	(75)
Southwest	0.9x	0.77	x	7.47	x	36.79		0.63	x	0.7	=	84	(79)
Southwest	0.9x	0.77	x	7.47	x	62.67		0.63	x	0.7	=	143.08	(79)
Southwest	0.9x	0.77	x	7.47	x	85.75		0.63	x	0.7	=	195.77	(79)
Southwest	0.9x	0.77	x	7.47	x	106.25		0.63	x	0.7	=	242.56	(79)

TER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	7.47	x	119.01	0.63	x	0.7	=	271.69	(79)
Southwest	0.9x	0.77	x	7.47	x	118.15	0.63	x	0.7	=	269.73	(79)
Southwest	0.9x	0.77	x	7.47	x	113.91	0.63	x	0.7	=	260.05	(79)
Southwest	0.9x	0.77	x	7.47	x	104.39	0.63	x	0.7	=	238.32	(79)
Southwest	0.9x	0.77	x	7.47	x	92.85	0.63	x	0.7	=	211.97	(79)
Southwest	0.9x	0.77	x	7.47	x	69.27	0.63	x	0.7	=	158.13	(79)
Southwest	0.9x	0.77	x	7.47	x	44.07	0.63	x	0.7	=	100.61	(79)
Southwest	0.9x	0.77	x	7.47	x	31.49	0.63	x	0.7	=	71.88	(79)
West	0.9x	0.77	x	0.9	x	19.64	0.63	x	0.7	=	5.4	(80)
West	0.9x	0.77	x	0.9	x	38.42	0.63	x	0.7	=	10.57	(80)
West	0.9x	0.77	x	0.9	x	63.27	0.63	x	0.7	=	17.4	(80)
West	0.9x	0.77	x	0.9	x	92.28	0.63	x	0.7	=	25.38	(80)
West	0.9x	0.77	x	0.9	x	113.09	0.63	x	0.7	=	31.11	(80)
West	0.9x	0.77	x	0.9	x	115.77	0.63	x	0.7	=	31.84	(80)
West	0.9x	0.77	x	0.9	x	110.22	0.63	x	0.7	=	30.32	(80)
West	0.9x	0.77	x	0.9	x	94.68	0.63	x	0.7	=	26.04	(80)
West	0.9x	0.77	x	0.9	x	73.59	0.63	x	0.7	=	20.24	(80)
West	0.9x	0.77	x	0.9	x	45.59	0.63	x	0.7	=	12.54	(80)
West	0.9x	0.77	x	0.9	x	24.49	0.63	x	0.7	=	6.74	(80)
West	0.9x	0.77	x	0.9	x	16.15	0.63	x	0.7	=	4.44	(80)
Northwest	0.9x	0.77	x	4.32	x	11.28	0.63	x	0.7	=	14.9	(81)
Northwest	0.9x	0.77	x	4.32	x	22.97	0.63	x	0.7	=	30.32	(81)
Northwest	0.9x	0.77	x	4.32	x	41.38	0.63	x	0.7	=	54.63	(81)
Northwest	0.9x	0.77	x	4.32	x	67.96	0.63	x	0.7	=	89.72	(81)
Northwest	0.9x	0.77	x	4.32	x	91.35	0.63	x	0.7	=	120.6	(81)
Northwest	0.9x	0.77	x	4.32	x	97.38	0.63	x	0.7	=	128.57	(81)
Northwest	0.9x	0.77	x	4.32	x	91.1	0.63	x	0.7	=	120.28	(81)
Northwest	0.9x	0.77	x	4.32	x	72.63	0.63	x	0.7	=	95.89	(81)
Northwest	0.9x	0.77	x	4.32	x	50.42	0.63	x	0.7	=	66.57	(81)
Northwest	0.9x	0.77	x	4.32	x	28.07	0.63	x	0.7	=	37.06	(81)
Northwest	0.9x	0.77	x	4.32	x	14.2	0.63	x	0.7	=	18.74	(81)
Northwest	0.9x	0.77	x	4.32	x	9.21	0.63	x	0.7	=	12.17	(81)
Rooflights	0.9x	1	x	0.59	x	16.37	0.63	x	0.7	=	3.83	(82)
Rooflights	0.9x	1	x	0.59	x	33.68	0.63	x	0.7	=	7.89	(82)
Rooflights	0.9x	1	x	0.59	x	62.13	0.63	x	0.7	=	14.55	(82)
Rooflights	0.9x	1	x	0.59	x	104.87	0.63	x	0.7	=	24.56	(82)
Rooflights	0.9x	1	x	0.59	x	143.66	0.63	x	0.7	=	33.64	(82)
Rooflights	0.9x	1	x	0.59	x	154.33	0.63	x	0.7	=	36.14	(82)
Rooflights	0.9x	1	x	0.59	x	143.9	0.63	x	0.7	=	33.7	(82)
Rooflights	0.9x	1	x	0.59	x	113.05	0.63	x	0.7	=	26.47	(82)
Rooflights	0.9x	1	x	0.59	x	76.56	0.63	x	0.7	=	17.93	(82)

TER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.59	x	41.49	x	0.63	x	0.7	=	9.72	(82)
Rooflights 0.9x	1	x	0.59	x	20.65	x	0.63	x	0.7	=	4.83	(82)
Rooflights 0.9x	1	x	0.59	x	13.34	x	0.63	x	0.7	=	3.12	(82)

Solar gains in watts, calculated for each month

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

(83)m=	121.47	218.64	330.04	460.2	561.9	578.16	548.96	470.04	374.67	250	147.63	102.56	(83)
--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	-----	--------	--------	------

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

(84)m=	545.52	640.52	737.06	842.53	918.98	911.01	866.55	794.57	712.26	612.52	538.06	514.07	(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	0.96	0.88	0.72	0.56	0.62	0.87	0.98	1	1	(86)

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

(87)m=	19.63	19.79	20.07	20.43	20.75	20.93	20.98	20.98	20.83	20.42	19.96	19.6	(87)
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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=	1	0.99	0.98	0.95	0.84	0.63	0.43	0.49	0.8	0.97	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=	18.07	18.31	18.71	19.24	19.66	19.87	19.91	19.91	19.78	19.23	18.56	18.03	(90)
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fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.3	18.53	18.91	19.42	19.83	20.03	20.07	20.07	19.94	19.41	18.77	18.27	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.3	18.53	18.91	19.42	19.83	20.03	20.07	20.07	19.94	19.41	18.77	18.27	(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=	1	0.99	0.98	0.94	0.83	0.64	0.45	0.51	0.8	0.96	0.99	1	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	543.53	635.4	722.02	791.13	766.13	583.7	389.82	407.38	569.34	589.57	534.05	512.64	(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=	1631.83	1585.04	1440.22	1207.92	931.56	617.25	394.59	416.14	665.39	1009.58	1342.62	1625.52	(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=	809.69	638.16	534.34	300.09	123.07	0	0	0	0	312.49	582.17	827.98	(98)
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Total per year (kWh/year) = Sum(98)1...5,9...12 = 4127.99 (98)

Space heating requirement in kWh/m²/year

43.67 (99)

TER WorkSheet: New dwelling design stage

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

Space heating:

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

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

Space heating requirement (calculated above)

809.69	638.16	534.34	300.09	123.07	0	0	0	0	312.49	582.17	827.98
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(211)m = {[[(98)m x (204)] } x 100 ÷ (206) (211)

866.91	683.25	572.1	321.29	131.77	0	0	0	0	334.57	623.31	886.49
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 4419.69 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

210.69	185.73	195.05	173	167.5	147.52	141.34	157.56	159.3	181.39	191.76	205.65
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Efficiency of water heater 80.3 (216)

(217)m = 88.11 87.91 87.46 86.42 84.29 80.3 80.3 80.3 80.3 86.41 87.67 88.19 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

239.11	211.27	223.02	200.18	198.72	183.71	176.01	196.21	198.38	209.92	218.74	233.18
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Total = Sum(219a)_{1...12} = 2488.45 (219)

Annual totals

Space heating fuel used, main system 1	4419.69	kWh/year	kWh/year
Water heating fuel used	2488.45		

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 390.85 (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 =	954.65 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	537.51 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1492.16 (265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.85	(268)
Total CO2, kg/year		sum of (265)...(271) =		1733.94	(272)
TER	=			18.34	(273)

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 27 January 2021 at 16:34:17

Project Information:

Assessed By: () **Building Type:** End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 94.53m²

Site Reference : Swansea Road

Plot Reference: Type A (Plot 6)

Address : Type A (Plot 6)

Client Details:

Name: Helix

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.69 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.63 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.5 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 47.1 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.65 (design value)

Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Database: (rev 471, product index 017616):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Potterton
Model: Promax Ultra
Model qualifier: Combi 33 ErP (Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (South East England): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: South West 4.32m²
 Windows facing: West 0.9m²
 Windows facing: South 0.9m²
 Windows facing: North West 3.02m²
 Windows facing: South East 7.47m²
 Roof windows facing: South West 0.59m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type A (Plot 6)

Address : Type A (Plot 6)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.97 (1a)	x	2.5 (2a)	=	102.43 (3a)
First floor	36.08 (1b)	x	2.7 (2b)	=	97.42 (3b)
Second floor	17.48 (1c)	x	2.54 (2c)	=	44.35 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.53 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	244.19 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)
 Additional infiltration [(9)-1]x0.1 = 0 (10)
 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4.65000009536743 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.2 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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			2.12	1.2	2.544		(26)
Windows Type 1			4.32	$\times 1/[1/(1.4) + 0.04]$	5.73		(27)
Windows Type 2			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 3			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 4			3.02	$\times 1/[1/(1.4) + 0.04]$	4		(27)
Windows Type 5			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Rooflights			0.59	$\times 1/[1/(1.2) + 0.04]$	0.708		(27b)
Floor			40.97	0.11	4.5067	75	3072.75 (28)
Walls Type1	104.26	18.73	85.53	0.25	21.38	60	5131.8 (29)
Walls Type2	23.4	0	23.4	0.25	5.85	9	210.6 (29)
Walls Type3	3.97	0	3.97	0.25	0.99	9	35.73 (29)
Roof Type1	9.62	0	9.62	0.11	1.06	9	86.58 (30)
Roof Type2	0.61	0	0.61	0.11	0.07	9	5.49 (30)
Roof Type3	4.28	0	4.28	0.15	0.64	9	38.52 (30)
Roof Type4	18.58	0	18.58	0.11	2.04	9	167.22 (30)
Roof Type5	8.33	0.59	7.74	0.15	1.16	9	69.66 (30)
Roof Type6	1.98	0	1.98	0.15	0.3	9	17.82 (30)

DER WorkSheet: New dwelling design stage

Total area of elements, m ²	216											(31)
Party wall	67.21	x	0	=	0		110		7393.1			(32)
Internal wall **	176.01						9		1584.09			(32c)
Internal floor	53.56						18		964.08			(32d)
Internal ceiling	53.56						9		482.04			(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) =	63.24	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	19259.48	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	= (34) ÷ (4) =	203.74	(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	9.91	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	73.15	(37)
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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=	40.45	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	(38)

Heat transfer coefficient, W/K											(39)m = (37) + (38)m		
(39)m=	113.6	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	
Average = Sum(39) _{1...12} /12=											113.46	(39)	

Heat loss parameter (HLP), W/m²K	(40)m = (39)m ÷ (4)												
(40)m=	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2		
	Average = Sum(40) _{1...12} /12=											1.2	(40)

Number of days in month (Table 1a)													
(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	2.68	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9) ²)] + 0.0013 x (TFA -13.9)		
if TFA ≤ 13.9, N = 1		

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	97.92	(43)
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Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.71	103.79	99.87	95.96	92.04	88.12	88.12	92.04	95.96	99.87	103.79	107.71	
	Total = Sum(44) _{1...12} =											1175	(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=	159.73	139.7	144.16	125.68	120.59	104.06	96.43	110.65	111.97	130.5	142.45	154.69	
	Total = Sum(45) _{1...12} =											1540.61	(45)

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

(46)m=	23.96	20.95	21.62	18.85	18.09	15.61	14.46	16.6	16.8	19.57	21.37	23.2	(46)
--------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
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DER WorkSheet: New dwelling design stage

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 (56)

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

(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 (57)

Primary circuit loss (annual) from Table 3

0 (58)

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

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

(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 (59)

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

(61)m= 21.97 19.82 21.9 21.11 21.75 20.98 21.63 21.71 21.05 21.84 21.21 21.95 (61)

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

(62)m= 181.7 159.52 166.05 146.79 142.34 125.04 118.06 132.36 133.02 152.33 163.65 176.63 (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= 181.7 159.52 166.05 146.79 142.34 125.04 118.06 132.36 133.02 152.33 163.65 176.63
Output from water heater (annual)_{1...12} 1797.5 (64)

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

(65)m= 58.6 51.41 53.41 47.07 45.53 39.84 37.47 42.22 42.49 48.85 52.66 56.92 (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
134.14 134.14 134.14 134.14 134.14 134.14 134.14 134.14 134.14 134.14 134.14 134.14 (66)

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

(67)m= 22.13 19.66 15.99 12.1 9.05 7.64 8.25 10.73 14.4 18.28 21.34 22.75 (67)

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

(68)m= 247.17 249.73 243.27 229.51 212.14 195.82 184.91 182.35 188.81 202.57 219.94 236.26 (68)

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

DER WorkSheet: New dwelling design stage

(69)m=

36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

78.77	76.5	71.78	65.37	61.2	55.34	50.36	56.75	59.02	65.66	73.15	76.51
-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

414.31	412.13	397.28	373.22	348.63	325.04	309.77	316.06	328.47	352.75	380.66	401.76
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)								
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>91</td></tr></table>	91	(77)
0.77																			
7.47																			
36.79																			
0.43																			
1.11																			
91																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>155.01</td></tr></table>	155.01	(77)
0.77																			
7.47																			
62.67																			
0.43																			
1.11																			
155.01																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>212.09</td></tr></table>	212.09	(77)
0.77																			
7.47																			
85.75																			
0.43																			
1.11																			
212.09																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>262.79</td></tr></table>	262.79	(77)
0.77																			
7.47																			
106.25																			
0.43																			
1.11																			
262.79																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>294.35</td></tr></table>	294.35	(77)
0.77																			
7.47																			
119.01																			
0.43																			
1.11																			
294.35																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>292.22</td></tr></table>	292.22	(77)
0.77																			
7.47																			
118.15																			
0.43																			
1.11																			
292.22																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>113.91</td></tr></table>	113.91	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>281.73</td></tr></table>	281.73	(77)
0.77																			
7.47																			
113.91																			
0.43																			
1.11																			
281.73																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>104.39</td></tr></table>	104.39	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>258.19</td></tr></table>	258.19	(77)
0.77																			
7.47																			
104.39																			
0.43																			
1.11																			
258.19																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>92.85</td></tr></table>	92.85	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>229.65</td></tr></table>	229.65	(77)
0.77																			
7.47																			
92.85																			
0.43																			
1.11																			
229.65																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>69.27</td></tr></table>	69.27	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>171.32</td></tr></table>	171.32	(77)
0.77																			
7.47																			
69.27																			
0.43																			
1.11																			
171.32																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>44.07</td></tr></table>	44.07	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>109</td></tr></table>	109	(77)
0.77																			
7.47																			
44.07																			
0.43																			
1.11																			
109																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>31.49</td></tr></table>	31.49	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>77.88</td></tr></table>	77.88	(77)
0.77																			
7.47																			
31.49																			
0.43																			
1.11																			
77.88																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>46.75</td></tr></table>	46.75	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>13.93</td></tr></table>	13.93	(78)
0.77																			
0.9																			
46.75																			
0.43																			
1.11																			
13.93																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>76.57</td></tr></table>	76.57	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>22.82</td></tr></table>	22.82	(78)
0.77																			
0.9																			
76.57																			
0.43																			
1.11																			
22.82																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>97.53</td></tr></table>	97.53	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>29.06</td></tr></table>	29.06	(78)
0.77																			
0.9																			
97.53																			
0.43																			
1.11																			
29.06																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>110.23</td></tr></table>	110.23	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>32.85</td></tr></table>	32.85	(78)
0.77																			
0.9																			
110.23																			
0.43																			
1.11																			
32.85																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>114.87</td></tr></table>	114.87	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>34.23</td></tr></table>	34.23	(78)
0.77																			
0.9																			
114.87																			
0.43																			
1.11																			
34.23																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>110.55</td></tr></table>	110.55	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>32.94</td></tr></table>	32.94	(78)
0.77																			
0.9																			
110.55																			
0.43																			
1.11																			
32.94																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>108.01</td></tr></table>	108.01	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>32.19</td></tr></table>	32.19	(78)
0.77																			
0.9																			
108.01																			
0.43																			
1.11																			
32.19																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>104.89</td></tr></table>	104.89	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>31.26</td></tr></table>	31.26	(78)
0.77																			
0.9																			
104.89																			
0.43																			
1.11																			
31.26																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>101.89</td></tr></table>	101.89	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>30.36</td></tr></table>	30.36	(78)
0.77																			
0.9																			
101.89																			
0.43																			
1.11																			
30.36																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>82.59</td></tr></table>	82.59	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>24.61</td></tr></table>	24.61	(78)
0.77																			
0.9																			
82.59																			
0.43																			
1.11																			
24.61																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>55.42</td></tr></table>	55.42	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>16.51</td></tr></table>	16.51	(78)
0.77																			
0.9																			
55.42																			
0.43																			
1.11																			
16.51																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>40.4</td></tr></table>	40.4	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>12.04</td></tr></table>	12.04	(78)
0.77																			
0.9																			
40.4																			
0.43																			
1.11																			
12.04																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>52.63</td></tr></table>	52.63	(79)
0.77																			
4.32																			
36.79																			
0.43																			
1.11																			
52.63																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>89.65</td></tr></table>	89.65	(79)
0.77																			
4.32																			
62.67																			
0.43																			
1.11																			
89.65																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>122.66</td></tr></table>	122.66	(79)
0.77																			
4.32																			
85.75																			
0.43																			
1.11																			
122.66																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>151.98</td></tr></table>	151.98	(79)
0.77																			
4.32																			
106.25																			
0.43																			
1.11																			
151.98																			

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	4.32	x	119.01	0.43	x	1.11	=	170.23	(79)
Southwest	0.9x	0.77	x	4.32	x	118.15	0.43	x	1.11	=	169	(79)
Southwest	0.9x	0.77	x	4.32	x	113.91	0.43	x	1.11	=	162.93	(79)
Southwest	0.9x	0.77	x	4.32	x	104.39	0.43	x	1.11	=	149.32	(79)
Southwest	0.9x	0.77	x	4.32	x	92.85	0.43	x	1.11	=	132.81	(79)
Southwest	0.9x	0.77	x	4.32	x	69.27	0.43	x	1.11	=	99.08	(79)
Southwest	0.9x	0.77	x	4.32	x	44.07	0.43	x	1.11	=	63.04	(79)
Southwest	0.9x	0.77	x	4.32	x	31.49	0.43	x	1.11	=	45.04	(79)
West	0.9x	0.77	x	0.9	x	19.64	0.43	x	1.11	=	5.85	(80)
West	0.9x	0.77	x	0.9	x	38.42	0.43	x	1.11	=	11.45	(80)
West	0.9x	0.77	x	0.9	x	63.27	0.43	x	1.11	=	18.85	(80)
West	0.9x	0.77	x	0.9	x	92.28	0.43	x	1.11	=	27.5	(80)
West	0.9x	0.77	x	0.9	x	113.09	0.43	x	1.11	=	33.7	(80)
West	0.9x	0.77	x	0.9	x	115.77	0.43	x	1.11	=	34.5	(80)
West	0.9x	0.77	x	0.9	x	110.22	0.43	x	1.11	=	32.84	(80)
West	0.9x	0.77	x	0.9	x	94.68	0.43	x	1.11	=	28.21	(80)
West	0.9x	0.77	x	0.9	x	73.59	0.43	x	1.11	=	21.93	(80)
West	0.9x	0.77	x	0.9	x	45.59	0.43	x	1.11	=	13.59	(80)
West	0.9x	0.77	x	0.9	x	24.49	0.43	x	1.11	=	7.3	(80)
West	0.9x	0.77	x	0.9	x	16.15	0.43	x	1.11	=	4.81	(80)
Northwest	0.9x	0.77	x	3.02	x	11.28	0.43	x	1.11	=	11.28	(81)
Northwest	0.9x	0.77	x	3.02	x	22.97	0.43	x	1.11	=	22.96	(81)
Northwest	0.9x	0.77	x	3.02	x	41.38	0.43	x	1.11	=	41.38	(81)
Northwest	0.9x	0.77	x	3.02	x	67.96	0.43	x	1.11	=	67.95	(81)
Northwest	0.9x	0.77	x	3.02	x	91.35	0.43	x	1.11	=	91.34	(81)
Northwest	0.9x	0.77	x	3.02	x	97.38	0.43	x	1.11	=	97.38	(81)
Northwest	0.9x	0.77	x	3.02	x	91.1	0.43	x	1.11	=	91.09	(81)
Northwest	0.9x	0.77	x	3.02	x	72.63	0.43	x	1.11	=	72.62	(81)
Northwest	0.9x	0.77	x	3.02	x	50.42	0.43	x	1.11	=	50.42	(81)
Northwest	0.9x	0.77	x	3.02	x	28.07	0.43	x	1.11	=	28.06	(81)
Northwest	0.9x	0.77	x	3.02	x	14.2	0.43	x	1.11	=	14.2	(81)
Northwest	0.9x	0.77	x	3.02	x	9.21	0.43	x	1.11	=	9.21	(81)
Rooflights	0.9x	1	x	0.59	x	39.98	0.63	x	0.7	=	9.36	(82)
Rooflights	0.9x	1	x	0.59	x	73.48	0.63	x	0.7	=	17.21	(82)
Rooflights	0.9x	1	x	0.59	x	112.11	0.63	x	0.7	=	26.25	(82)
Rooflights	0.9x	1	x	0.59	x	153.81	0.63	x	0.7	=	36.02	(82)
Rooflights	0.9x	1	x	0.59	x	182.63	0.63	x	0.7	=	42.77	(82)
Rooflights	0.9x	1	x	0.59	x	184.99	0.63	x	0.7	=	43.32	(82)
Rooflights	0.9x	1	x	0.59	x	176.88	0.63	x	0.7	=	41.42	(82)
Rooflights	0.9x	1	x	0.59	x	155.4	0.63	x	0.7	=	36.39	(82)
Rooflights	0.9x	1	x	0.59	x	126.86	0.63	x	0.7	=	29.71	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.59	x	84.6	x	0.63	x	0.7	=	19.81	(82)
Rooflights 0.9x	1	x	0.59	x	48.93	x	0.63	x	0.7	=	11.46	(82)
Rooflights 0.9x	1	x	0.59	x	33.5	x	0.63	x	0.7	=	7.84	(82)

Solar gains in watts, calculated for each month

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

(83)m=	184.06	319.09	450.3	579.09	666.61	669.36	642.21	575.99	494.88	356.47	221.5	156.83	(83)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(84)m=	598.37	731.22	847.58	952.31	1015.25	994.39	951.98	892.05	823.35	709.22	602.17	558.58	(84)
--------	--------	--------	--------	--------	---------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.82	0.66	0.51	0.56	0.78	0.95	0.99	1	(86)

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

(87)m=	19.5	19.73	20.05	20.43	20.74	20.92	20.98	20.97	20.84	20.42	19.87	19.45	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.9	0.77	0.57	0.39	0.44	0.71	0.93	0.98	0.99	(89)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	17.93	18.26	18.72	19.25	19.67	19.87	19.91	19.91	19.79	19.25	18.47	17.85	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.16	18.48	18.92	19.43	19.83	20.02	20.07	20.07	19.95	19.42	18.68	18.09	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.01	18.33	18.77	19.28	19.68	19.87	19.92	19.92	19.8	19.27	18.53	17.94	(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	0.97	0.95	0.88	0.76	0.57	0.39	0.44	0.7	0.91	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

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

(95)m=	591.3	712.63	801.57	838.53	768.21	566.89	371.82	390.81	574.72	646.56	588.45	553.46	(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=	1557.84	1523.23	1392.06	1177.37	904.87	598.19	376.75	398.78	646.26	983.65	1296.24	1558.4	(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=	719.11	544.72	439.32	243.96	101.68	0	0	0	0	250.8	509.61	747.68	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)1...5,9...12 = 3556.87 (98)

Space heating requirement in kWh/m²/year

37.63 (99)

DER WorkSheet: New dwelling design stage

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

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

Space heating requirement (calculated above)

719.11	544.72	439.32	243.96	101.68	0	0	0	0	250.8	509.61	747.68
--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------

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

799.01	605.24	488.13	271.07	112.97	0	0	0	0	278.67	566.23	830.75
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 3952.08 (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)

181.7	159.52	166.05	146.79	142.34	125.04	118.06	132.36	133.02	152.33	163.65	176.63
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Efficiency of water heater 86.7 (216)

(217)m=	89.31	89.23	89.07	88.73	88.05	86.7	86.7	86.7	86.7	88.72	89.17	89.35	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.43	178.77	186.43	165.43	161.67	144.22	136.17	152.67	153.43	171.69	183.52	197.69		
Total = Sum(219a) _{1...12} =													2035.12	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	3952.08	
Water heating fuel used	2035.12	

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 71.07 (230a)

central heating pump: 30 (230c)

boiler with a fan-assisted flue 45 (230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 146.07 (231)

Electricity for lighting 390.85 (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	= 853.65 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 439.59 (264)

DER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			1293.24	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	75.81	(267)
Electricity for lighting	(232) x	0.519	=	202.85	(268)
Total CO2, kg/year	sum of (265)...(271) =			1571.9	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			16.63	(273)
EI rating (section 14)				85	(274)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type A (Plot 6)

Address : Type A (Plot 6)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.97 (1a)	x	2.5 (2a)	=	102.43 (3a)
First floor	36.08 (1b)	x	2.7 (2b)	=	97.42 (3b)
Second floor	17.48 (1c)	x	2.54 (2c)	=	44.35 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.53 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	244.19 (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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)

Additional infiltration

[(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

0.25 - [0.2 x (14) ÷ 100] =

Infiltration rate

(8) + (10) + (11) + (12) + (13) + (15) =

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered

Shelter factor

(20) = 1 - [0.075 x (19)] =

Infiltration rate incorporating shelter factor

(21) = (18) x (20) =

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

TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
--	-----	-----	------	------	------	-----	-----	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

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

(24a)

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

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

(24b)

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

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

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

(24c)

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

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

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
---------	------	------	------	------	------	------	------	------	------	------	------	------

(24d)

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
--------	------	------	------	------	------	------	------	------	------	------	------	------

(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			2.12	1.2	2.544		(26)
Windows Type 1			4.32	$\times 1/[1/(1.4) + 0.04]$	5.73		(27)
Windows Type 2			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 3			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 4			3.02	$\times 1/[1/(1.4) + 0.04]$	4		(27)
Windows Type 5			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Rooflights			0.59	$\times 1/[1/(1.7) + 0.04]$	1.003		(27b)
Floor			40.97	$\times 0.13$	5.3261		(28)
Walls Type1	104.26	18.73	85.53	$\times 0.18$	15.4		(29)
Walls Type2	23.4	0	23.4	$\times 0.18$	4.21		(29)
Walls Type3	3.97	0	3.97	$\times 0.18$	0.71		(29)
Roof Type1	9.62	0	9.62	$\times 0.13$	1.25		(30)
Roof Type2	0.61	0	0.61	$\times 0.13$	0.08		(30)
Roof Type3	4.28	0	4.28	$\times 0.13$	0.56		(30)
Roof Type4	18.58	0	18.58	$\times 0.13$	2.42		(30)
Roof Type5	8.33	0.59	7.74	$\times 0.13$	1.01		(30)
Roof Type6	1.98	0	1.98	$\times 0.13$	0.26		(30)

TER WorkSheet: New dwelling design stage

Total area of elements, m ²	216					(31)
Party wall	67.21	x	0	=	0	(32)
Internal wall **	176.01					(32c)
Internal floor	53.56					(32d)
Internal ceiling	53.56					(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) =	56.72	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	19259.48	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	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	12.96	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	69.68	(37)
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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=	46.87	46.61	46.36	45.19	44.97	43.94	43.94	43.75	44.34	44.97	45.41	45.88	(38)

Heat transfer coefficient, W/K												(39)m = (37) + (38)m	
(39)m=	116.55	116.29	116.04	114.87	114.65	113.62	113.62	113.43	114.02	114.65	115.09	115.56	
Average = Sum(39) _{1...12} /12=												114.87	(39)

Heat loss parameter (HLP), W/m²K										(40)m = (39)m ÷ (4)		
(40)m=	1.23	1.23	1.23	1.22	1.21	1.2	1.2	1.2	1.21	1.21	1.22	1.22
Average = Sum(40) _{1...12} /12=											1.22	(40)

Number of days in month (Table 1a)													
(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	2.68	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9) ²)] + 0.0013 x (TFA -13.9)		
if TFA ≤ 13.9, N = 1		

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	97.92	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.71	103.79	99.87	95.96	92.04	88.12	88.12	92.04	95.96	99.87	103.79	107.71	
	Total = Sum(44) _{1...12} =											1175	(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=	159.73	139.7	144.16	125.68	120.59	104.06	96.43	110.65	111.97	130.5	142.45	154.69		
Total = Sum(45) _{1...12} =													1540.61	(45)

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

(46)m=	23.96	20.95	21.62	18.85	18.09	15.61	14.46	16.6	16.8	19.57	21.37	23.2	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
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TER WorkSheet: New dwelling design stage

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 (56)

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

(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 (57)

Primary circuit loss (annual) from Table 3

0 (58)

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

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

(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 (59)

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

(61)m= 50.96 46.03 50.9 47.32 46.9 43.46 44.91 46.9 47.32 50.9 49.32 50.96 (61)

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

(62)m= 210.69 185.73 195.05 173 167.5 147.52 141.34 157.56 159.3 181.39 191.76 205.65 (62)

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

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

(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater

(64)m= 210.69 185.73 195.05 173 167.5 147.52 141.34 157.56 159.3 181.39 191.76 205.65
Output from water heater (annual)_{1...12} 2116.47 (64)

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

(65)m= 65.85 57.96 60.66 53.62 51.82 45.47 43.29 48.52 49.06 56.11 59.69 64.17 (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=	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14

(66)

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

(67)m= 22.13 19.66 15.99 12.1 9.05 7.64 8.25 10.73 14.4 18.28 21.34 22.75 (67)

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

(68)m= 247.17 249.73 243.27 229.51 212.14 195.82 184.91 182.35 188.81 202.57 219.94 236.26 (68)

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

TER WorkSheet: New dwelling design stage

(69)m=

36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

88.51	86.25	81.53	74.47	69.65	63.15	58.18	65.21	68.14	75.42	82.91	86.25
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

424.05	421.88	407.03	382.33	357.09	332.84	317.59	324.53	337.59	362.52	390.42	411.51
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)								
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>84</td></tr></table>	84	(77)
0.77																			
7.47																			
36.79																			
0.63																			
0.7																			
84																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>143.08</td></tr></table>	143.08	(77)
0.77																			
7.47																			
62.67																			
0.63																			
0.7																			
143.08																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>195.77</td></tr></table>	195.77	(77)
0.77																			
7.47																			
85.75																			
0.63																			
0.7																			
195.77																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>242.56</td></tr></table>	242.56	(77)
0.77																			
7.47																			
106.25																			
0.63																			
0.7																			
242.56																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>271.69</td></tr></table>	271.69	(77)
0.77																			
7.47																			
119.01																			
0.63																			
0.7																			
271.69																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>269.73</td></tr></table>	269.73	(77)
0.77																			
7.47																			
118.15																			
0.63																			
0.7																			
269.73																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>113.91</td></tr></table>	113.91	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>260.05</td></tr></table>	260.05	(77)
0.77																			
7.47																			
113.91																			
0.63																			
0.7																			
260.05																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>104.39</td></tr></table>	104.39	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>238.32</td></tr></table>	238.32	(77)
0.77																			
7.47																			
104.39																			
0.63																			
0.7																			
238.32																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>92.85</td></tr></table>	92.85	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>211.97</td></tr></table>	211.97	(77)
0.77																			
7.47																			
92.85																			
0.63																			
0.7																			
211.97																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>69.27</td></tr></table>	69.27	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>158.13</td></tr></table>	158.13	(77)
0.77																			
7.47																			
69.27																			
0.63																			
0.7																			
158.13																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>44.07</td></tr></table>	44.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>100.61</td></tr></table>	100.61	(77)
0.77																			
7.47																			
44.07																			
0.63																			
0.7																			
100.61																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>31.49</td></tr></table>	31.49	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>71.88</td></tr></table>	71.88	(77)
0.77																			
7.47																			
31.49																			
0.63																			
0.7																			
71.88																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>46.75</td></tr></table>	46.75	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>12.86</td></tr></table>	12.86	(78)
0.77																			
0.9																			
46.75																			
0.63																			
0.7																			
12.86																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>76.57</td></tr></table>	76.57	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>21.06</td></tr></table>	21.06	(78)
0.77																			
0.9																			
76.57																			
0.63																			
0.7																			
21.06																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>97.53</td></tr></table>	97.53	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>26.83</td></tr></table>	26.83	(78)
0.77																			
0.9																			
97.53																			
0.63																			
0.7																			
26.83																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>110.23</td></tr></table>	110.23	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>30.32</td></tr></table>	30.32	(78)
0.77																			
0.9																			
110.23																			
0.63																			
0.7																			
30.32																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>114.87</td></tr></table>	114.87	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>31.6</td></tr></table>	31.6	(78)
0.77																			
0.9																			
114.87																			
0.63																			
0.7																			
31.6																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>110.55</td></tr></table>	110.55	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>30.41</td></tr></table>	30.41	(78)
0.77																			
0.9																			
110.55																			
0.63																			
0.7																			
30.41																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>108.01</td></tr></table>	108.01	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>29.71</td></tr></table>	29.71	(78)
0.77																			
0.9																			
108.01																			
0.63																			
0.7																			
29.71																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>104.89</td></tr></table>	104.89	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>28.85</td></tr></table>	28.85	(78)
0.77																			
0.9																			
104.89																			
0.63																			
0.7																			
28.85																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>101.89</td></tr></table>	101.89	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>28.02</td></tr></table>	28.02	(78)
0.77																			
0.9																			
101.89																			
0.63																			
0.7																			
28.02																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>82.59</td></tr></table>	82.59	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>22.72</td></tr></table>	22.72	(78)
0.77																			
0.9																			
82.59																			
0.63																			
0.7																			
22.72																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>55.42</td></tr></table>	55.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>15.24</td></tr></table>	15.24	(78)
0.77																			
0.9																			
55.42																			
0.63																			
0.7																			
15.24																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>40.4</td></tr></table>	40.4	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>11.11</td></tr></table>	11.11	(78)
0.77																			
0.9																			
40.4																			
0.63																			
0.7																			
11.11																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>48.58</td></tr></table>	48.58	(79)
0.77																			
4.32																			
36.79																			
0.63																			
0.7																			
48.58																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>82.74</td></tr></table>	82.74	(79)
0.77																			
4.32																			
62.67																			
0.63																			
0.7																			
82.74																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>113.21</td></tr></table>	113.21	(79)
0.77																			
4.32																			
85.75																			
0.63																			
0.7																			
113.21																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>140.28</td></tr></table>	140.28	(79)
0.77																			
4.32																			
106.25																			
0.63																			
0.7																			
140.28																			

TER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	4.32	x	119.01	0.63	x	0.7	=	157.12	(79)
Southwest	0.9x	0.77	x	4.32	x	118.15	0.63	x	0.7	=	155.99	(79)
Southwest	0.9x	0.77	x	4.32	x	113.91	0.63	x	0.7	=	150.39	(79)
Southwest	0.9x	0.77	x	4.32	x	104.39	0.63	x	0.7	=	137.82	(79)
Southwest	0.9x	0.77	x	4.32	x	92.85	0.63	x	0.7	=	122.59	(79)
Southwest	0.9x	0.77	x	4.32	x	69.27	0.63	x	0.7	=	91.45	(79)
Southwest	0.9x	0.77	x	4.32	x	44.07	0.63	x	0.7	=	58.18	(79)
Southwest	0.9x	0.77	x	4.32	x	31.49	0.63	x	0.7	=	41.57	(79)
West	0.9x	0.77	x	0.9	x	19.64	0.63	x	0.7	=	5.4	(80)
West	0.9x	0.77	x	0.9	x	38.42	0.63	x	0.7	=	10.57	(80)
West	0.9x	0.77	x	0.9	x	63.27	0.63	x	0.7	=	17.4	(80)
West	0.9x	0.77	x	0.9	x	92.28	0.63	x	0.7	=	25.38	(80)
West	0.9x	0.77	x	0.9	x	113.09	0.63	x	0.7	=	31.11	(80)
West	0.9x	0.77	x	0.9	x	115.77	0.63	x	0.7	=	31.84	(80)
West	0.9x	0.77	x	0.9	x	110.22	0.63	x	0.7	=	30.32	(80)
West	0.9x	0.77	x	0.9	x	94.68	0.63	x	0.7	=	26.04	(80)
West	0.9x	0.77	x	0.9	x	73.59	0.63	x	0.7	=	20.24	(80)
West	0.9x	0.77	x	0.9	x	45.59	0.63	x	0.7	=	12.54	(80)
West	0.9x	0.77	x	0.9	x	24.49	0.63	x	0.7	=	6.74	(80)
West	0.9x	0.77	x	0.9	x	16.15	0.63	x	0.7	=	4.44	(80)
Northwest	0.9x	0.77	x	3.02	x	11.28	0.63	x	0.7	=	10.41	(81)
Northwest	0.9x	0.77	x	3.02	x	22.97	0.63	x	0.7	=	21.2	(81)
Northwest	0.9x	0.77	x	3.02	x	41.38	0.63	x	0.7	=	38.19	(81)
Northwest	0.9x	0.77	x	3.02	x	67.96	0.63	x	0.7	=	62.72	(81)
Northwest	0.9x	0.77	x	3.02	x	91.35	0.63	x	0.7	=	84.31	(81)
Northwest	0.9x	0.77	x	3.02	x	97.38	0.63	x	0.7	=	89.88	(81)
Northwest	0.9x	0.77	x	3.02	x	91.1	0.63	x	0.7	=	84.08	(81)
Northwest	0.9x	0.77	x	3.02	x	72.63	0.63	x	0.7	=	67.03	(81)
Northwest	0.9x	0.77	x	3.02	x	50.42	0.63	x	0.7	=	46.54	(81)
Northwest	0.9x	0.77	x	3.02	x	28.07	0.63	x	0.7	=	25.9	(81)
Northwest	0.9x	0.77	x	3.02	x	14.2	0.63	x	0.7	=	13.1	(81)
Northwest	0.9x	0.77	x	3.02	x	9.21	0.63	x	0.7	=	8.5	(81)
Rooflights	0.9x	1	x	0.59	x	39.98	0.63	x	0.7	=	9.36	(82)
Rooflights	0.9x	1	x	0.59	x	73.48	0.63	x	0.7	=	17.21	(82)
Rooflights	0.9x	1	x	0.59	x	112.11	0.63	x	0.7	=	26.25	(82)
Rooflights	0.9x	1	x	0.59	x	153.81	0.63	x	0.7	=	36.02	(82)
Rooflights	0.9x	1	x	0.59	x	182.63	0.63	x	0.7	=	42.77	(82)
Rooflights	0.9x	1	x	0.59	x	184.99	0.63	x	0.7	=	43.32	(82)
Rooflights	0.9x	1	x	0.59	x	176.88	0.63	x	0.7	=	41.42	(82)
Rooflights	0.9x	1	x	0.59	x	155.4	0.63	x	0.7	=	36.39	(82)
Rooflights	0.9x	1	x	0.59	x	126.86	0.63	x	0.7	=	29.71	(82)

TER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.59	x	84.6	x	0.63	x	0.7	=	19.81	(82)
Rooflights 0.9x	1	x	0.59	x	48.93	x	0.63	x	0.7	=	11.46	(82)
Rooflights 0.9x	1	x	0.59	x	33.5	x	0.63	x	0.7	=	7.84	(82)

Solar gains in watts, calculated for each month

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

(83)m=	170.61	295.86	417.66	537.28	618.59	621.17	595.96	534.45	459.07	330.55	205.33	145.36	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	594.66	717.73	824.68	919.61	975.68	954.01	913.55	858.98	796.66	693.07	595.76	556.87	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.53	0.59	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=	19.68	19.86	20.15	20.49	20.78	20.94	20.99	20.98	20.87	20.49	20.01	19.64	(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=	1	0.99	0.98	0.93	0.81	0.61	0.41	0.46	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=	18.14	18.42	18.82	19.32	19.7	19.88	19.91	19.91	19.81	19.32	18.64	18.09	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.37	18.63	19.02	19.49	19.86	20.04	20.07	20.07	19.97	19.5	18.84	18.32	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(93)m=	18.37	18.63	19.02	19.49	19.86	20.04	20.07	20.07	19.97	19.5	18.84	18.32	(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	0.92	0.81	0.62	0.43	0.48	0.75	0.94	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	591.6	708.89	799.82	846.95	790.44	589.28	390.89	410.04	597.29	654.47	589.18	554.73	(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=	1639.54	1596.88	1452.86	1216.94	935.31	618.03	394.74	416.51	669.56	1020.06	1351.42	1632.22	(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=	779.66	596.73	485.87	266.4	107.78	0	0	0	0	272	548.81	801.65	(98)
--------	--------	--------	--------	-------	--------	---	---	---	---	-----	--------	--------	------

Total per year (kWh/year) = Sum(98)1...5,9...12 = 3858.9 (98)

Space heating requirement in kWh/m²/year

40.82 (99)

TER WorkSheet: New dwelling design stage

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

Space heating:

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

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

Space heating requirement (calculated above)

779.66	596.73	485.87	266.4	107.78	0	0	0	0	272	548.81	801.65
--------	--------	--------	-------	--------	---	---	---	---	-----	--------	--------

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

834.76	638.9	520.2	285.22	115.4	0	0	0	0	291.22	587.59	858.3
--------	-------	-------	--------	-------	---	---	---	---	--------	--------	-------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 4131.58 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

210.69	185.73	195.05	173	167.5	147.52	141.34	157.56	159.3	181.39	191.76	205.65
--------	--------	--------	-----	-------	--------	--------	--------	-------	--------	--------	--------

Efficiency of water heater 80.3 (216)

(217)m = 88.04 87.78 87.26 86.13 83.97 80.3 80.3 80.3 80.3 86.07 87.55 88.14 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

239.3	211.58	223.54	200.85	199.46	183.71	176.01	196.21	198.38	210.75	219.03	233.33
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} = 2492.15 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	4131.58	
Water heating fuel used	2492.15	

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 390.85 (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	=	892.42 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	538.31 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1430.73 (265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.85	(268)
Total CO2, kg/year		sum of (265)...(271) =		1672.51	(272)
TER	=			17.69	(273)

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 27 January 2021 at 16:34:16

Project Information:

Assessed By: ()

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 94.53m²

Site Reference : Swansea Road

Plot Reference: Type A (Plot 9)

Address : Type A (Plot 9)

Client Details:

Name: Helix

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

17.69 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

16.63 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

53.5 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

47.1 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.25 (max. 0.30)

0.25 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

0.11 (max. 0.25)

0.11 (max. 0.70)

Roof

0.12 (max. 0.20)

0.15 (max. 0.35)

Openings

1.37 (max. 2.00)

1.40 (max. 3.30)

OK

OK

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

4.65 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Database: (rev 471, product index 017616):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Potterton

Model: Promax Ultra

Model qualifier: Combi 33 ErP

(Combi)

Efficiency 89.1 % SEDBUK2009

Minimum 88.0 %

OK

Secondary heating system:

None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (South East England): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: South West 4.32m²
 Windows facing: West 0.9m²
 Windows facing: South 0.9m²
 Windows facing: North West 3.02m²
 Windows facing: South East 7.47m²
 Roof windows facing: South West 0.59m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type A (Plot 9)

Address : Type A (Plot 9)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.97 (1a)	x	2.5 (2a)	=	102.43 (3a)
First floor	36.08 (1b)	x	2.7 (2b)	=	97.42 (3b)
Second floor	17.48 (1c)	x	2.54 (2c)	=	44.35 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.53 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	244.19 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
---	---	---------	-------

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration	[(9)-1]x0.1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4.65000009536743 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.2 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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			2.12	1.2	2.544		(26)
Windows Type 1			4.32	$\times 1/[1/(1.4) + 0.04]$	5.73		(27)
Windows Type 2			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 3			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 4			3.02	$\times 1/[1/(1.4) + 0.04]$	4		(27)
Windows Type 5			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Rooflights			0.59	$\times 1/[1/(1.2) + 0.04]$	0.708		(27b)
Floor			40.97	0.11	4.5067	75	3072.75 (28)
Walls Type1	104.26	18.73	85.53	0.25	21.38	60	5131.8 (29)
Walls Type2	23.4	0	23.4	0.25	5.85	9	210.6 (29)
Walls Type3	3.97	0	3.97	0.25	0.99	9	35.73 (29)
Roof Type1	9.62	0	9.62	0.11	1.06	9	86.58 (30)
Roof Type2	0.61	0	0.61	0.11	0.07	9	5.49 (30)
Roof Type3	4.28	0	4.28	0.15	0.64	9	38.52 (30)
Roof Type4	18.58	0	18.58	0.11	2.04	9	167.22 (30)
Roof Type5	8.33	0.59	7.74	0.15	1.16	9	69.66 (30)
Roof Type6	1.98	0	1.98	0.15	0.3	9	17.82 (30)

DER WorkSheet: New dwelling design stage

Total area of elements, m ²	216											(31)
Party wall	67.21	x	0	=	0		110		7393.1			(32)
Internal wall **	176.01						9		1584.09			(32c)
Internal floor	53.56						18		964.08			(32d)
Internal ceiling	53.56						9		482.04			(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) =	63.24	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	19259.48	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	= (34) ÷ (4) =	203.74	(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	9.91	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	73.15	(37)
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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=	40.45	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	40.29	(38)

Heat transfer coefficient, W/K												(39)m = (37) + (38)m	
(39)m=	113.6	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	113.44	
Average = Sum(39) _{1...12} / 12=												113.46	(39)

Heat loss parameter (HLP), W/m²K	(40)m = (39)m ÷ (4)												
(40)m=	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
	Average = Sum(40) _{1...12} / 12=											1.2	(40)

Number of days in month (Table 1a)													
(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	2.68	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9) ²)] + 0.0013 x (TFA - 13.9)		
if TFA ≤ 13.9, N = 1		

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	97.92	(43)
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Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.71	103.79	99.87	95.96	92.04	88.12	88.12	92.04	95.96	99.87	103.79	107.71	
	Total = Sum(44) _{1...12} =											1175	(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=	159.73	139.7	144.16	125.68	120.59	104.06	96.43	110.65	111.97	130.5	142.45	154.69	
	Total = Sum(45) _{1...12} =											1540.61	(45)

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

(46)m=	23.96	20.95	21.62	18.85	18.09	15.61	14.46	16.6	16.8	19.57	21.37	23.2	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
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DER WorkSheet: New dwelling design stage

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 (56)

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

(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 (57)

Primary circuit loss (annual) from Table 3

0 (58)

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

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

(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 (59)

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

(61)m= 21.97 19.82 21.9 21.11 21.75 20.98 21.63 21.71 21.05 21.84 21.21 21.95 (61)

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

(62)m= 181.7 159.52 166.05 146.79 142.34 125.04 118.06 132.36 133.02 152.33 163.65 176.63 (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= 181.7 159.52 166.05 146.79 142.34 125.04 118.06 132.36 133.02 152.33 163.65 176.63
Output from water heater (annual)_{1...12} 1797.5 (64)

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

(65)m= 58.6 51.41 53.41 47.07 45.53 39.84 37.47 42.22 42.49 48.85 52.66 56.92 (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=	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14

(66)

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

(67)m= 22.13 19.66 15.99 12.1 9.05 7.64 8.25 10.73 14.4 18.28 21.34 22.75 (67)

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

(68)m= 247.17 249.73 243.27 229.51 212.14 195.82 184.91 182.35 188.81 202.57 219.94 236.26 (68)

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

DER WorkSheet: New dwelling design stage

(69)m=

36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41	36.41
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31	-107.31
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

78.77	76.5	71.78	65.37	61.2	55.34	50.36	56.75	59.02	65.66	73.15	76.51
-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

414.31	412.13	397.28	373.22	348.63	325.04	309.77	316.06	328.47	352.75	380.66	401.76
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)								
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>91</td></tr></table>	91	(77)
0.77																			
7.47																			
36.79																			
0.43																			
1.11																			
91																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>155.01</td></tr></table>	155.01	(77)
0.77																			
7.47																			
62.67																			
0.43																			
1.11																			
155.01																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>212.09</td></tr></table>	212.09	(77)
0.77																			
7.47																			
85.75																			
0.43																			
1.11																			
212.09																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>262.79</td></tr></table>	262.79	(77)
0.77																			
7.47																			
106.25																			
0.43																			
1.11																			
262.79																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>294.35</td></tr></table>	294.35	(77)
0.77																			
7.47																			
119.01																			
0.43																			
1.11																			
294.35																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>292.22</td></tr></table>	292.22	(77)
0.77																			
7.47																			
118.15																			
0.43																			
1.11																			
292.22																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>113.91</td></tr></table>	113.91	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>281.73</td></tr></table>	281.73	(77)
0.77																			
7.47																			
113.91																			
0.43																			
1.11																			
281.73																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>104.39</td></tr></table>	104.39	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>258.19</td></tr></table>	258.19	(77)
0.77																			
7.47																			
104.39																			
0.43																			
1.11																			
258.19																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>92.85</td></tr></table>	92.85	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>229.65</td></tr></table>	229.65	(77)
0.77																			
7.47																			
92.85																			
0.43																			
1.11																			
229.65																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>69.27</td></tr></table>	69.27	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>171.32</td></tr></table>	171.32	(77)
0.77																			
7.47																			
69.27																			
0.43																			
1.11																			
171.32																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>44.07</td></tr></table>	44.07	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>109</td></tr></table>	109	(77)
0.77																			
7.47																			
44.07																			
0.43																			
1.11																			
109																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>7.47</td></tr></table>	7.47	x	<table><tr><td>31.49</td></tr></table>	31.49	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>77.88</td></tr></table>	77.88	(77)
0.77																			
7.47																			
31.49																			
0.43																			
1.11																			
77.88																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>46.75</td></tr></table>	46.75	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>13.93</td></tr></table>	13.93	(78)
0.77																			
0.9																			
46.75																			
0.43																			
1.11																			
13.93																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>76.57</td></tr></table>	76.57	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>22.82</td></tr></table>	22.82	(78)
0.77																			
0.9																			
76.57																			
0.43																			
1.11																			
22.82																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>97.53</td></tr></table>	97.53	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>29.06</td></tr></table>	29.06	(78)
0.77																			
0.9																			
97.53																			
0.43																			
1.11																			
29.06																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>110.23</td></tr></table>	110.23	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>32.85</td></tr></table>	32.85	(78)
0.77																			
0.9																			
110.23																			
0.43																			
1.11																			
32.85																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>114.87</td></tr></table>	114.87	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>34.23</td></tr></table>	34.23	(78)
0.77																			
0.9																			
114.87																			
0.43																			
1.11																			
34.23																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>110.55</td></tr></table>	110.55	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>32.94</td></tr></table>	32.94	(78)
0.77																			
0.9																			
110.55																			
0.43																			
1.11																			
32.94																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>108.01</td></tr></table>	108.01	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>32.19</td></tr></table>	32.19	(78)
0.77																			
0.9																			
108.01																			
0.43																			
1.11																			
32.19																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>104.89</td></tr></table>	104.89	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>31.26</td></tr></table>	31.26	(78)
0.77																			
0.9																			
104.89																			
0.43																			
1.11																			
31.26																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>101.89</td></tr></table>	101.89	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>30.36</td></tr></table>	30.36	(78)
0.77																			
0.9																			
101.89																			
0.43																			
1.11																			
30.36																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>82.59</td></tr></table>	82.59	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>24.61</td></tr></table>	24.61	(78)
0.77																			
0.9																			
82.59																			
0.43																			
1.11																			
24.61																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>55.42</td></tr></table>	55.42	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>16.51</td></tr></table>	16.51	(78)
0.77																			
0.9																			
55.42																			
0.43																			
1.11																			
16.51																			
South	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.9</td></tr></table>	0.9	x	<table><tr><td>40.4</td></tr></table>	40.4	x	<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>12.04</td></tr></table>	12.04	(78)
0.77																			
0.9																			
40.4																			
0.43																			
1.11																			
12.04																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>52.63</td></tr></table>	52.63	(79)
0.77																			
4.32																			
36.79																			
0.43																			
1.11																			
52.63																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>89.65</td></tr></table>	89.65	(79)
0.77																			
4.32																			
62.67																			
0.43																			
1.11																			
89.65																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>122.66</td></tr></table>	122.66	(79)
0.77																			
4.32																			
85.75																			
0.43																			
1.11																			
122.66																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.32</td></tr></table>	4.32	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.43</td></tr></table>	0.43	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>151.98</td></tr></table>	151.98	(79)
0.77																			
4.32																			
106.25																			
0.43																			
1.11																			
151.98																			

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	4.32	x	119.01	0.43	x	1.11	=	170.23	(79)
Southwest	0.9x	0.77	x	4.32	x	118.15	0.43	x	1.11	=	169	(79)
Southwest	0.9x	0.77	x	4.32	x	113.91	0.43	x	1.11	=	162.93	(79)
Southwest	0.9x	0.77	x	4.32	x	104.39	0.43	x	1.11	=	149.32	(79)
Southwest	0.9x	0.77	x	4.32	x	92.85	0.43	x	1.11	=	132.81	(79)
Southwest	0.9x	0.77	x	4.32	x	69.27	0.43	x	1.11	=	99.08	(79)
Southwest	0.9x	0.77	x	4.32	x	44.07	0.43	x	1.11	=	63.04	(79)
Southwest	0.9x	0.77	x	4.32	x	31.49	0.43	x	1.11	=	45.04	(79)
West	0.9x	0.77	x	0.9	x	19.64	0.43	x	1.11	=	5.85	(80)
West	0.9x	0.77	x	0.9	x	38.42	0.43	x	1.11	=	11.45	(80)
West	0.9x	0.77	x	0.9	x	63.27	0.43	x	1.11	=	18.85	(80)
West	0.9x	0.77	x	0.9	x	92.28	0.43	x	1.11	=	27.5	(80)
West	0.9x	0.77	x	0.9	x	113.09	0.43	x	1.11	=	33.7	(80)
West	0.9x	0.77	x	0.9	x	115.77	0.43	x	1.11	=	34.5	(80)
West	0.9x	0.77	x	0.9	x	110.22	0.43	x	1.11	=	32.84	(80)
West	0.9x	0.77	x	0.9	x	94.68	0.43	x	1.11	=	28.21	(80)
West	0.9x	0.77	x	0.9	x	73.59	0.43	x	1.11	=	21.93	(80)
West	0.9x	0.77	x	0.9	x	45.59	0.43	x	1.11	=	13.59	(80)
West	0.9x	0.77	x	0.9	x	24.49	0.43	x	1.11	=	7.3	(80)
West	0.9x	0.77	x	0.9	x	16.15	0.43	x	1.11	=	4.81	(80)
Northwest	0.9x	0.77	x	3.02	x	11.28	0.43	x	1.11	=	11.28	(81)
Northwest	0.9x	0.77	x	3.02	x	22.97	0.43	x	1.11	=	22.96	(81)
Northwest	0.9x	0.77	x	3.02	x	41.38	0.43	x	1.11	=	41.38	(81)
Northwest	0.9x	0.77	x	3.02	x	67.96	0.43	x	1.11	=	67.95	(81)
Northwest	0.9x	0.77	x	3.02	x	91.35	0.43	x	1.11	=	91.34	(81)
Northwest	0.9x	0.77	x	3.02	x	97.38	0.43	x	1.11	=	97.38	(81)
Northwest	0.9x	0.77	x	3.02	x	91.1	0.43	x	1.11	=	91.09	(81)
Northwest	0.9x	0.77	x	3.02	x	72.63	0.43	x	1.11	=	72.62	(81)
Northwest	0.9x	0.77	x	3.02	x	50.42	0.43	x	1.11	=	50.42	(81)
Northwest	0.9x	0.77	x	3.02	x	28.07	0.43	x	1.11	=	28.06	(81)
Northwest	0.9x	0.77	x	3.02	x	14.2	0.43	x	1.11	=	14.2	(81)
Northwest	0.9x	0.77	x	3.02	x	9.21	0.43	x	1.11	=	9.21	(81)
Rooflights	0.9x	1	x	0.59	x	39.98	0.63	x	0.7	=	9.36	(82)
Rooflights	0.9x	1	x	0.59	x	73.48	0.63	x	0.7	=	17.21	(82)
Rooflights	0.9x	1	x	0.59	x	112.11	0.63	x	0.7	=	26.25	(82)
Rooflights	0.9x	1	x	0.59	x	153.81	0.63	x	0.7	=	36.02	(82)
Rooflights	0.9x	1	x	0.59	x	182.63	0.63	x	0.7	=	42.77	(82)
Rooflights	0.9x	1	x	0.59	x	184.99	0.63	x	0.7	=	43.32	(82)
Rooflights	0.9x	1	x	0.59	x	176.88	0.63	x	0.7	=	41.42	(82)
Rooflights	0.9x	1	x	0.59	x	155.4	0.63	x	0.7	=	36.39	(82)
Rooflights	0.9x	1	x	0.59	x	126.86	0.63	x	0.7	=	29.71	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.59	x	84.6	x	0.63	x	0.7	=	19.81	(82)
Rooflights 0.9x	1	x	0.59	x	48.93	x	0.63	x	0.7	=	11.46	(82)
Rooflights 0.9x	1	x	0.59	x	33.5	x	0.63	x	0.7	=	7.84	(82)

Solar gains in watts, calculated for each month

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

(83)m=	184.06	319.09	450.3	579.09	666.61	669.36	642.21	575.99	494.88	356.47	221.5	156.83	(83)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(84)m=	598.37	731.22	847.58	952.31	1015.25	994.39	951.98	892.05	823.35	709.22	602.17	558.58	(84)
--------	--------	--------	--------	--------	---------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.82	0.66	0.51	0.56	0.78	0.95	0.99	1	(86)

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

(87)m=	19.5	19.73	20.05	20.43	20.74	20.92	20.98	20.97	20.84	20.42	19.87	19.45	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.9	0.77	0.57	0.39	0.44	0.71	0.93	0.98	0.99	(89)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	17.93	18.26	18.72	19.25	19.67	19.87	19.91	19.91	19.79	19.25	18.47	17.85	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.16	18.48	18.92	19.43	19.83	20.02	20.07	20.07	19.95	19.42	18.68	18.09	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.01	18.33	18.77	19.28	19.68	19.87	19.92	19.92	19.8	19.27	18.53	17.94	(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	0.97	0.95	0.88	0.76	0.57	0.39	0.44	0.7	0.91	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

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

(95)m=	591.3	712.63	801.57	838.53	768.21	566.89	371.82	390.81	574.72	646.56	588.45	553.46	(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=	1557.84	1523.23	1392.06	1177.37	904.87	598.19	376.75	398.78	646.26	983.65	1296.24	1558.4	(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=	719.11	544.72	439.32	243.96	101.68	0	0	0	0	250.8	509.61	747.68	(98)
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Total per year (kWh/year) = Sum(98)1...5,9...12 = 3556.87 (98)

Space heating requirement in kWh/m²/year

37.63 (99)

DER WorkSheet: New dwelling design stage

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

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

Space heating requirement (calculated above)

719.11	544.72	439.32	243.96	101.68	0	0	0	0	250.8	509.61	747.68
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(211)m = {[[(98)m x (204)] } x 100 ÷ (206) (211)

799.01	605.24	488.13	271.07	112.97	0	0	0	0	278.67	566.23	830.75
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Total (kWh/year) =Sum(211)_{1...5,10...12}= 3952.08 (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)
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Water heating

Output from water heater (calculated above)

181.7	159.52	166.05	146.79	142.34	125.04	118.06	132.36	133.02	152.33	163.65	176.63
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Efficiency of water heater 86.7 (216)

(217)m= 89.31 89.23 89.07 88.73 88.05 86.7 86.7 86.7 86.7 88.72 89.17 89.35 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.43	178.77	186.43	165.43	161.67	144.22	136.17	152.67	153.43	171.69	183.52	197.69	Total = Sum(219a) _{1...12} = 2035.12 (219)
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---

Annual totals

Space heating fuel used, main system 1	3952.08	kWh/year	kWh/year
Water heating fuel used	2035.12		

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 71.07 (230a)

central heating pump: 30 (230c)

boiler with a fan-assisted flue 45 (230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 146.07 (231)

Electricity for lighting 390.85 (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	= 853.65 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 439.59 (264)

DER WorkSheet: New dwelling design stage

Space and water heating	$(261) + (262) + (263) + (264) =$			1293.24	(265)
Electricity for pumps, fans and electric keep-hot	$(231) \times$	0.519	=	75.81	(267)
Electricity for lighting	$(232) \times$	0.519	=	202.85	(268)
Total CO2, kg/year		$\text{sum of } (265) \dots (271) =$		1571.9	(272)
Dwelling CO2 Emission Rate		$(272) \div (4) =$		16.63	(273)
El rating (section 14)				85	(274)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type A (Plot 9)

Address : Type A (Plot 9)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.97 (1a)	x	2.5 (2a)	=	102.43 (3a)
First floor	36.08 (1b)	x	2.7 (2b)	=	97.42 (3b)
Second floor	17.48 (1c)	x	2.54 (2c)	=	44.35 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.53 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	244.19 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 ÷ (5) = 0.12 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

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)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
--	-----	-----	------	------	------	-----	-----	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

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

(24a)

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

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

(24b)

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

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

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

(24c)

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

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

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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(24d)

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	1.2	2.544		(26)
Windows Type 1			4.32	$\times 1/[1/(1.4) + 0.04]$	5.73		(27)
Windows Type 2			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 3			0.9	$\times 1/[1/(1.4) + 0.04]$	1.19		(27)
Windows Type 4			3.02	$\times 1/[1/(1.4) + 0.04]$	4		(27)
Windows Type 5			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Rooflights			0.59	$\times 1/[1/(1.7) + 0.04]$	1.003		(27b)
Floor			40.97	$\times 0.13$	5.3261		(28)
Walls Type1	104.26	18.73	85.53	$\times 0.18$	15.4		(29)
Walls Type2	23.4	0	23.4	$\times 0.18$	4.21		(29)
Walls Type3	3.97	0	3.97	$\times 0.18$	0.71		(29)
Roof Type1	9.62	0	9.62	$\times 0.13$	1.25		(30)
Roof Type2	0.61	0	0.61	$\times 0.13$	0.08		(30)
Roof Type3	4.28	0	4.28	$\times 0.13$	0.56		(30)
Roof Type4	18.58	0	18.58	$\times 0.13$	2.42		(30)
Roof Type5	8.33	0.59	7.74	$\times 0.13$	1.01		(30)
Roof Type6	1.98	0	1.98	$\times 0.13$	0.26		(30)

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Total area of elements, m²	216					(31)	
Party wall	67.21	x	0	=	0		(32)
Internal wall **	176.01						(32c)
Internal floor	53.56						(32d)
Internal ceiling	53.56						(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 56.72 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19259.48 (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 12.96 (36)

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

Total fabric heat loss (33) + (36) = 69.68 (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=	46.87	46.61	46.36	45.19	44.97	43.94	43.94	43.75	44.34	44.97	45.41	45.88	(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=	116.55	116.29	116.04	114.87	114.65	113.62	113.62	113.43	114.02	114.65	115.09	115.56	
Average = Sum(39) _{1...12} /12=												114.87	(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=	1.23	1.23	1.23	1.22	1.21	1.2	1.2	1.2	1.21	1.21	1.22	1.22	
Average = Sum(40) _{1...12} /12=												1.22	(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 2.68 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.92 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.71	103.79	99.87	95.96	92.04	88.12	88.12	92.04	95.96	99.87	103.79	107.71	
Total = Sum(44) _{1...12} =												1175	(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=	159.73	139.7	144.16	125.68	120.59	104.06	96.43	110.65	111.97	130.5	142.45	154.69	
Total = Sum(45) _{1...12} =												1540.61	(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=	23.96	20.95	21.62	18.85	18.09	15.61	14.46	16.6	16.8	19.57	21.37	23.2	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m= 0 0 0 0 0 0 0 0 0 0 0 0 (56)

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

(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 (57)

Primary circuit loss (annual) from Table 3

0 (58)

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

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

(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 (59)

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

(61)m= 50.96 46.03 50.9 47.32 46.9 43.46 44.91 46.9 47.32 50.9 49.32 50.96 (61)

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

(62)m= 210.69 185.73 195.05 173 167.5 147.52 141.34 157.56 159.3 181.39 191.76 205.65 (62)

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

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

(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater

(64)m= 210.69 185.73 195.05 173 167.5 147.52 141.34 157.56 159.3 181.39 191.76 205.65
Output from water heater (annual)_{1...12} 2116.47 (64)

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

(65)m= 65.85 57.96 60.66 53.62 51.82 45.47 43.29 48.52 49.06 56.11 59.69 64.17 (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=	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14	134.14

(66)

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

(67)m= 22.13 19.66 15.99 12.1 9.05 7.64 8.25 10.73 14.4 18.28 21.34 22.75 (67)

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

(68)m= 247.17 249.73 243.27 229.51 212.14 195.82 184.91 182.35 188.81 202.57 219.94 236.26 (68)

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

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(69)m= 36.41 36.41 36.41 36.41 36.41 36.41 36.41 36.41 36.41 36.41 36.41 (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= -107.31 -107.31 -107.31 -107.31 -107.31 -107.31 -107.31 -107.31 -107.31 -107.31 -107.31 (71)

Water heating gains (Table 5)

(72)m= 88.51 86.25 81.53 74.47 69.65 63.15 58.18 65.21 68.14 75.42 82.91 86.25 (72)

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

(73)m= 424.05 421.88 407.03 382.33 357.09 332.84 317.59 324.53 337.59 362.52 390.42 411.51 (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)	
Southeast 0.9x	0.77	x	7.47	x	36.79	x	0.63	x	0.7	=	84	(77)
Southeast 0.9x	0.77	x	7.47	x	62.67	x	0.63	x	0.7	=	143.08	(77)
Southeast 0.9x	0.77	x	7.47	x	85.75	x	0.63	x	0.7	=	195.77	(77)
Southeast 0.9x	0.77	x	7.47	x	106.25	x	0.63	x	0.7	=	242.56	(77)
Southeast 0.9x	0.77	x	7.47	x	119.01	x	0.63	x	0.7	=	271.69	(77)
Southeast 0.9x	0.77	x	7.47	x	118.15	x	0.63	x	0.7	=	269.73	(77)
Southeast 0.9x	0.77	x	7.47	x	113.91	x	0.63	x	0.7	=	260.05	(77)
Southeast 0.9x	0.77	x	7.47	x	104.39	x	0.63	x	0.7	=	238.32	(77)
Southeast 0.9x	0.77	x	7.47	x	92.85	x	0.63	x	0.7	=	211.97	(77)
Southeast 0.9x	0.77	x	7.47	x	69.27	x	0.63	x	0.7	=	158.13	(77)
Southeast 0.9x	0.77	x	7.47	x	44.07	x	0.63	x	0.7	=	100.61	(77)
Southeast 0.9x	0.77	x	7.47	x	31.49	x	0.63	x	0.7	=	71.88	(77)
South 0.9x	0.77	x	0.9	x	46.75	x	0.63	x	0.7	=	12.86	(78)
South 0.9x	0.77	x	0.9	x	76.57	x	0.63	x	0.7	=	21.06	(78)
South 0.9x	0.77	x	0.9	x	97.53	x	0.63	x	0.7	=	26.83	(78)
South 0.9x	0.77	x	0.9	x	110.23	x	0.63	x	0.7	=	30.32	(78)
South 0.9x	0.77	x	0.9	x	114.87	x	0.63	x	0.7	=	31.6	(78)
South 0.9x	0.77	x	0.9	x	110.55	x	0.63	x	0.7	=	30.41	(78)
South 0.9x	0.77	x	0.9	x	108.01	x	0.63	x	0.7	=	29.71	(78)
South 0.9x	0.77	x	0.9	x	104.89	x	0.63	x	0.7	=	28.85	(78)
South 0.9x	0.77	x	0.9	x	101.89	x	0.63	x	0.7	=	28.02	(78)
South 0.9x	0.77	x	0.9	x	82.59	x	0.63	x	0.7	=	22.72	(78)
South 0.9x	0.77	x	0.9	x	55.42	x	0.63	x	0.7	=	15.24	(78)
South 0.9x	0.77	x	0.9	x	40.4	x	0.63	x	0.7	=	11.11	(78)
Southwest 0.9x	0.77	x	4.32	x	36.79		0.63	x	0.7	=	48.58	(79)
Southwest 0.9x	0.77	x	4.32	x	62.67		0.63	x	0.7	=	82.74	(79)
Southwest 0.9x	0.77	x	4.32	x	85.75		0.63	x	0.7	=	113.21	(79)
Southwest 0.9x	0.77	x	4.32	x	106.25		0.63	x	0.7	=	140.28	(79)

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Southwest	0.9x	0.77	x	4.32	x	119.01	0.63	x	0.7	=	157.12	(79)
Southwest	0.9x	0.77	x	4.32	x	118.15	0.63	x	0.7	=	155.99	(79)
Southwest	0.9x	0.77	x	4.32	x	113.91	0.63	x	0.7	=	150.39	(79)
Southwest	0.9x	0.77	x	4.32	x	104.39	0.63	x	0.7	=	137.82	(79)
Southwest	0.9x	0.77	x	4.32	x	92.85	0.63	x	0.7	=	122.59	(79)
Southwest	0.9x	0.77	x	4.32	x	69.27	0.63	x	0.7	=	91.45	(79)
Southwest	0.9x	0.77	x	4.32	x	44.07	0.63	x	0.7	=	58.18	(79)
Southwest	0.9x	0.77	x	4.32	x	31.49	0.63	x	0.7	=	41.57	(79)
West	0.9x	0.77	x	0.9	x	19.64	0.63	x	0.7	=	5.4	(80)
West	0.9x	0.77	x	0.9	x	38.42	0.63	x	0.7	=	10.57	(80)
West	0.9x	0.77	x	0.9	x	63.27	0.63	x	0.7	=	17.4	(80)
West	0.9x	0.77	x	0.9	x	92.28	0.63	x	0.7	=	25.38	(80)
West	0.9x	0.77	x	0.9	x	113.09	0.63	x	0.7	=	31.11	(80)
West	0.9x	0.77	x	0.9	x	115.77	0.63	x	0.7	=	31.84	(80)
West	0.9x	0.77	x	0.9	x	110.22	0.63	x	0.7	=	30.32	(80)
West	0.9x	0.77	x	0.9	x	94.68	0.63	x	0.7	=	26.04	(80)
West	0.9x	0.77	x	0.9	x	73.59	0.63	x	0.7	=	20.24	(80)
West	0.9x	0.77	x	0.9	x	45.59	0.63	x	0.7	=	12.54	(80)
West	0.9x	0.77	x	0.9	x	24.49	0.63	x	0.7	=	6.74	(80)
West	0.9x	0.77	x	0.9	x	16.15	0.63	x	0.7	=	4.44	(80)
Northwest	0.9x	0.77	x	3.02	x	11.28	0.63	x	0.7	=	10.41	(81)
Northwest	0.9x	0.77	x	3.02	x	22.97	0.63	x	0.7	=	21.2	(81)
Northwest	0.9x	0.77	x	3.02	x	41.38	0.63	x	0.7	=	38.19	(81)
Northwest	0.9x	0.77	x	3.02	x	67.96	0.63	x	0.7	=	62.72	(81)
Northwest	0.9x	0.77	x	3.02	x	91.35	0.63	x	0.7	=	84.31	(81)
Northwest	0.9x	0.77	x	3.02	x	97.38	0.63	x	0.7	=	89.88	(81)
Northwest	0.9x	0.77	x	3.02	x	91.1	0.63	x	0.7	=	84.08	(81)
Northwest	0.9x	0.77	x	3.02	x	72.63	0.63	x	0.7	=	67.03	(81)
Northwest	0.9x	0.77	x	3.02	x	50.42	0.63	x	0.7	=	46.54	(81)
Northwest	0.9x	0.77	x	3.02	x	28.07	0.63	x	0.7	=	25.9	(81)
Northwest	0.9x	0.77	x	3.02	x	14.2	0.63	x	0.7	=	13.1	(81)
Northwest	0.9x	0.77	x	3.02	x	9.21	0.63	x	0.7	=	8.5	(81)
Rooflights	0.9x	1	x	0.59	x	39.98	0.63	x	0.7	=	9.36	(82)
Rooflights	0.9x	1	x	0.59	x	73.48	0.63	x	0.7	=	17.21	(82)
Rooflights	0.9x	1	x	0.59	x	112.11	0.63	x	0.7	=	26.25	(82)
Rooflights	0.9x	1	x	0.59	x	153.81	0.63	x	0.7	=	36.02	(82)
Rooflights	0.9x	1	x	0.59	x	182.63	0.63	x	0.7	=	42.77	(82)
Rooflights	0.9x	1	x	0.59	x	184.99	0.63	x	0.7	=	43.32	(82)
Rooflights	0.9x	1	x	0.59	x	176.88	0.63	x	0.7	=	41.42	(82)
Rooflights	0.9x	1	x	0.59	x	155.4	0.63	x	0.7	=	36.39	(82)
Rooflights	0.9x	1	x	0.59	x	126.86	0.63	x	0.7	=	29.71	(82)

TER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.59	x	84.6	x	0.63	x	0.7	=	19.81	(82)
Rooflights 0.9x	1	x	0.59	x	48.93	x	0.63	x	0.7	=	11.46	(82)
Rooflights 0.9x	1	x	0.59	x	33.5	x	0.63	x	0.7	=	7.84	(82)

Solar gains in watts, calculated for each month

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

(83)m=	170.61	295.86	417.66	537.28	618.59	621.17	595.96	534.45	459.07	330.55	205.33	145.36	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	594.66	717.73	824.68	919.61	975.68	954.01	913.55	858.98	796.66	693.07	595.76	556.87	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.53	0.59	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=	19.68	19.86	20.15	20.49	20.78	20.94	20.99	20.98	20.87	20.49	20.01	19.64	(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=	1	0.99	0.98	0.93	0.81	0.61	0.41	0.46	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=	18.14	18.42	18.82	19.32	19.7	19.88	19.91	19.91	19.81	19.32	18.64	18.09	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.37	18.63	19.02	19.49	19.86	20.04	20.07	20.07	19.97	19.5	18.84	18.32	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(93)m=	18.37	18.63	19.02	19.49	19.86	20.04	20.07	20.07	19.97	19.5	18.84	18.32	(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	0.92	0.81	0.62	0.43	0.48	0.75	0.94	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	591.6	708.89	799.82	846.95	790.44	589.28	390.89	410.04	597.29	654.47	589.18	554.73	(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=	1639.54	1596.88	1452.86	1216.94	935.31	618.03	394.74	416.51	669.56	1020.06	1351.42	1632.22	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	---------	---------	------

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

(98)m=	779.66	596.73	485.87	266.4	107.78	0	0	0	0	272	548.81	801.65	(98)
--------	--------	--------	--------	-------	--------	---	---	---	---	-----	--------	--------	------

Total per year (kWh/year) = Sum(98)1...5,9...12 = 3858.9

Space heating requirement in kWh/m²/year

40.82 (99)

TER WorkSheet: New dwelling design stage

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

Space heating:

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

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

Space heating requirement (calculated above)

779.66	596.73	485.87	266.4	107.78	0	0	0	0	272	548.81	801.65	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												(211)
834.76	638.9	520.2	285.22	115.4	0	0	0	0	291.22	587.59	858.3	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												4131.58 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

210.69	185.73	195.05	173	167.5	147.52	141.34	157.56	159.3	181.39	191.76	205.65	
Efficiency of water heater												80.3 (216)
(217)m =	88.04	87.78	87.26	86.13	83.97	80.3	80.3	80.3	80.3	86.07	87.55	88.14 (217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m =	239.3	211.58	223.54	200.85	199.46	183.71	176.01	196.21	198.38	210.75	219.03	233.33
Total = Sum(219a) _{1...12} =												2492.15 (219)

Annual totals

Space heating fuel used, main system 1		kWh/year	kWh/year
		4131.58	
Water heating fuel used		2492.15	
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		390.85	(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	=	892.42 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	538.31 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1430.73 (265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.85	(268)
Total CO2, kg/year		sum of (265)...(271) =		1672.51	(272)
TER	=			17.69	(273)

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 27 January 2021 at 16:34:17

Project Information:

Assessed By: ()

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 92.03m²

Site Reference : Swansea Road

Plot Reference: Type B (Plot 5)

Address : Type B (Plot 5)

Client Details:

Name: Helix

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

20.05 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

18.84 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

64.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

56.6 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.25 (max. 0.30)

0.25 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

0.13 (max. 0.25)

0.15 (max. 0.70)

Roof

0.11 (max. 0.20)

0.11 (max. 0.35)

Openings

1.38 (max. 2.00)

1.40 (max. 3.30)

OK

OK

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

4.65 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Database: (rev 471, product index 017616):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Potterton

Model: Promax Ultra

Model qualifier: Combi 33 ErP
(Combi)

Efficiency 89.1 % SEDBUK2009

Minimum 88.0 %

OK

Secondary heating system:

None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (South East England): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 6.98m²
 Windows facing: North 1.01m²
 Windows facing: West 1.01m²
 Windows facing: South West 4.18m²
 Windows facing: South East 6.01m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Software Name: Stroma FSAP 2012

Stroma Number:

Software Version:

Version: 1.0.5.12

Property Address: Type B (Plot 5)

Address : Type B (Plot 5)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	35.72 (1a)	x	2.5 (2a)	=	89.3 (3a)
First floor	56.31 (1b)	x	2.7 (2b)	=	152.04 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.03 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	241.34 (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							0	x 10 =	0 (7a)		
Number of passive vents							0	x 10 =	0 (7b)		
Number of flueless gas fires							0	x 40 =	0 (7c)		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)											
Number of storeys in the dwelling (ns)											0 (9)
Additional infiltration										[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction											0 (11)
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											
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0											0 (12)
If no draught lobby, enter 0.05, else enter 0											0 (13)
Percentage of windows and doors draught stripped											0 (14)
Window infiltration										0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate										(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area											4.65000009536743 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)											0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used											
Number of sides sheltered											2 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor										(21) = (18) x (20) =	0.2 (21)
Infiltration rate modified for monthly wind speed											
											Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly average wind speed from Table 7											
(22)m=											5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (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 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (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			2.12	1.2	2.544		(26)
Windows Type 1			6.98	$\times 1/[1/(1.4) + 0.04]$	9.25		(27)
Windows Type 2			1.01	$\times 1/[1/(1.4) + 0.04]$	1.34		(27)
Windows Type 3			1.01	$\times 1/[1/(1.4) + 0.04]$	1.34		(27)
Windows Type 4			4.18	$\times 1/[1/(1.4) + 0.04]$	5.54		(27)
Windows Type 5			6.01	$\times 1/[1/(1.4) + 0.04]$	7.97		(27)
Floor Type 1			35.72	0.11	3.9292	75	2679 (28)
Floor Type 2			21.48	0.15	3.222	20	429.6 (28)
Walls	136.56	21.31	115.25	0.25	28.81	60	6915 (29)
Roof Type1	56.31	0	56.31	0.11	6.19	9	506.79 (30)
Roof Type2	0.94	0	0.94	0.11	0.1	9	8.46 (30)
Total area of elements, m²			251.01				(31)
Party wall			13.22	0	0	110	1454.2 (32)
Internal wall **			184.48			9	1660.32 (32c)
Internal floor			56.31			18	1013.58 (32d)
Internal ceiling			56.31			9	506.79 (32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 70.25 (33)

DER WorkSheet: New dwelling design stage

Heat capacity $C_m = S(A \times k)$

$((28)...(30) + (32) + (32a)...(32e) =$ 15173.74 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in $\text{kJ/m}^2\text{K}$

$= (34) \div (4) =$ 164.88 (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 : $S(L \times Y)$ calculated using Appendix K

15.13 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss

$(33) + (36) =$ 85.38 (37)

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=	39.98	39.82	39.82	39.82	39.82	39.82	39.82	39.82	39.82	39.82	39.82	39.82	(38)

Heat transfer coefficient, W/K

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

(39)m=	125.36	125.2	125.2	125.2	125.2	125.2	125.2	125.2	125.2	125.2	125.2	125.2	
Average = $\text{Sum}(39)_{1...12} / 12 =$												125.21	(39)

Heat loss parameter (HLP), W/m^2K

$(40)m = (39)m \div (4)$

(40)m=	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
Average = $\text{Sum}(40)_{1...12} / 12 =$												1.36	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if $TFA \leq 13.9$, $N = 1$

2.65 (42)

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$

97.2 (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=	106.92	103.03	99.14	95.25	91.37	87.48	87.48	91.37	95.25	99.14	103.03	106.92	
Total = $\text{Sum}(44)_{1...12} =$												1166.36	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600 \text{ kWh/month}$ (see Tables 1b, 1c, 1d)

(45)m=	158.55	138.67	143.1	124.76	119.71	103.3	95.72	109.84	111.15	129.54	141.4	153.55	
Total = $\text{Sum}(45)_{1...12} =$												1529.28	(45)

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

(46)m=	23.78	20.8	21.46	18.71	17.96	15.49	14.36	16.48	16.67	19.43	21.21	23.03	(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

$(48) \times (49) =$

0 (50)

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

DER WorkSheet: New dwelling design stage

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

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

(56)m=

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

(56)

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

(57)m=

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

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

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

(59)

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

(61)m=

21.96	19.82	21.89	21.1	21.74	20.97	21.63	21.7	21.04	21.83	21.2	21.94
-------	-------	-------	------	-------	-------	-------	------	-------	-------	------	-------

(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=

180.52	158.49	164.99	145.86	141.45	124.27	117.35	131.54	132.19	151.36	162.6	175.49
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(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=

180.52	158.49	164.99	145.86	141.45	124.27	117.35	131.54	132.19	151.36	162.6	175.49
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

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

1786.1

(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=

58.21	51.06	53.05	46.76	45.24	39.59	37.23	41.95	42.22	48.53	52.32	56.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62

(66)

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

(67)m=

21.64	19.22	15.63	11.84	8.85	7.47	8.07	10.49	14.08	17.88	20.87	22.24
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

242.76	245.28	238.93	225.42	208.36	192.33	181.62	179.1	185.44	198.96	216.02	232.05
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(68)

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

(69)m=

36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

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

(70)

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

(71)m=

-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

78.24	75.99	71.31	64.94	60.8	54.98	50.05	56.38	58.64	65.23	72.66	76
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	----

(72)

DER WorkSheet: New dwelling design stage

Total internal gains =

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

(73)m=	408.43	406.28	391.66	367.98	343.8	320.57	305.52	311.75	323.95	347.85	375.33	396.08
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(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)	
North	0.9x	0.77	x	1.01	x	10.63	x	0.43	x	1.11	=	3.56 (74)
North	0.9x	0.77	x	1.01	x	20.32	x	0.43	x	1.11	=	6.8 (74)
North	0.9x	0.77	x	1.01	x	34.53	x	0.43	x	1.11	=	11.55 (74)
North	0.9x	0.77	x	1.01	x	55.46	x	0.43	x	1.11	=	18.55 (74)
North	0.9x	0.77	x	1.01	x	74.72	x	0.43	x	1.11	=	24.99 (74)
North	0.9x	0.77	x	1.01	x	79.99	x	0.43	x	1.11	=	26.75 (74)
North	0.9x	0.77	x	1.01	x	74.68	x	0.43	x	1.11	=	24.97 (74)
North	0.9x	0.77	x	1.01	x	59.25	x	0.43	x	1.11	=	19.81 (74)
North	0.9x	0.77	x	1.01	x	41.52	x	0.43	x	1.11	=	13.88 (74)
North	0.9x	0.77	x	1.01	x	24.19	x	0.43	x	1.11	=	8.09 (74)
North	0.9x	0.77	x	1.01	x	13.12	x	0.43	x	1.11	=	4.39 (74)
North	0.9x	0.77	x	1.01	x	8.86	x	0.43	x	1.11	=	2.96 (74)
Southeast	0.9x	0.77	x	6.01	x	36.79	x	0.43	x	1.11	=	73.22 (77)
Southeast	0.9x	0.77	x	6.01	x	62.67	x	0.43	x	1.11	=	124.71 (77)
Southeast	0.9x	0.77	x	6.01	x	85.75	x	0.43	x	1.11	=	170.64 (77)
Southeast	0.9x	0.77	x	6.01	x	106.25	x	0.43	x	1.11	=	211.43 (77)
Southeast	0.9x	0.77	x	6.01	x	119.01	x	0.43	x	1.11	=	236.82 (77)
Southeast	0.9x	0.77	x	6.01	x	118.15	x	0.43	x	1.11	=	235.11 (77)
Southeast	0.9x	0.77	x	6.01	x	113.91	x	0.43	x	1.11	=	226.67 (77)
Southeast	0.9x	0.77	x	6.01	x	104.39	x	0.43	x	1.11	=	207.73 (77)
Southeast	0.9x	0.77	x	6.01	x	92.85	x	0.43	x	1.11	=	184.77 (77)
Southeast	0.9x	0.77	x	6.01	x	69.27	x	0.43	x	1.11	=	137.84 (77)
Southeast	0.9x	0.77	x	6.01	x	44.07	x	0.43	x	1.11	=	87.7 (77)
Southeast	0.9x	0.77	x	6.01	x	31.49	x	0.43	x	1.11	=	62.66 (77)
Southwest	0.9x	0.77	x	4.18	x	36.79		0.43	x	1.11	=	50.92 (79)
Southwest	0.9x	0.77	x	4.18	x	62.67		0.43	x	1.11	=	86.74 (79)
Southwest	0.9x	0.77	x	4.18	x	85.75		0.43	x	1.11	=	118.68 (79)
Southwest	0.9x	0.77	x	4.18	x	106.25		0.43	x	1.11	=	147.05 (79)
Southwest	0.9x	0.77	x	4.18	x	119.01		0.43	x	1.11	=	164.71 (79)
Southwest	0.9x	0.77	x	4.18	x	118.15		0.43	x	1.11	=	163.52 (79)
Southwest	0.9x	0.77	x	4.18	x	113.91		0.43	x	1.11	=	157.65 (79)
Southwest	0.9x	0.77	x	4.18	x	104.39		0.43	x	1.11	=	144.48 (79)
Southwest	0.9x	0.77	x	4.18	x	92.85		0.43	x	1.11	=	128.51 (79)
Southwest	0.9x	0.77	x	4.18	x	69.27		0.43	x	1.11	=	95.87 (79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	4.18	x	44.07		0.43	x	1.11	=	60.99	(79)
Southwest	0.9x	0.77	x	4.18	x	31.49		0.43	x	1.11	=	43.58	(79)
West	0.9x	0.77	x	1.01	x	19.64	x	0.43	x	1.11	=	6.57	(80)
West	0.9x	0.77	x	1.01	x	38.42	x	0.43	x	1.11	=	12.85	(80)
West	0.9x	0.77	x	1.01	x	63.27	x	0.43	x	1.11	=	21.16	(80)
West	0.9x	0.77	x	1.01	x	92.28	x	0.43	x	1.11	=	30.86	(80)
West	0.9x	0.77	x	1.01	x	113.09	x	0.43	x	1.11	=	37.82	(80)
West	0.9x	0.77	x	1.01	x	115.77	x	0.43	x	1.11	=	38.71	(80)
West	0.9x	0.77	x	1.01	x	110.22	x	0.43	x	1.11	=	36.86	(80)
West	0.9x	0.77	x	1.01	x	94.68	x	0.43	x	1.11	=	31.66	(80)
West	0.9x	0.77	x	1.01	x	73.59	x	0.43	x	1.11	=	24.61	(80)
West	0.9x	0.77	x	1.01	x	45.59	x	0.43	x	1.11	=	15.25	(80)
West	0.9x	0.77	x	1.01	x	24.49	x	0.43	x	1.11	=	8.19	(80)
West	0.9x	0.77	x	1.01	x	16.15	x	0.43	x	1.11	=	5.4	(80)
Northwest	0.9x	0.77	x	6.98	x	11.28	x	0.43	x	1.11	=	26.08	(81)
Northwest	0.9x	0.77	x	6.98	x	22.97	x	0.43	x	1.11	=	53.08	(81)
Northwest	0.9x	0.77	x	6.98	x	41.38	x	0.43	x	1.11	=	95.63	(81)
Northwest	0.9x	0.77	x	6.98	x	67.96	x	0.43	x	1.11	=	157.05	(81)
Northwest	0.9x	0.77	x	6.98	x	91.35	x	0.43	x	1.11	=	211.11	(81)
Northwest	0.9x	0.77	x	6.98	x	97.38	x	0.43	x	1.11	=	225.06	(81)
Northwest	0.9x	0.77	x	6.98	x	91.1	x	0.43	x	1.11	=	210.54	(81)
Northwest	0.9x	0.77	x	6.98	x	72.63	x	0.43	x	1.11	=	167.85	(81)
Northwest	0.9x	0.77	x	6.98	x	50.42	x	0.43	x	1.11	=	116.53	(81)
Northwest	0.9x	0.77	x	6.98	x	28.07	x	0.43	x	1.11	=	64.87	(81)
Northwest	0.9x	0.77	x	6.98	x	14.2	x	0.43	x	1.11	=	32.81	(81)
Northwest	0.9x	0.77	x	6.98	x	9.21	x	0.43	x	1.11	=	21.29	(81)

Solar gains in watts, calculated for each month

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

(83)m= 160.34 284.18 417.66 564.94 675.44 689.15 656.69 571.52 468.29 321.9 194.08 135.9 (83)

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

(84)m= 568.77 690.46 809.32 932.92 1019.24 1009.72 962.21 883.28 792.24 669.75 569.41 531.98 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.98	0.96	0.91	0.81	0.67	0.53	0.58	0.8	0.94	0.98	0.99

(86)

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

(87)m= 18.97 19.22 19.62 20.11 20.55 20.83 20.94 20.92 20.69 20.11 19.43 18.91 (87)

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

(88)m= 19.79 19.79 19.79 19.79 19.79 19.79 19.79 19.79 19.79 19.79 19.79 19.79 (88)

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

(89)m= 0.99 0.97 0.95 0.88 0.76 0.58 0.4 0.46 0.72 0.92 0.98 0.99 (89)

DER WorkSheet: New dwelling design stage

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

(90)m=	17.11	17.48	18.05	18.75	19.33	19.67	19.77	19.75	19.52	18.75	17.79	17.02	(90)
fLA = Living area ÷ (4) =												0.29	(91)

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

(92)m=	17.65	17.99	18.51	19.14	19.69	20.01	20.11	20.09	19.86	19.15	18.26	17.57	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.5	17.84	18.36	18.99	19.54	19.86	19.96	19.94	19.71	19	18.11	17.42	(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=	0.98	0.96	0.93	0.87	0.75	0.58	0.42	0.47	0.72	0.9	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	-----	------	------	------

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

(95)m=	556.93	664.85	753.65	806.99	764.16	589.8	403.89	418.48	567.7	603.73	550	522.82	(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=	1654.8	1619.46	1484.47	1263.89	981.41	658.01	420.53	443.42	702.5	1051.38	1379.06	1655.25	(97)
--------	--------	---------	---------	---------	--------	--------	--------	--------	-------	---------	---------	---------	------

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

(98)m=	816.81	641.5	543.73	328.97	161.63	0	0	0	0	333.05	596.92	842.53	(98)
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												4265.15	(98)

Space heating requirement in kWh/m²/year

(99)	46.35
------	-------

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

Space heating:

Fraction of space heat from secondary/supplementary system

(201)	0
-------	---

Fraction of space heat from main system(s)

$$(202) = 1 - (201) =$$

(202)	1
-------	---

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] =$$

(204)	1
-------	---

Efficiency of main space heating system 1

(206)	90
-------	----

Efficiency of secondary/supplementary heating system, %

(208)	0
-------	---

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

Space heating requirement (calculated above)

816.81	641.5	543.73	328.97	161.63	0	0	0	0	333.05	596.92	842.53
--------	-------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

907.57	712.78	604.15	365.52	179.59	0	0	0	0	370.06	663.25	936.14
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

(211)	4739.05
-------	---------

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)

180.52	158.49	164.99	145.86	141.45	124.27	117.35	131.54	132.19	151.36	162.6	175.49
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Efficiency of water heater

(216)	86.7
-------	------

DER WorkSheet: New dwelling design stage

(217)m=

89.38	89.33	89.21	88.96	88.43	86.7	86.7	86.7	86.7	88.94	89.27	89.41
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

201.96	177.43	184.94	163.96	159.96	143.33	135.35	151.72	152.47	170.18	182.14	196.27
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2019.71

 (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

mechanical ventilation - balanced, extract or positive input from outside

70.24

 (230a)

central heating pump:

30

 (230c)

boiler with a fan-assisted flue

45

 (230e)

Total electricity for the above, kWh/year

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

145.24

 (231)

Electricity for lighting

382.21

 (232)

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	1023.64 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	436.26 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1459.89 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	75.38 (267)
Electricity for lighting	(232) x	0.519 =	198.37 (268)
Total CO2, kg/year		sum of (265)...(271) =	1733.64 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	18.84 (273)
El rating (section 14)			83 (274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type B (Plot 5)

Address : Type B (Plot 5)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	35.72 (1a)	x	2.5 (2a)	=	89.3 (3a)
First floor	56.31 (1b)	x	2.7 (2b)	=	152.04 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.03 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	241.34 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total		m ³ per hour
Number of chimneys	0	+	0	=	0 x 40 =	0 (6a)
Number of open flues	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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =						30 ÷ (5) = 0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)						
Number of storeys in the dwelling (ns)						0 (9)
Additional infiltration					[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction						0 (11)
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						
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)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used						
Number of sides sheltered						2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

	0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
--	------	-----	------	------	------	-----	-----	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (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			2.12	1.2	2.544		(26)
Windows Type 1			6.98	$\frac{1}{1/(1.4) + 0.04}$	9.25		(27)
Windows Type 2			1.01	$\frac{1}{1/(1.4) + 0.04}$	1.34		(27)
Windows Type 3			1.01	$\frac{1}{1/(1.4) + 0.04}$	1.34		(27)
Windows Type 4			4.18	$\frac{1}{1/(1.4) + 0.04}$	5.54		(27)
Windows Type 5			6.01	$\frac{1}{1/(1.4) + 0.04}$	7.97		(27)
Floor Type 1			35.72	0.13	4.6436		(28)
Floor Type 2			21.48	0.13	2.7924		(28)
Walls	136.56	21.31	115.25	0.18	20.75		(29)
Roof Type1	56.31	0	56.31	0.13	7.32		(30)
Roof Type2	0.94	0	0.94	0.13	0.12		(30)
Total area of elements, m²			251.01				(31)
Party wall			13.22	0	0		(32)
Internal wall **			184.48				(32c)
Internal floor			56.31				(32d)
Internal ceiling			56.31				(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 63.61 (33)

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Heat capacity $C_m = S(A \times k)$

$((28)...(30) + (32) + (32a)...(32e) =$ 15173.74 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in $\text{kJ/m}^2\text{K}$

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 : $S(L \times Y)$ calculated using Appendix K

17.32 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss

$(33) + (36) =$ 80.93 (37)

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=	46.37	46.12	45.87	44.7	44.48	43.46	43.46	43.27	43.85	44.48	44.92	45.39	(38)

Heat transfer coefficient, W/K

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

(39)m=	127.3	127.05	126.8	125.63	125.41	124.39	124.39	124.2	124.78	125.41	125.85	126.31	
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Average = $\text{Sum}(39)_{1...12} / 12 =$ 125.63 (39)

Heat loss parameter (HLP), W/m^2K

$(40)m = (39)m \div (4)$

(40)m=	1.38	1.38	1.38	1.37	1.36	1.35	1.35	1.35	1.36	1.36	1.37	1.37	
--------	------	------	------	------	------	------	------	------	------	------	------	------	--

Average = $\text{Sum}(40)_{1...12} / 12 =$ 1.37 (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

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if $TFA \leq 13.9$, $N = 1$

2.65 (42)

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$

97.2 (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=	106.92	103.03	99.14	95.25	91.37	87.48	87.48	91.37	95.25	99.14	103.03	106.92	
--------	--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------	--

Total = $\text{Sum}(44)_{1...12} =$ 1166.36 (44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600 \text{ kWh/month}$ (see Tables 1b, 1c, 1d)

(45)m=	158.55	138.67	143.1	124.76	119.71	103.3	95.72	109.84	111.15	129.54	141.4	153.55	
--------	--------	--------	-------	--------	--------	-------	-------	--------	--------	--------	-------	--------	--

Total = $\text{Sum}(45)_{1...12} =$ 1529.28 (45)

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

(46)m=	23.78	20.8	21.46	18.71	17.96	15.49	14.36	16.48	16.67	19.43	21.21	23.03	(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

$(48) \times (49) =$ 0 (50)

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

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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 (55)

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

(56)m=

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

 (56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
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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=

0	0	0	0	0	0	0	0	0	0	0	0
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 (59)

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

(61)m=

50.96	46.03	50.52	46.97	46.56	43.14	44.58	46.56	46.97	50.52	49.32	50.96
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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=

209.51	184.7	193.62	171.73	166.26	146.44	140.3	156.4	158.13	180.06	190.72	204.51
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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=

209.51	184.7	193.62	171.73	166.26	146.44	140.3	156.4	158.13	180.06	190.72	204.51
--------	-------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 2102.37 (64)

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

(65)m=

65.46	57.62	60.21	53.22	51.44	45.13	42.97	48.16	48.7	55.7	59.34	63.8
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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
132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62	132.62

 (66)

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

(67)m=

21.64	19.22	15.63	11.84	8.85	7.47	8.07	10.49	14.08	17.88	20.87	22.24
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 (67)

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

(68)m=

242.76	245.28	238.93	225.42	208.36	192.33	181.62	179.1	185.44	198.96	216.02	232.05
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 (68)

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

(69)m=

36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26	36.26
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

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

 (70)

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

(71)m=

-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1	-106.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

87.98	85.74	80.93	73.92	69.14	62.68	57.76	64.73	67.64	74.87	82.42	85.75
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 (72)

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Total internal gains =

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

(73)m=	418.18	416.03	401.28	376.97	352.14	328.27	313.23	320.11	332.95	357.49	385.09	405.83
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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)	
North	0.9x	0.77	x	1.01	x	10.63	x	0.63	x	0.7	=	3.28 (74)
North	0.9x	0.77	x	1.01	x	20.32	x	0.63	x	0.7	=	6.27 (74)
North	0.9x	0.77	x	1.01	x	34.53	x	0.63	x	0.7	=	10.66 (74)
North	0.9x	0.77	x	1.01	x	55.46	x	0.63	x	0.7	=	17.12 (74)
North	0.9x	0.77	x	1.01	x	74.72	x	0.63	x	0.7	=	23.06 (74)
North	0.9x	0.77	x	1.01	x	79.99	x	0.63	x	0.7	=	24.69 (74)
North	0.9x	0.77	x	1.01	x	74.68	x	0.63	x	0.7	=	23.05 (74)
North	0.9x	0.77	x	1.01	x	59.25	x	0.63	x	0.7	=	18.29 (74)
North	0.9x	0.77	x	1.01	x	41.52	x	0.63	x	0.7	=	12.81 (74)
North	0.9x	0.77	x	1.01	x	24.19	x	0.63	x	0.7	=	7.47 (74)
North	0.9x	0.77	x	1.01	x	13.12	x	0.63	x	0.7	=	4.05 (74)
North	0.9x	0.77	x	1.01	x	8.86	x	0.63	x	0.7	=	2.74 (74)
Southeast	0.9x	0.77	x	6.01	x	36.79	x	0.63	x	0.7	=	67.58 (77)
Southeast	0.9x	0.77	x	6.01	x	62.67	x	0.63	x	0.7	=	115.11 (77)
Southeast	0.9x	0.77	x	6.01	x	85.75	x	0.63	x	0.7	=	157.5 (77)
Southeast	0.9x	0.77	x	6.01	x	106.25	x	0.63	x	0.7	=	195.16 (77)
Southeast	0.9x	0.77	x	6.01	x	119.01	x	0.63	x	0.7	=	218.59 (77)
Southeast	0.9x	0.77	x	6.01	x	118.15	x	0.63	x	0.7	=	217.01 (77)
Southeast	0.9x	0.77	x	6.01	x	113.91	x	0.63	x	0.7	=	209.22 (77)
Southeast	0.9x	0.77	x	6.01	x	104.39	x	0.63	x	0.7	=	191.74 (77)
Southeast	0.9x	0.77	x	6.01	x	92.85	x	0.63	x	0.7	=	170.54 (77)
Southeast	0.9x	0.77	x	6.01	x	69.27	x	0.63	x	0.7	=	127.23 (77)
Southeast	0.9x	0.77	x	6.01	x	44.07	x	0.63	x	0.7	=	80.95 (77)
Southeast	0.9x	0.77	x	6.01	x	31.49	x	0.63	x	0.7	=	57.83 (77)
Southwest	0.9x	0.77	x	4.18	x	36.79		0.63	x	0.7	=	47 (79)
Southwest	0.9x	0.77	x	4.18	x	62.67		0.63	x	0.7	=	80.06 (79)
Southwest	0.9x	0.77	x	4.18	x	85.75		0.63	x	0.7	=	109.55 (79)
Southwest	0.9x	0.77	x	4.18	x	106.25		0.63	x	0.7	=	135.73 (79)
Southwest	0.9x	0.77	x	4.18	x	119.01		0.63	x	0.7	=	152.03 (79)
Southwest	0.9x	0.77	x	4.18	x	118.15		0.63	x	0.7	=	150.93 (79)
Southwest	0.9x	0.77	x	4.18	x	113.91		0.63	x	0.7	=	145.51 (79)
Southwest	0.9x	0.77	x	4.18	x	104.39		0.63	x	0.7	=	133.35 (79)
Southwest	0.9x	0.77	x	4.18	x	92.85		0.63	x	0.7	=	118.61 (79)
Southwest	0.9x	0.77	x	4.18	x	69.27		0.63	x	0.7	=	88.49 (79)

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Southwest	0.9x	0.77	x	4.18	x	44.07	0.63	x	0.7	=	56.3	(79)
Southwest	0.9x	0.77	x	4.18	x	31.49	0.63	x	0.7	=	40.22	(79)
West	0.9x	0.77	x	1.01	x	19.64	0.63	x	0.7	=	6.06	(80)
West	0.9x	0.77	x	1.01	x	38.42	0.63	x	0.7	=	11.86	(80)
West	0.9x	0.77	x	1.01	x	63.27	0.63	x	0.7	=	19.53	(80)
West	0.9x	0.77	x	1.01	x	92.28	0.63	x	0.7	=	28.48	(80)
West	0.9x	0.77	x	1.01	x	113.09	0.63	x	0.7	=	34.91	(80)
West	0.9x	0.77	x	1.01	x	115.77	0.63	x	0.7	=	35.73	(80)
West	0.9x	0.77	x	1.01	x	110.22	0.63	x	0.7	=	34.02	(80)
West	0.9x	0.77	x	1.01	x	94.68	0.63	x	0.7	=	29.22	(80)
West	0.9x	0.77	x	1.01	x	73.59	0.63	x	0.7	=	22.71	(80)
West	0.9x	0.77	x	1.01	x	45.59	0.63	x	0.7	=	14.07	(80)
West	0.9x	0.77	x	1.01	x	24.49	0.63	x	0.7	=	7.56	(80)
West	0.9x	0.77	x	1.01	x	16.15	0.63	x	0.7	=	4.99	(80)
Northwest	0.9x	0.77	x	6.98	x	11.28	0.63	x	0.7	=	24.07	(81)
Northwest	0.9x	0.77	x	6.98	x	22.97	0.63	x	0.7	=	48.99	(81)
Northwest	0.9x	0.77	x	6.98	x	41.38	0.63	x	0.7	=	88.27	(81)
Northwest	0.9x	0.77	x	6.98	x	67.96	0.63	x	0.7	=	144.96	(81)
Northwest	0.9x	0.77	x	6.98	x	91.35	0.63	x	0.7	=	194.86	(81)
Northwest	0.9x	0.77	x	6.98	x	97.38	0.63	x	0.7	=	207.74	(81)
Northwest	0.9x	0.77	x	6.98	x	91.1	0.63	x	0.7	=	194.34	(81)
Northwest	0.9x	0.77	x	6.98	x	72.63	0.63	x	0.7	=	154.93	(81)
Northwest	0.9x	0.77	x	6.98	x	50.42	0.63	x	0.7	=	107.56	(81)
Northwest	0.9x	0.77	x	6.98	x	28.07	0.63	x	0.7	=	59.87	(81)
Northwest	0.9x	0.77	x	6.98	x	14.2	0.63	x	0.7	=	30.28	(81)
Northwest	0.9x	0.77	x	6.98	x	9.21	0.63	x	0.7	=	19.66	(81)

Solar gains in watts, calculated for each month

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

(83)m=

148	262.3	385.51	521.45	623.45	636.1	606.14	527.53	432.25	297.12	179.14	125.44
-----	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

 (83)

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

(84)m=

566.17	678.33	786.79	898.42	975.59	964.37	919.37	847.64	765.2	654.62	564.23	531.27
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.99	0.96	0.88	0.73	0.57	0.63	0.86	0.98	1	1

 (86)

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

(87)m=

19.47	19.66	19.96	20.35	20.7	20.91	20.98	20.96	20.8	20.35	19.83	19.44
-------	-------	-------	-------	------	-------	-------	-------	------	-------	-------	-------

 (87)

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

(88)m=

19.78	19.78	19.78	19.79	19.79	19.8	19.8	19.8	19.8	19.79	19.79	19.78
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (88)

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

(89)m=

1	0.99	0.98	0.94	0.83	0.63	0.43	0.49	0.78	0.96	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (89)

TER WorkSheet: New dwelling design stage

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

(90)m=	17.76	18.03	18.47	19.04	19.5	19.74	19.79	19.79	19.64	19.04	18.3	17.72	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	------

$$fLA = \text{Living area} \div (4) = 0.29 \quad (91)$$

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

(92)m=	18.26	18.5	18.9	19.42	19.85	20.08	20.14	20.13	19.98	19.42	18.74	18.22	(92)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.26	18.5	18.9	19.42	19.85	20.08	20.14	20.13	19.98	19.42	18.74	18.22	(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	0.97	0.93	0.83	0.65	0.47	0.53	0.8	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	-----	------	------	---	------

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

(95)m=	563.49	671.26	767.12	838.05	812.66	630.96	430.97	448.21	610.21	626.33	558.92	529.34	(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=	1776.89	1728.47	1572.7	1321.44	1021.6	681.76	439.92	463.22	733.15	1106.03	1465.49	1770.71	(97)
--------	---------	---------	--------	---------	--------	--------	--------	--------	--------	---------	---------	---------	------

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

(98)m=	902.77	710.45	599.35	348.04	155.45	0	0	0	0	356.89	652.73	923.58	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 4649.26 \quad (98)$$

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

50.52	(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 93.4 (206)

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

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

Space heating requirement (calculated above)

902.77	710.45	599.35	348.04	155.45	0	0	0	0	356.89	652.73	923.58
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

966.56	760.65	641.7	372.64	166.43	0	0	0	0	382.11	698.85	988.84
--------	--------	-------	--------	--------	---	---	---	---	--------	--------	--------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 4977.79 \quad (211)$$

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

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

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

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

Water heating

Output from water heater (calculated above)

209.51	184.7	193.62	171.73	166.26	146.44	140.3	156.4	158.13	180.06	190.72	204.51
--------	-------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------

Efficiency of water heater 80.3 (216)

TER WorkSheet: New dwelling design stage

(217)m=

88.31	88.11	87.71	86.79	84.88	80.3	80.3	80.3	80.3	86.74	87.9	88.38
-------	-------	-------	-------	-------	------	------	------	------	-------	------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

237.25	209.62	220.76	197.86	195.88	182.36	174.72	194.77	196.92	207.58	216.97	231.39
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2466.07

 (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

382.21

(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		<table><tr><td>0.216</td></tr></table>	0.216	=	<table><tr><td>1075.2</td></tr></table> (261)	1075.2
0.216							
1075.2							
Space heating (secondary)	(215) x		<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>0</td></tr></table> (263)	0
0.519							
0							
Water heating	(219) x		<table><tr><td>0.216</td></tr></table>	0.216	=	<table><tr><td>532.67</td></tr></table> (264)	532.67
0.216							
532.67							
Space and water heating	(261) + (262) + (263) + (264) =				<table><tr><td>1607.87</td></tr></table> (265)	1607.87	
1607.87							
Electricity for pumps, fans and electric keep-hot	(231) x		<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>38.93</td></tr></table> (267)	38.93
0.519							
38.93							
Electricity for lighting	(232) x		<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>198.37</td></tr></table> (268)	198.37
0.519							
198.37							
Total CO2, kg/year	sum of (265)...(271) =				<table><tr><td>1845.17</td></tr></table> (272)	1845.17	
1845.17							

TER =

20.05

(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 27 January 2021 at 16:34:18

Project Information:

Assessed By: () **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 93.89m²

Site Reference : Swansea Road

Plot Reference: Type C (Plot 2)

Address : Type C (Plot 2)

Client Details:

Name: Helix

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.46 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.23 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 46.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 40.0 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.65 (design value)
Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Database: (rev 471, product index 017616):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Potterton
Model: Promax Ultra
Model qualifier: Combi 33 ErP (Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (South East England): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 4.88m²
 Windows facing: South East 7.47m²
 Windows facing: South East 1.44m²
 Roof windows facing: North West 0.59m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type C (Plot 2)

Address : Type C (Plot 2)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.35 (1a)	x	2.5 (2a)	=	100.87 (3a)
First floor	36.07 (1b)	x	2.7 (2b)	=	97.39 (3b)
Second floor	17.47 (1c)	x	2.54 (2c)	=	44.32 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.89 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.59 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)
 Additional infiltration [(9)-1]x0.1 = 0 (10)
 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)
 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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4.65000009536743 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.2 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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			2.12	1.2	2.544		(26)
Windows Type 1			4.88	$\times 1/[1/(1.4) + 0.04]$	6.47		(27)
Windows Type 2			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Windows Type 3			1.44	$\times 1/[1/(1.4) + 0.04]$	1.91		(27)
Rooflights			0.59	$\times 1/[1/(1.2) + 0.04]$	0.708		(27b)
Floor			40.35	0.11	4.4385	75	3026.25 (28)
Walls Type1	47.71	14.47	33.24	0.25	8.31	60	1994.4 (29)
Walls Type2	23.03	0	23.03	0.25	5.76	9	207.27 (29)
Walls Type3	3.97	1.44	2.53	0.25	0.63	9	22.77 (29)
Roof Type1	9.56	0	9.56	0.11	1.05	9	86.04 (30)
Roof Type2	4.28	0	4.28	0.15	0.64	9	38.52 (30)
Roof Type3	18.61	0	18.61	0.11	2.05	9	167.49 (30)
Roof Type4	8.33	0.59	7.74	0.15	1.16	9	69.66 (30)
Roof Type5	1.98	0	1.98	0.15	0.3	9	17.82 (30)
Total area of elements, m²			157.82				(31)
Party wall			122.47	0	0	110	13471.7 (32)
Internal wall **			175.53			9	1579.77 (32c)

DER WorkSheet: New dwelling design stage

Internal floor	53.54	18	963.72 (32d)
Internal ceiling	53.54	9	481.86 (32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = 45.84 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 22127.27 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) $\div$ (4) = 235.67 (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 : $S (L \times Y)$ calculated using Appendix K 8.92 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss (33) + (36) = 54.76 (37)

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=	40.18	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	(38)

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

(39)m=	94.94	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	
Average = Sum(39) _{1...12} / 12 =												94.8	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m $\div$ (4)

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	
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 2.68 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 97.74 (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=	107.51	103.6	99.69	95.78	91.87	87.96	87.96	91.87	95.78	99.69	103.6	107.51	
Total = Sum(44) _{1...12} =												1172.86	(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=	159.44	139.45	143.9	125.45	120.37	103.87	96.25	110.45	111.77	130.26	142.19	154.41	
Total = Sum(45) _{1...12} =												1537.81	(45)

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

(46)m=	23.92	20.92	21.58	18.82	18.06	15.58	14.44	16.57	16.77	19.54	21.33	23.16	(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:

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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)

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

(56)m=

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

(56)

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

(57)m=

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

(57)

Primary circuit loss (annual) from Table 3 (58)

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

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

(59)m=

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

(59)

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

(61)m=

21.97	19.82	21.9	21.11	21.75	20.98	21.63	21.71	21.05	21.83	21.2	21.94
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------

(61)

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

(62)m=

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(64)

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

1794.69

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

(65)m=

58.5	51.32	53.32	46.99	45.46	39.78	37.41	42.15	42.43	48.77	52.58	56.83
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77

(66)

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

(67)m=

22.47	19.95	16.23	12.29	9.18	7.75	8.38	10.89	14.62	18.56	21.66	23.09
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

246.06	248.61	242.17	228.48	211.19	194.93	184.08	181.53	187.96	201.66	218.95	235.2
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=

36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

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=

-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

78.64	76.37	71.67	65.26	61.1	55.25	50.29	56.66	58.92	65.55	73.03	76.38
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

413.29	411.06	396.2	372.15	347.6	324.07	308.87	315.2	327.63	351.89	379.76	400.8
--------	--------	-------	--------	-------	--------	--------	-------	--------	--------	--------	-------

 (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)	
Southeast 0.9x	0.77	x	7.47	x	36.79	x	0.43	x	1.11	=	91	(77)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.43	x	1.11	=	17.54	(77)
Southeast 0.9x	0.77	x	7.47	x	62.67	x	0.43	x	1.11	=	155.01	(77)
Southeast 0.9x	0.77	x	1.44	x	62.67	x	0.43	x	1.11	=	29.88	(77)
Southeast 0.9x	0.77	x	7.47	x	85.75	x	0.43	x	1.11	=	212.09	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.43	x	1.11	=	40.89	(77)
Southeast 0.9x	0.77	x	7.47	x	106.25	x	0.43	x	1.11	=	262.79	(77)
Southeast 0.9x	0.77	x	1.44	x	106.25	x	0.43	x	1.11	=	50.66	(77)
Southeast 0.9x	0.77	x	7.47	x	119.01	x	0.43	x	1.11	=	294.35	(77)
Southeast 0.9x	0.77	x	1.44	x	119.01	x	0.43	x	1.11	=	56.74	(77)
Southeast 0.9x	0.77	x	7.47	x	118.15	x	0.43	x	1.11	=	292.22	(77)
Southeast 0.9x	0.77	x	1.44	x	118.15	x	0.43	x	1.11	=	56.33	(77)
Southeast 0.9x	0.77	x	7.47	x	113.91	x	0.43	x	1.11	=	281.73	(77)
Southeast 0.9x	0.77	x	1.44	x	113.91	x	0.43	x	1.11	=	54.31	(77)
Southeast 0.9x	0.77	x	7.47	x	104.39	x	0.43	x	1.11	=	258.19	(77)
Southeast 0.9x	0.77	x	1.44	x	104.39	x	0.43	x	1.11	=	49.77	(77)
Southeast 0.9x	0.77	x	7.47	x	92.85	x	0.43	x	1.11	=	229.65	(77)
Southeast 0.9x	0.77	x	1.44	x	92.85	x	0.43	x	1.11	=	44.27	(77)
Southeast 0.9x	0.77	x	7.47	x	69.27	x	0.43	x	1.11	=	171.32	(77)
Southeast 0.9x	0.77	x	1.44	x	69.27	x	0.43	x	1.11	=	33.03	(77)
Southeast 0.9x	0.77	x	7.47	x	44.07	x	0.43	x	1.11	=	109	(77)
Southeast 0.9x	0.77	x	1.44	x	44.07	x	0.43	x	1.11	=	21.01	(77)
Southeast 0.9x	0.77	x	7.47	x	31.49	x	0.43	x	1.11	=	77.88	(77)
Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.43	x	1.11	=	15.01	(77)
Northwest 0.9x	0.77	x	4.88	x	11.28	x	0.43	x	1.11	=	18.23	(81)
Northwest 0.9x	0.77	x	4.88	x	22.97	x	0.43	x	1.11	=	37.11	(81)
Northwest 0.9x	0.77	x	4.88	x	41.38	x	0.43	x	1.11	=	66.86	(81)
Northwest 0.9x	0.77	x	4.88	x	67.96	x	0.43	x	1.11	=	109.8	(81)
Northwest 0.9x	0.77	x	4.88	x	91.35	x	0.43	x	1.11	=	147.59	(81)
Northwest 0.9x	0.77	x	4.88	x	97.38	x	0.43	x	1.11	=	157.35	(81)

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Northwest 0.9x	0.77	x	4.88	x	91.1	x	0.43	x	1.11	=	147.2	(81)
Northwest 0.9x	0.77	x	4.88	x	72.63	x	0.43	x	1.11	=	117.35	(81)
Northwest 0.9x	0.77	x	4.88	x	50.42	x	0.43	x	1.11	=	81.47	(81)
Northwest 0.9x	0.77	x	4.88	x	28.07	x	0.43	x	1.11	=	45.35	(81)
Northwest 0.9x	0.77	x	4.88	x	14.2	x	0.43	x	1.11	=	22.94	(81)
Northwest 0.9x	0.77	x	4.88	x	9.21	x	0.43	x	1.11	=	14.89	(81)
Rooflights 0.9x	1	x	0.59	x	16.37	x	0.63	x	0.7	=	3.83	(82)
Rooflights 0.9x	1	x	0.59	x	33.68	x	0.63	x	0.7	=	7.89	(82)
Rooflights 0.9x	1	x	0.59	x	62.13	x	0.63	x	0.7	=	14.55	(82)
Rooflights 0.9x	1	x	0.59	x	104.87	x	0.63	x	0.7	=	24.56	(82)
Rooflights 0.9x	1	x	0.59	x	143.66	x	0.63	x	0.7	=	33.64	(82)
Rooflights 0.9x	1	x	0.59	x	154.33	x	0.63	x	0.7	=	36.14	(82)
Rooflights 0.9x	1	x	0.59	x	143.9	x	0.63	x	0.7	=	33.7	(82)
Rooflights 0.9x	1	x	0.59	x	113.05	x	0.63	x	0.7	=	26.47	(82)
Rooflights 0.9x	1	x	0.59	x	76.56	x	0.63	x	0.7	=	17.93	(82)
Rooflights 0.9x	1	x	0.59	x	41.49	x	0.63	x	0.7	=	9.72	(82)
Rooflights 0.9x	1	x	0.59	x	20.65	x	0.63	x	0.7	=	4.83	(82)
Rooflights 0.9x	1	x	0.59	x	13.34	x	0.63	x	0.7	=	3.12	(82)

Solar gains in watts, calculated for each month

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

(83)m=	130.61	229.89	334.39	447.81	532.33	542.05	516.94	451.78	373.32	259.41	157.79	110.9	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	543.89	640.95	730.58	819.97	879.93	866.12	825.81	766.98	700.95	611.31	537.55	511.7	(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	0.99	0.98	0.95	0.84	0.67	0.5	0.56	0.81	0.97	0.99	1	

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

(87)m=	19.88	20.04	20.29	20.6	20.85	20.97	20.99	20.99	20.91	20.58	20.16	19.84	(87)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.07	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	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	0.93	0.8	0.58	0.4	0.45	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=	18.57	18.81	19.17	19.6	19.93	20.05	20.07	20.07	20	19.58	18.98	18.51	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	----	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.14 (91)

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

(92)m=	18.76	18.99	19.33	19.75	20.06	20.18	20.21	20.2	20.13	19.72	19.15	18.7	(92)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------	------

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

(93)m=	18.61	18.84	19.18	19.6	19.91	20.03	20.06	20.05	19.98	19.57	19	18.55	(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
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.92	0.79	0.58	0.39	0.45	0.73	0.94	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	541.37	633.86	709.46	751.41	691.58	501.46	326.08	343.47	513.38	577.47	532.05	509.94	(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=	1358.26	1321.05	1202.27	1013.99	778.17	515.1	327.52	346.24	557.45	850.48	1127.68	1360.02	(97)
--------	---------	---------	---------	---------	--------	-------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	607.77	461.79	366.65	189.05	64.42	0	0	0	0	203.12	428.85	632.46	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2954.11 (98)

Space heating requirement in kWh/m²/year

31.46 (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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

90 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

607.77	461.79	366.65	189.05	64.42	0	0	0	0	203.12	428.85	632.46
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

675.3	513.1	407.39	210.06	71.58	0	0	0	0	225.69	476.5	702.73
-------	-------	--------	--------	-------	---	---	---	---	--------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 3282.35 (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)

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

86.7 (216)

(217)m=	89.22	89.13	88.95	88.53	87.7	86.7	86.7	86.7	86.7	88.56	89.06	89.26	(217)
---------	-------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.32	178.69	186.4	165.55	162.05	144	135.97	152.43	153.19	171.75	183.45	197.57
---------	--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} = 2034.37 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3282.35

Water heating fuel used

2034.37

Electricity for pumps, fans and electric keep-hot

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mechanical ventilation - balanced, extract or positive input from outside		70.61	(230a)
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	145.61	(231)
Electricity for lighting		396.75	(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	=	708.99	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	439.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1148.41	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	75.57	(267)
Electricity for lighting	(232) x	0.519	=	205.91	(268)
Total CO2, kg/year			sum of (265)...(271) =	1429.89	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =	15.23	(273)
El rating (section 14)				86	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type C (Plot 2)

Address : Type C (Plot 2)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.35 (1a)	x	2.5 (2a)	=	100.87 (3a)
First floor	36.07 (1b)	x	2.7 (2b)	=	97.39 (3b)
Second floor	17.47 (1c)	x	2.54 (2c)	=	44.32 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.89 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.59 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 ÷ (5) = 0.12 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

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)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.32 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

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

	0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
--	-----	-----	------	------	------	-----	-----	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

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

(24c)

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

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

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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(24d)

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
--------	------	------	------	------	------	------	------	------	------	------	------	------

(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			2.12	1.2	2.544		(26)
Windows Type 1			4.88	$\times 1/[1/(1.4) + 0.04]$	6.47		(27)
Windows Type 2			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Windows Type 3			1.44	$\times 1/[1/(1.4) + 0.04]$	1.91		(27)
Rooflights			0.59	$\times 1/[1/(1.7) + 0.04]$	1.003		(27b)
Floor			40.35	0.13	5.2455		(28)
Walls Type1	47.71	14.47	33.24	0.18	5.98		(29)
Walls Type2	23.03	0	23.03	0.18	4.15		(29)
Walls Type3	3.97	1.44	2.53	0.18	0.46		(29)
Roof Type1	9.56	0	9.56	0.13	1.24		(30)
Roof Type2	4.28	0	4.28	0.13	0.56		(30)
Roof Type3	18.61	0	18.61	0.13	2.42		(30)
Roof Type4	8.33	0.59	7.74	0.13	1.01		(30)
Roof Type5	1.98	0	1.98	0.13	0.26		(30)
Total area of elements, m²			157.82				(31)
Party wall			122.47	0	0		(32)
Internal wall **			175.53				(32c)

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Internal floor	53.54		(32d)
Internal ceiling	53.54		(32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = 43.08 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 22127.27 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) 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 : $S (L \times Y)$ calculated using Appendix K 10.17 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss (33) + (36) = 53.25 (37)

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=	46.59	46.34	46.09	44.91	44.69	43.67	43.67	43.48	44.06	44.69	45.14	45.6	(38)

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

(39)m=	99.84	99.58	99.33	98.16	97.94	96.92	96.92	96.73	97.31	97.94	98.38	98.85	
	Average = $\text{Sum}(39)_{1...12} / 12 =$												98.16 (39)

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

(40)m=	1.06	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	
	Average = $\text{Sum}(40)_{1...12} / 12 =$												1.05 (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 2.68 (42)

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if $TFA \leq 13.9$, $N = 1$

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$ 97.74 (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=	107.51	103.6	99.69	95.78	91.87	87.96	87.96	91.87	95.78	99.69	103.6	107.51	
	Total = $\text{Sum}(44)_{1...12} =$												1172.86 (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=	159.44	139.45	143.9	125.45	120.37	103.87	96.25	110.45	111.77	130.26	142.19	154.41	
	Total = $\text{Sum}(45)_{1...12} =$												1537.81 (45)

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

(46)m=	23.92	20.92	21.58	18.82	18.06	15.58	14.44	16.57	16.77	19.54	21.33	23.16	(46)
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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:

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a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0 (55)

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

(56)m=

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

 (56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
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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 x (41)m

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (59)

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

(61)m=

50.96	46.03	50.8	47.24	46.82	43.38	44.83	46.82	47.24	50.8	49.32	50.96
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 (61)

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

(62)m=

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
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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=

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
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Output from water heater (annual)_{1...12} 2112.99 (64)

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

(65)m=

65.75	57.87	60.55	53.52	51.73	45.38	43.21	48.43	48.97	56.01	59.61	64.08
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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
133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77

 (66)

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

(67)m=

22.47	19.95	16.23	12.29	9.18	7.75	8.38	10.89	14.62	18.56	21.66	23.09
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 (67)

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

(68)m=

246.06	248.61	242.17	228.48	211.19	194.93	184.08	181.53	187.96	201.66	218.95	235.2
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (68)

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

(69)m=

36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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 (70)

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

(71)m=

-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

88.38	86.12	81.38	74.34	69.53	63.03	58.08	65.09	68.02	75.28	82.79	86.13
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 (72)

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

(73)m=

423.03	420.81	405.91	381.23	356.03	331.85	316.66	323.64	336.72	361.63	389.52	410.55
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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)	
Southeast 0.9x	0.77	x	7.47	x	36.79	x	0.63	x	0.7	=	84	(77)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.63	x	0.7	=	16.19	(77)
Southeast 0.9x	0.77	x	7.47	x	62.67	x	0.63	x	0.7	=	143.08	(77)
Southeast 0.9x	0.77	x	1.44	x	62.67	x	0.63	x	0.7	=	27.58	(77)
Southeast 0.9x	0.77	x	7.47	x	85.75	x	0.63	x	0.7	=	195.77	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.63	x	0.7	=	37.74	(77)
Southeast 0.9x	0.77	x	7.47	x	106.25	x	0.63	x	0.7	=	242.56	(77)
Southeast 0.9x	0.77	x	1.44	x	106.25	x	0.63	x	0.7	=	46.76	(77)
Southeast 0.9x	0.77	x	7.47	x	119.01	x	0.63	x	0.7	=	271.69	(77)
Southeast 0.9x	0.77	x	1.44	x	119.01	x	0.63	x	0.7	=	52.37	(77)
Southeast 0.9x	0.77	x	7.47	x	118.15	x	0.63	x	0.7	=	269.73	(77)
Southeast 0.9x	0.77	x	1.44	x	118.15	x	0.63	x	0.7	=	52	(77)
Southeast 0.9x	0.77	x	7.47	x	113.91	x	0.63	x	0.7	=	260.05	(77)
Southeast 0.9x	0.77	x	1.44	x	113.91	x	0.63	x	0.7	=	50.13	(77)
Southeast 0.9x	0.77	x	7.47	x	104.39	x	0.63	x	0.7	=	238.32	(77)
Southeast 0.9x	0.77	x	1.44	x	104.39	x	0.63	x	0.7	=	45.94	(77)
Southeast 0.9x	0.77	x	7.47	x	92.85	x	0.63	x	0.7	=	211.97	(77)
Southeast 0.9x	0.77	x	1.44	x	92.85	x	0.63	x	0.7	=	40.86	(77)
Southeast 0.9x	0.77	x	7.47	x	69.27	x	0.63	x	0.7	=	158.13	(77)
Southeast 0.9x	0.77	x	1.44	x	69.27	x	0.63	x	0.7	=	30.48	(77)
Southeast 0.9x	0.77	x	7.47	x	44.07	x	0.63	x	0.7	=	100.61	(77)
Southeast 0.9x	0.77	x	1.44	x	44.07	x	0.63	x	0.7	=	19.39	(77)
Southeast 0.9x	0.77	x	7.47	x	31.49	x	0.63	x	0.7	=	71.88	(77)
Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.63	x	0.7	=	13.86	(77)
Northwest 0.9x	0.77	x	4.88	x	11.28	x	0.63	x	0.7	=	16.83	(81)
Northwest 0.9x	0.77	x	4.88	x	22.97	x	0.63	x	0.7	=	34.25	(81)
Northwest 0.9x	0.77	x	4.88	x	41.38	x	0.63	x	0.7	=	61.71	(81)
Northwest 0.9x	0.77	x	4.88	x	67.96	x	0.63	x	0.7	=	101.35	(81)
Northwest 0.9x	0.77	x	4.88	x	91.35	x	0.63	x	0.7	=	136.23	(81)
Northwest 0.9x	0.77	x	4.88	x	97.38	x	0.63	x	0.7	=	145.24	(81)

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Northwest 0.9x	0.77	x	4.88	x	91.1	x	0.63	x	0.7	=	135.87	(81)
Northwest 0.9x	0.77	x	4.88	x	72.63	x	0.63	x	0.7	=	108.32	(81)
Northwest 0.9x	0.77	x	4.88	x	50.42	x	0.63	x	0.7	=	75.2	(81)
Northwest 0.9x	0.77	x	4.88	x	28.07	x	0.63	x	0.7	=	41.86	(81)
Northwest 0.9x	0.77	x	4.88	x	14.2	x	0.63	x	0.7	=	21.17	(81)
Northwest 0.9x	0.77	x	4.88	x	9.21	x	0.63	x	0.7	=	13.74	(81)
Rooflights 0.9x	1	x	0.59	x	16.37	x	0.63	x	0.7	=	3.83	(82)
Rooflights 0.9x	1	x	0.59	x	33.68	x	0.63	x	0.7	=	7.89	(82)
Rooflights 0.9x	1	x	0.59	x	62.13	x	0.63	x	0.7	=	14.55	(82)
Rooflights 0.9x	1	x	0.59	x	104.87	x	0.63	x	0.7	=	24.56	(82)
Rooflights 0.9x	1	x	0.59	x	143.66	x	0.63	x	0.7	=	33.64	(82)
Rooflights 0.9x	1	x	0.59	x	154.33	x	0.63	x	0.7	=	36.14	(82)
Rooflights 0.9x	1	x	0.59	x	143.9	x	0.63	x	0.7	=	33.7	(82)
Rooflights 0.9x	1	x	0.59	x	113.05	x	0.63	x	0.7	=	26.47	(82)
Rooflights 0.9x	1	x	0.59	x	76.56	x	0.63	x	0.7	=	17.93	(82)
Rooflights 0.9x	1	x	0.59	x	41.49	x	0.63	x	0.7	=	9.72	(82)
Rooflights 0.9x	1	x	0.59	x	20.65	x	0.63	x	0.7	=	4.83	(82)
Rooflights 0.9x	1	x	0.59	x	13.34	x	0.63	x	0.7	=	3.12	(82)

Solar gains in watts, calculated for each month

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

(83)m=	120.85	212.8	309.77	415.23	493.94	503.1	479.74	419.04	345.96	240.19	146.01	102.61	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	543.88	633.61	715.68	796.46	849.97	834.95	796.41	742.68	682.68	601.82	535.54	513.15	(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	1	0.99	0.96	0.87	0.7	0.53	0.58	0.84	0.98	1	1	(86)

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

(87)m=	19.86	20.01	20.25	20.57	20.83	20.96	20.99	20.99	20.9	20.56	20.15	19.83	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(88)m=	20.03	20.03	20.04	20.05	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.94	0.83	0.61	0.42	0.47	0.77	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=	18.5	18.73	19.08	19.53	19.88	20.03	20.05	20.05	19.97	19.53	18.94	18.47	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.14 (91)

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

(92)m=	18.7	18.91	19.25	19.68	20.01	20.17	20.19	20.19	20.1	19.68	19.11	18.66	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(93)m=	18.7	18.91	19.25	19.68	20.01	20.17	20.19	20.19	20.1	19.68	19.11	18.66	(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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TER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.83	0.62	0.43	0.49	0.77	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	542.01	628.57	700.81	746.3	702.07	520.92	345.75	362.53	527.63	576.5	531.49	511.85	(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=	1437.26	1395.34	1266.49	1058.49	814.26	539.39	347.85	366.4	584.33	889.27	1181.8	1429.78	(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=	666.06	515.27	420.86	224.78	83.47	0	0	0	0	232.7	468.22	682.94	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------	------

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

3294.31 (98)

Space heating requirement in kWh/m²/year

35.09 (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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

666.06	515.27	420.86	224.78	83.47	0	0	0	0	232.7	468.22	682.94	
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------	--

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

713.13	551.68	450.6	240.66	89.37	0	0	0	0	249.15	501.31	731.2	
--------	--------	-------	--------	-------	---	---	---	---	--------	--------	-------	--

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

3527.1 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

0 (215)

Water heating

Output from water heater (calculated above)

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37	
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Efficiency of water heater

80.3 (216)

(217)m=	87.75	87.49	86.94	85.72	83.4	80.3	80.3	80.3	80.3	85.68	87.22	87.85	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.77	212	223.94	201.46	200.46	183.38	175.69	195.85	198.02	211.31	219.57	233.78	(219)
---------	--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

2495.24 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3527.1

Water heating fuel used

2495.24

Electricity for pumps, fans and electric keep-hot

TER WorkSheet: New dwelling design stage

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		396.75	(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	761.85 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	538.97 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1300.83 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	205.91 (268)
Total CO2, kg/year	sum of (265)...(271) =		1545.66 (272)

TER =

16.46 (273)

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 27 January 2021 at 16:34:18

Project Information:

Assessed By: () **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 93.89m²

Site Reference : Swansea Road

Plot Reference: Type C (Plot 3)

Address : Type C (Plot 3)

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.46 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.23 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 46.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 40.0 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.65 (design value)

Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Database: (rev 471, product index 017616):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Potterton
Model: Promax Ultra
Model qualifier: Combi 33 ErP (Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (South East England): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 4.88m²
 Windows facing: South East 7.47m²
 Windows facing: South East 1.44m²
 Roof windows facing: North West 0.59m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type C (Plot 3)

Address : Type C (Plot 3)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.35 (1a)	x	2.5 (2a)	=	100.87 (3a)
First floor	36.07 (1b)	x	2.7 (2b)	=	97.39 (3b)
Second floor	17.47 (1c)	x	2.54 (2c)	=	44.32 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.89 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.59 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration	[(9)-1]x0.1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4.65000009536743 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.2 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
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(24c)

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
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(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	1.2	2.544		(26)
Windows Type 1			4.88	$\times 1/[1/(1.4) + 0.04]$	6.47		(27)
Windows Type 2			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Windows Type 3			1.44	$\times 1/[1/(1.4) + 0.04]$	1.91		(27)
Rooflights			0.59	$\times 1/[1/(1.2) + 0.04]$	0.708		(27b)
Floor			40.35	0.11	4.4385	75	3026.25 (28)
Walls Type1	47.71	14.47	33.24	0.25	8.31	60	1994.4 (29)
Walls Type2	23.03	0	23.03	0.25	5.76	9	207.27 (29)
Walls Type3	3.97	1.44	2.53	0.25	0.63	9	22.77 (29)
Roof Type1	9.56	0	9.56	0.11	1.05	9	86.04 (30)
Roof Type2	4.28	0	4.28	0.15	0.64	9	38.52 (30)
Roof Type3	18.61	0	18.61	0.11	2.05	9	167.49 (30)
Roof Type4	8.33	0.59	7.74	0.15	1.16	9	69.66 (30)
Roof Type5	1.98	0	1.98	0.15	0.3	9	17.82 (30)
Total area of elements, m²			157.82				(31)
Party wall			122.47	0	0	110	13471.7 (32)
Internal wall **			175.53			9	1579.77 (32c)

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Internal floor	53.54	18	963.72 (32d)
Internal ceiling	53.54	9	481.86 (32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = 45.84 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 22127.27 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) ÷ (4) = 235.67 (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 : $S (L \times Y)$ calculated using Appendix K 8.92 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss (33) + (36) = 54.76 (37)

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=	40.18	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	(38)

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

(39)m=	94.94	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	
Average = Sum(39) _{1...12} / 12 =												94.8	(39)

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

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	
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 2.68 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 97.74 (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=	107.51	103.6	99.69	95.78	91.87	87.96	87.96	91.87	95.78	99.69	103.6	107.51	
Total = Sum(44) _{1...12} =												1172.86	(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=	159.44	139.45	143.9	125.45	120.37	103.87	96.25	110.45	111.77	130.26	142.19	154.41	
Total = Sum(45) _{1...12} =												1537.81	(45)

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

(46)m=	23.92	20.92	21.58	18.82	18.06	15.58	14.44	16.57	16.77	19.54	21.33	23.16	(46)
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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:

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a) If manufacturer's declared loss factor is known (kWh/day): (48)

0

Temperature factor from Table 2b (49)

0

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

0

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

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

0

If community heating see section 4.3

Volume factor from Table 2a (52)

0

Temperature factor from Table 2b (53)

0

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

0

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

0

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

(56)m=

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

(56)

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
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(57)

Primary circuit loss (annual) from Table 3 (58)

0

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

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

(59)m=

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

(59)

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

(61)m=

21.97	19.82	21.9	21.11	21.75	20.98	21.63	21.71	21.05	21.83	21.2	21.94
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------

(61)

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

(62)m=

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(64)

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

1794.69

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

(65)m=

58.5	51.32	53.32	46.99	45.46	39.78	37.41	42.15	42.43	48.77	52.58	56.83
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77

(66)

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

(67)m=

22.47	19.95	16.23	12.29	9.18	7.75	8.38	10.89	14.62	18.56	21.66	23.09
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

246.06	248.61	242.17	228.48	211.19	194.93	184.08	181.53	187.96	201.66	218.95	235.2
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=

36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

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

(70)

DER WorkSheet: New dwelling design stage

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

(71)m=

-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

78.64	76.37	71.67	65.26	61.1	55.25	50.29	56.66	58.92	65.55	73.03	76.38
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

413.29	411.06	396.2	372.15	347.6	324.07	308.87	315.2	327.63	351.89	379.76	400.8
--------	--------	-------	--------	-------	--------	--------	-------	--------	--------	--------	-------

 (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)	
Southeast 0.9x	0.77	x	7.47	x	36.79	x	0.43	x	1.11	=	91	(77)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.43	x	1.11	=	17.54	(77)
Southeast 0.9x	0.77	x	7.47	x	62.67	x	0.43	x	1.11	=	155.01	(77)
Southeast 0.9x	0.77	x	1.44	x	62.67	x	0.43	x	1.11	=	29.88	(77)
Southeast 0.9x	0.77	x	7.47	x	85.75	x	0.43	x	1.11	=	212.09	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.43	x	1.11	=	40.89	(77)
Southeast 0.9x	0.77	x	7.47	x	106.25	x	0.43	x	1.11	=	262.79	(77)
Southeast 0.9x	0.77	x	1.44	x	106.25	x	0.43	x	1.11	=	50.66	(77)
Southeast 0.9x	0.77	x	7.47	x	119.01	x	0.43	x	1.11	=	294.35	(77)
Southeast 0.9x	0.77	x	1.44	x	119.01	x	0.43	x	1.11	=	56.74	(77)
Southeast 0.9x	0.77	x	7.47	x	118.15	x	0.43	x	1.11	=	292.22	(77)
Southeast 0.9x	0.77	x	1.44	x	118.15	x	0.43	x	1.11	=	56.33	(77)
Southeast 0.9x	0.77	x	7.47	x	113.91	x	0.43	x	1.11	=	281.73	(77)
Southeast 0.9x	0.77	x	1.44	x	113.91	x	0.43	x	1.11	=	54.31	(77)
Southeast 0.9x	0.77	x	7.47	x	104.39	x	0.43	x	1.11	=	258.19	(77)
Southeast 0.9x	0.77	x	1.44	x	104.39	x	0.43	x	1.11	=	49.77	(77)
Southeast 0.9x	0.77	x	7.47	x	92.85	x	0.43	x	1.11	=	229.65	(77)
Southeast 0.9x	0.77	x	1.44	x	92.85	x	0.43	x	1.11	=	44.27	(77)
Southeast 0.9x	0.77	x	7.47	x	69.27	x	0.43	x	1.11	=	171.32	(77)
Southeast 0.9x	0.77	x	1.44	x	69.27	x	0.43	x	1.11	=	33.03	(77)
Southeast 0.9x	0.77	x	7.47	x	44.07	x	0.43	x	1.11	=	109	(77)
Southeast 0.9x	0.77	x	1.44	x	44.07	x	0.43	x	1.11	=	21.01	(77)
Southeast 0.9x	0.77	x	7.47	x	31.49	x	0.43	x	1.11	=	77.88	(77)
Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.43	x	1.11	=	15.01	(77)
Northwest 0.9x	0.77	x	4.88	x	11.28	x	0.43	x	1.11	=	18.23	(81)
Northwest 0.9x	0.77	x	4.88	x	22.97	x	0.43	x	1.11	=	37.11	(81)
Northwest 0.9x	0.77	x	4.88	x	41.38	x	0.43	x	1.11	=	66.86	(81)
Northwest 0.9x	0.77	x	4.88	x	67.96	x	0.43	x	1.11	=	109.8	(81)
Northwest 0.9x	0.77	x	4.88	x	91.35	x	0.43	x	1.11	=	147.59	(81)
Northwest 0.9x	0.77	x	4.88	x	97.38	x	0.43	x	1.11	=	157.35	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	4.88	x	91.1	x	0.43	x	1.11	=	147.2	(81)
Northwest 0.9x	0.77	x	4.88	x	72.63	x	0.43	x	1.11	=	117.35	(81)
Northwest 0.9x	0.77	x	4.88	x	50.42	x	0.43	x	1.11	=	81.47	(81)
Northwest 0.9x	0.77	x	4.88	x	28.07	x	0.43	x	1.11	=	45.35	(81)
Northwest 0.9x	0.77	x	4.88	x	14.2	x	0.43	x	1.11	=	22.94	(81)
Northwest 0.9x	0.77	x	4.88	x	9.21	x	0.43	x	1.11	=	14.89	(81)
Rooflights 0.9x	1	x	0.59	x	16.37	x	0.63	x	0.7	=	3.83	(82)
Rooflights 0.9x	1	x	0.59	x	33.68	x	0.63	x	0.7	=	7.89	(82)
Rooflights 0.9x	1	x	0.59	x	62.13	x	0.63	x	0.7	=	14.55	(82)
Rooflights 0.9x	1	x	0.59	x	104.87	x	0.63	x	0.7	=	24.56	(82)
Rooflights 0.9x	1	x	0.59	x	143.66	x	0.63	x	0.7	=	33.64	(82)
Rooflights 0.9x	1	x	0.59	x	154.33	x	0.63	x	0.7	=	36.14	(82)
Rooflights 0.9x	1	x	0.59	x	143.9	x	0.63	x	0.7	=	33.7	(82)
Rooflights 0.9x	1	x	0.59	x	113.05	x	0.63	x	0.7	=	26.47	(82)
Rooflights 0.9x	1	x	0.59	x	76.56	x	0.63	x	0.7	=	17.93	(82)
Rooflights 0.9x	1	x	0.59	x	41.49	x	0.63	x	0.7	=	9.72	(82)
Rooflights 0.9x	1	x	0.59	x	20.65	x	0.63	x	0.7	=	4.83	(82)
Rooflights 0.9x	1	x	0.59	x	13.34	x	0.63	x	0.7	=	3.12	(82)

Solar gains in watts, calculated for each month

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

(83)m=	130.61	229.89	334.39	447.81	532.33	542.05	516.94	451.78	373.32	259.41	157.79	110.9	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	543.89	640.95	730.58	819.97	879.93	866.12	825.81	766.98	700.95	611.31	537.55	511.7	(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	0.99	0.98	0.95	0.84	0.67	0.5	0.56	0.81	0.97	0.99	1	

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

(87)m=	19.88	20.04	20.29	20.6	20.85	20.97	20.99	20.99	20.91	20.58	20.16	19.84	(87)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.07	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	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	0.93	0.8	0.58	0.4	0.45	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=	18.57	18.81	19.17	19.6	19.93	20.05	20.07	20.07	20	19.58	18.98	18.51	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	----	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.14 (91)

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

(92)m=	18.76	18.99	19.33	19.75	20.06	20.18	20.21	20.2	20.13	19.72	19.15	18.7	(92)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------	------

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

(93)m=	18.61	18.84	19.18	19.6	19.91	20.03	20.06	20.05	19.98	19.57	19	18.55	(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	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.92	0.79	0.58	0.39	0.45	0.73	0.94	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	541.37	633.86	709.46	751.41	691.58	501.46	326.08	343.47	513.38	577.47	532.05	509.94	(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=	1358.26	1321.05	1202.27	1013.99	778.17	515.1	327.52	346.24	557.45	850.48	1127.68	1360.02	(97)
--------	---------	---------	---------	---------	--------	-------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	607.77	461.79	366.65	189.05	64.42	0	0	0	0	203.12	428.85	632.46	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2954.11 (98)

Space heating requirement in kWh/m²/year

31.46 (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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

90 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

607.77	461.79	366.65	189.05	64.42	0	0	0	0	203.12	428.85	632.46
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

675.3	513.1	407.39	210.06	71.58	0	0	0	0	225.69	476.5	702.73
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Total (kWh/year) =Sum(211)_{1...5,10...12} = 3282.35 (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)

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

86.7 (216)

(217)m=	89.22	89.13	88.95	88.53	87.7	86.7	86.7	86.7	86.7	88.56	89.06	89.26	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.32	178.69	186.4	165.55	162.05	144	135.97	152.43	153.19	171.75	183.45	197.57
---------	--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} = 2034.37 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3282.35

Water heating fuel used

2034.37

Electricity for pumps, fans and electric keep-hot

DER WorkSheet: New dwelling design stage

mechanical ventilation - balanced, extract or positive input from outside		70.61	(230a)
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	145.61	(231)
Electricity for lighting		396.75	(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	=	708.99	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	439.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1148.41	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	75.57	(267)
Electricity for lighting	(232) x	0.519	=	205.91	(268)
Total CO2, kg/year			sum of (265)...(271) =	1429.89	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =	15.23	(273)
El rating (section 14)				86	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type C (Plot 3)

Address : Type C (Plot 3)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.35 (1a)	x	2.5 (2a)	=	100.87 (3a)
First floor	36.07 (1b)	x	2.7 (2b)	=	97.39 (3b)
Second floor	17.47 (1c)	x	2.54 (2c)	=	44.32 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.89 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.59 (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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 ÷ (5) = 0.12 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

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)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

	0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

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

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

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

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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(24d)

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1.2	= 2.544		(26)
Windows Type 1			4.88	x 1/[1/(1.4) + 0.04]	= 6.47		(27)
Windows Type 2			7.47	x 1/[1/(1.4) + 0.04]	= 9.9		(27)
Windows Type 3			1.44	x 1/[1/(1.4) + 0.04]	= 1.91		(27)
Rooflights			0.59	x 1/[1/(1.7) + 0.04]	= 1.003		(27b)
Floor			40.35	x 0.13	= 5.2455		(28)
Walls Type1	47.71	14.47	33.24	x 0.18	= 5.98		(29)
Walls Type2	23.03	0	23.03	x 0.18	= 4.15		(29)
Walls Type3	3.97	1.44	2.53	x 0.18	= 0.46		(29)
Roof Type1	9.56	0	9.56	x 0.13	= 1.24		(30)
Roof Type2	4.28	0	4.28	x 0.13	= 0.56		(30)
Roof Type3	18.61	0	18.61	x 0.13	= 2.42		(30)
Roof Type4	8.33	0.59	7.74	x 0.13	= 1.01		(30)
Roof Type5	1.98	0	1.98	x 0.13	= 0.26		(30)
Total area of elements, m²			157.82				(31)
Party wall			122.47	x 0	= 0		(32)
Internal wall **			175.53				(32c)

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Internal floor	53.54		(32d)
Internal ceiling	53.54		(32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = 43.08 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 22127.27 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) 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 : $S (L \times Y)$ calculated using Appendix K 10.17 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss (33) + (36) = 53.25 (37)

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=	46.59	46.34	46.09	44.91	44.69	43.67	43.67	43.48	44.06	44.69	45.14	45.6	(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=	99.84	99.58	99.33	98.16	97.94	96.92	96.92	96.73	97.31	97.94	98.38	98.85	
Average = $\text{Sum}(39)_{1...12} / 12 =$												98.16	(39)

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

	1.06	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	
(40)m=	1.06	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	
Average = $\text{Sum}(40)_{1...12} / 12 =$												1.05	(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 2.68 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$ 97.74 (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=	107.51	103.6	99.69	95.78	91.87	87.96	87.96	91.87	95.78	99.69	103.6	107.51	
Total = $\text{Sum}(44)_{1...12} =$												1172.86	(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)

	159.44	139.45	143.9	125.45	120.37	103.87	96.25	110.45	111.77	130.26	142.19	154.41	
(45)m=	159.44	139.45	143.9	125.45	120.37	103.87	96.25	110.45	111.77	130.26	142.19	154.41	
Total = $\text{Sum}(45)_{1...12} =$												1537.81	(45)

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

	23.92	20.92	21.58	18.82	18.06	15.58	14.44	16.57	16.77	19.54	21.33	23.16	
(46)m=	23.92	20.92	21.58	18.82	18.06	15.58	14.44	16.57	16.77	19.54	21.33	23.16	(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:

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a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0 (55)

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

(56)m=

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

 (56)

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

(57)m=

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

 (57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=

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

 (59)

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

(61)m=

50.96	46.03	50.8	47.24	46.82	43.38	44.83	46.82	47.24	50.8	49.32	50.96
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 (61)

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

(62)m=

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (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=

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual)_{1...12} 2112.99 (64)

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

(65)m=

65.75	57.87	60.55	53.52	51.73	45.38	43.21	48.43	48.97	56.01	59.61	64.08
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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
133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77

 (66)

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

(67)m=

22.47	19.95	16.23	12.29	9.18	7.75	8.38	10.89	14.62	18.56	21.66	23.09
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

246.06	248.61	242.17	228.48	211.19	194.93	184.08	181.53	187.96	201.66	218.95	235.2
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (68)

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

(69)m=

36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

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=

-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

88.38	86.12	81.38	74.34	69.53	63.03	58.08	65.09	68.02	75.28	82.79	86.13
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

423.03	420.81	405.91	381.23	356.03	331.85	316.66	323.64	336.72	361.63	389.52	410.55
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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)	
Southeast 0.9x	0.77	x	7.47	x	36.79	x	0.63	x	0.7	=	84	(77)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.63	x	0.7	=	16.19	(77)
Southeast 0.9x	0.77	x	7.47	x	62.67	x	0.63	x	0.7	=	143.08	(77)
Southeast 0.9x	0.77	x	1.44	x	62.67	x	0.63	x	0.7	=	27.58	(77)
Southeast 0.9x	0.77	x	7.47	x	85.75	x	0.63	x	0.7	=	195.77	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.63	x	0.7	=	37.74	(77)
Southeast 0.9x	0.77	x	7.47	x	106.25	x	0.63	x	0.7	=	242.56	(77)
Southeast 0.9x	0.77	x	1.44	x	106.25	x	0.63	x	0.7	=	46.76	(77)
Southeast 0.9x	0.77	x	7.47	x	119.01	x	0.63	x	0.7	=	271.69	(77)
Southeast 0.9x	0.77	x	1.44	x	119.01	x	0.63	x	0.7	=	52.37	(77)
Southeast 0.9x	0.77	x	7.47	x	118.15	x	0.63	x	0.7	=	269.73	(77)
Southeast 0.9x	0.77	x	1.44	x	118.15	x	0.63	x	0.7	=	52	(77)
Southeast 0.9x	0.77	x	7.47	x	113.91	x	0.63	x	0.7	=	260.05	(77)
Southeast 0.9x	0.77	x	1.44	x	113.91	x	0.63	x	0.7	=	50.13	(77)
Southeast 0.9x	0.77	x	7.47	x	104.39	x	0.63	x	0.7	=	238.32	(77)
Southeast 0.9x	0.77	x	1.44	x	104.39	x	0.63	x	0.7	=	45.94	(77)
Southeast 0.9x	0.77	x	7.47	x	92.85	x	0.63	x	0.7	=	211.97	(77)
Southeast 0.9x	0.77	x	1.44	x	92.85	x	0.63	x	0.7	=	40.86	(77)
Southeast 0.9x	0.77	x	7.47	x	69.27	x	0.63	x	0.7	=	158.13	(77)
Southeast 0.9x	0.77	x	1.44	x	69.27	x	0.63	x	0.7	=	30.48	(77)
Southeast 0.9x	0.77	x	7.47	x	44.07	x	0.63	x	0.7	=	100.61	(77)
Southeast 0.9x	0.77	x	1.44	x	44.07	x	0.63	x	0.7	=	19.39	(77)
Southeast 0.9x	0.77	x	7.47	x	31.49	x	0.63	x	0.7	=	71.88	(77)
Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.63	x	0.7	=	13.86	(77)
Northwest 0.9x	0.77	x	4.88	x	11.28	x	0.63	x	0.7	=	16.83	(81)
Northwest 0.9x	0.77	x	4.88	x	22.97	x	0.63	x	0.7	=	34.25	(81)
Northwest 0.9x	0.77	x	4.88	x	41.38	x	0.63	x	0.7	=	61.71	(81)
Northwest 0.9x	0.77	x	4.88	x	67.96	x	0.63	x	0.7	=	101.35	(81)
Northwest 0.9x	0.77	x	4.88	x	91.35	x	0.63	x	0.7	=	136.23	(81)
Northwest 0.9x	0.77	x	4.88	x	97.38	x	0.63	x	0.7	=	145.24	(81)

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Northwest 0.9x	0.77	x	4.88	x	91.1	x	0.63	x	0.7	=	135.87	(81)
Northwest 0.9x	0.77	x	4.88	x	72.63	x	0.63	x	0.7	=	108.32	(81)
Northwest 0.9x	0.77	x	4.88	x	50.42	x	0.63	x	0.7	=	75.2	(81)
Northwest 0.9x	0.77	x	4.88	x	28.07	x	0.63	x	0.7	=	41.86	(81)
Northwest 0.9x	0.77	x	4.88	x	14.2	x	0.63	x	0.7	=	21.17	(81)
Northwest 0.9x	0.77	x	4.88	x	9.21	x	0.63	x	0.7	=	13.74	(81)
Rooflights 0.9x	1	x	0.59	x	16.37	x	0.63	x	0.7	=	3.83	(82)
Rooflights 0.9x	1	x	0.59	x	33.68	x	0.63	x	0.7	=	7.89	(82)
Rooflights 0.9x	1	x	0.59	x	62.13	x	0.63	x	0.7	=	14.55	(82)
Rooflights 0.9x	1	x	0.59	x	104.87	x	0.63	x	0.7	=	24.56	(82)
Rooflights 0.9x	1	x	0.59	x	143.66	x	0.63	x	0.7	=	33.64	(82)
Rooflights 0.9x	1	x	0.59	x	154.33	x	0.63	x	0.7	=	36.14	(82)
Rooflights 0.9x	1	x	0.59	x	143.9	x	0.63	x	0.7	=	33.7	(82)
Rooflights 0.9x	1	x	0.59	x	113.05	x	0.63	x	0.7	=	26.47	(82)
Rooflights 0.9x	1	x	0.59	x	76.56	x	0.63	x	0.7	=	17.93	(82)
Rooflights 0.9x	1	x	0.59	x	41.49	x	0.63	x	0.7	=	9.72	(82)
Rooflights 0.9x	1	x	0.59	x	20.65	x	0.63	x	0.7	=	4.83	(82)
Rooflights 0.9x	1	x	0.59	x	13.34	x	0.63	x	0.7	=	3.12	(82)

Solar gains in watts, calculated for each month

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

(83)m=	120.85	212.8	309.77	415.23	493.94	503.1	479.74	419.04	345.96	240.19	146.01	102.61	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	543.88	633.61	715.68	796.46	849.97	834.95	796.41	742.68	682.68	601.82	535.54	513.15	(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)
	1	1	0.99	0.96	0.87	0.7	0.53	0.58	0.84	0.98	1	1	

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

(87)m=	19.86	20.01	20.25	20.57	20.83	20.96	20.99	20.99	20.9	20.56	20.15	19.83	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.04	20.05	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.83	0.61	0.42	0.47	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=	18.5	18.73	19.08	19.53	19.88	20.03	20.05	20.05	19.97	19.53	18.94	18.47	(90)
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fLA = Living area ÷ (4) = 0.14 (91)

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

(92)m=	18.7	18.91	19.25	19.68	20.01	20.17	20.19	20.19	20.1	19.68	19.11	18.66	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.7	18.91	19.25	19.68	20.01	20.17	20.19	20.19	20.1	19.68	19.11	18.66	(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=	1	0.99	0.98	0.94	0.83	0.62	0.43	0.49	0.77	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	542.01	628.57	700.81	746.3	702.07	520.92	345.75	362.53	527.63	576.5	531.49	511.85	(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=	1437.26	1395.34	1266.49	1058.49	814.26	539.39	347.85	366.4	584.33	889.27	1181.8	1429.78	(97)
--------	---------	---------	---------	---------	--------	--------	--------	-------	--------	--------	--------	---------	------

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

(98)m=	666.06	515.27	420.86	224.78	83.47	0	0	0	0	232.7	468.22	682.94	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------	------

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

3294.31 (98)

Space heating requirement in kWh/m²/year

35.09 (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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

666.06	515.27	420.86	224.78	83.47	0	0	0	0	232.7	468.22	682.94	
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------	--

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

713.13	551.68	450.6	240.66	89.37	0	0	0	0	249.15	501.31	731.2	
--------	--------	-------	--------	-------	---	---	---	---	--------	--------	-------	--

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

3527.1 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

0 (215)

Water heating

Output from water heater (calculated above)

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37	
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Efficiency of water heater

80.3 (216)

(217)m=	87.75	87.49	86.94	85.72	83.4	80.3	80.3	80.3	80.3	85.68	87.22	87.85	(217)
---------	-------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.77	212	223.94	201.46	200.46	183.38	175.69	195.85	198.02	211.31	219.57	233.78	(219)
---------	--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

2495.24 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3527.1

Water heating fuel used

2495.24

Electricity for pumps, fans and electric keep-hot

TER WorkSheet: New dwelling design stage

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		396.75	(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	= 761.85 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 538.97 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1300.83 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 205.91 (268)
Total CO2, kg/year		sum of (265)...(271) =	1545.66 (272)

TER =

16.46 (273)

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 27 January 2021 at 16:34:16

Project Information:

Assessed By: () **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 93.89m²

Site Reference : Swansea Road

Plot Reference: Type C (Plot 7)

Address : Type C (Plot 7)

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.8 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.61 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 47.9 kWh/m²

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

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.65 (design value)

Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Database: (rev 471, product index 017616):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Potterton
Model: Promax Ultra
Model qualifier: Combi 33 ErP (Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (South East England): Not significant **OK**

Based on:

Overshading: Average or unknown
 Windows facing: South West 4.88m²
 Windows facing: North East 7.47m²
 Windows facing: North East 1.44m²
 Roof windows facing: South West 0.59m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type C (Plot 7)

Address : Type C (Plot 7)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.35 (1a)	x	2.5 (2a)	=	100.87 (3a)
First floor	36.07 (1b)	x	2.7 (2b)	=	97.39 (3b)
Second floor	17.47 (1c)	x	2.54 (2c)	=	44.32 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.89 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.59 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
---	---	---------	-------

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration	[(9)-1]x0.1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4.65000009536743 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.2 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
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(24c)

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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			2.12	1.2	2.544		(26)
Windows Type 1			4.88	$\times 1/[1/(1.4) + 0.04]$	6.47		(27)
Windows Type 2			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Windows Type 3			1.44	$\times 1/[1/(1.4) + 0.04]$	1.91		(27)
Rooflights			0.59	$\times 1/[1/(1.2) + 0.04]$	0.708		(27b)
Floor			40.35	0.11	4.4385	75	3026.25 (28)
Walls Type1	47.71	14.47	33.24	0.25	8.31	60	1994.4 (29)
Walls Type2	23.03	0	23.03	0.25	5.76	9	207.27 (29)
Walls Type3	3.97	1.44	2.53	0.25	0.63	9	22.77 (29)
Roof Type1	9.56	0	9.56	0.11	1.05	9	86.04 (30)
Roof Type2	4.28	0	4.28	0.15	0.64	9	38.52 (30)
Roof Type3	18.61	0	18.61	0.11	2.05	9	167.49 (30)
Roof Type4	8.33	0.59	7.74	0.15	1.16	9	69.66 (30)
Roof Type5	1.98	0	1.98	0.15	0.3	9	17.82 (30)
Total area of elements, m²			157.82				(31)
Party wall			122.47	0	0	110	13471.7 (32)
Internal wall **			175.53			9	1579.77 (32c)

DER WorkSheet: New dwelling design stage

Internal floor	53.54	18	963.72 (32d)
Internal ceiling	53.54	9	481.86 (32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = 45.84 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 22127.27 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) ÷ (4) = 235.67 (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 : $S (L \times Y)$ calculated using Appendix K 8.92 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss (33) + (36) = 54.76 (37)

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=	40.18	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	(38)

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

(39)m=	94.94	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78		
Average = Sum(39) _{1...12} /12=													94.8	(39)

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

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	
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 2.68 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 97.74 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.51	103.6	99.69	95.78	91.87	87.96	87.96	91.87	95.78	99.69	103.6	107.51	
Total = Sum(44) _{1...12} =												1172.86	(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=	159.44	139.45	143.9	125.45	120.37	103.87	96.25	110.45	111.77	130.26	142.19	154.41		
Total = Sum(45) _{1...12} =													1537.81	(45)

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

(46)m=	23.92	20.92	21.58	18.82	18.06	15.58	14.44	16.57	16.77	19.54	21.33	23.16	(46)
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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:

DER WorkSheet: New dwelling design stage

a) If manufacturer's declared loss factor is known (kWh/day): (48)

0

Temperature factor from Table 2b (49)

0

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

0

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

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

0

If community heating see section 4.3

Volume factor from Table 2a (52)

0

Temperature factor from Table 2b (53)

0

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

0

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

0

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

(56)m=

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

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

(57)m=

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

(57)

Primary circuit loss (annual) from Table 3 (58)

0

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

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

(59)m=

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

(59)

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

(61)m=

21.97	19.82	21.9	21.11	21.75	20.98	21.63	21.71	21.05	21.83	21.2	21.94
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(61)

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

(62)m=

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} (64)

1794.69

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

(65)m=

58.5	51.32	53.32	46.99	45.46	39.78	37.41	42.15	42.43	48.77	52.58	56.83
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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
133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77

(66)

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

(67)m=

22.47	19.95	16.23	12.29	9.18	7.75	8.38	10.89	14.62	18.56	21.66	23.09
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

246.06	248.61	242.17	228.48	211.19	194.93	184.08	181.53	187.96	201.66	218.95	235.2
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(68)

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

(69)m=

36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38
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(69)

Pumps and fans gains (Table 5a)

(70)m=

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

(70)

DER WorkSheet: New dwelling design stage

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

(71)m=

-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

78.64	76.37	71.67	65.26	61.1	55.25	50.29	56.66	58.92	65.55	73.03	76.38
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

413.29	411.06	396.2	372.15	347.6	324.07	308.87	315.2	327.63	351.89	379.76	400.8
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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	x	7.47	x	11.28	x	0.43	x	1.11	=	27.91	(75)
Northeast 0.9x	0.77	x	1.44	x	11.28	x	0.43	x	1.11	=	5.38	(75)
Northeast 0.9x	0.77	x	7.47	x	22.97	x	0.43	x	1.11	=	56.8	(75)
Northeast 0.9x	0.77	x	1.44	x	22.97	x	0.43	x	1.11	=	10.95	(75)
Northeast 0.9x	0.77	x	7.47	x	41.38	x	0.43	x	1.11	=	102.34	(75)
Northeast 0.9x	0.77	x	1.44	x	41.38	x	0.43	x	1.11	=	19.73	(75)
Northeast 0.9x	0.77	x	7.47	x	67.96	x	0.43	x	1.11	=	168.08	(75)
Northeast 0.9x	0.77	x	1.44	x	67.96	x	0.43	x	1.11	=	32.4	(75)
Northeast 0.9x	0.77	x	7.47	x	91.35	x	0.43	x	1.11	=	225.93	(75)
Northeast 0.9x	0.77	x	1.44	x	91.35	x	0.43	x	1.11	=	43.55	(75)
Northeast 0.9x	0.77	x	7.47	x	97.38	x	0.43	x	1.11	=	240.86	(75)
Northeast 0.9x	0.77	x	1.44	x	97.38	x	0.43	x	1.11	=	46.43	(75)
Northeast 0.9x	0.77	x	7.47	x	91.1	x	0.43	x	1.11	=	225.32	(75)
Northeast 0.9x	0.77	x	1.44	x	91.1	x	0.43	x	1.11	=	43.44	(75)
Northeast 0.9x	0.77	x	7.47	x	72.63	x	0.43	x	1.11	=	179.63	(75)
Northeast 0.9x	0.77	x	1.44	x	72.63	x	0.43	x	1.11	=	34.63	(75)
Northeast 0.9x	0.77	x	7.47	x	50.42	x	0.43	x	1.11	=	124.71	(75)
Northeast 0.9x	0.77	x	1.44	x	50.42	x	0.43	x	1.11	=	24.04	(75)
Northeast 0.9x	0.77	x	7.47	x	28.07	x	0.43	x	1.11	=	69.42	(75)
Northeast 0.9x	0.77	x	1.44	x	28.07	x	0.43	x	1.11	=	13.38	(75)
Northeast 0.9x	0.77	x	7.47	x	14.2	x	0.43	x	1.11	=	35.11	(75)
Northeast 0.9x	0.77	x	1.44	x	14.2	x	0.43	x	1.11	=	6.77	(75)
Northeast 0.9x	0.77	x	7.47	x	9.21	x	0.43	x	1.11	=	22.79	(75)
Northeast 0.9x	0.77	x	1.44	x	9.21	x	0.43	x	1.11	=	4.39	(75)
Southwest 0.9x	0.77	x	4.88	x	36.79		0.43	x	1.11	=	59.45	(79)
Southwest 0.9x	0.77	x	4.88	x	62.67		0.43	x	1.11	=	101.27	(79)
Southwest 0.9x	0.77	x	4.88	x	85.75		0.43	x	1.11	=	138.56	(79)
Southwest 0.9x	0.77	x	4.88	x	106.25		0.43	x	1.11	=	171.68	(79)
Southwest 0.9x	0.77	x	4.88	x	119.01		0.43	x	1.11	=	192.29	(79)
Southwest 0.9x	0.77	x	4.88	x	118.15		0.43	x	1.11	=	190.9	(79)

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Southwest	0.9x	0.77	x	4.88	x	113.91		0.43	x	1.11	=	184.05	(79)
Southwest	0.9x	0.77	x	4.88	x	104.39		0.43	x	1.11	=	168.67	(79)
Southwest	0.9x	0.77	x	4.88	x	92.85		0.43	x	1.11	=	150.03	(79)
Southwest	0.9x	0.77	x	4.88	x	69.27		0.43	x	1.11	=	111.92	(79)
Southwest	0.9x	0.77	x	4.88	x	44.07		0.43	x	1.11	=	71.21	(79)
Southwest	0.9x	0.77	x	4.88	x	31.49		0.43	x	1.11	=	50.88	(79)
Rooflights	0.9x	1	x	0.59	x	39.98	x	0.63	x	0.7	=	9.36	(82)
Rooflights	0.9x	1	x	0.59	x	73.48	x	0.63	x	0.7	=	17.21	(82)
Rooflights	0.9x	1	x	0.59	x	112.11	x	0.63	x	0.7	=	26.25	(82)
Rooflights	0.9x	1	x	0.59	x	153.81	x	0.63	x	0.7	=	36.02	(82)
Rooflights	0.9x	1	x	0.59	x	182.63	x	0.63	x	0.7	=	42.77	(82)
Rooflights	0.9x	1	x	0.59	x	184.99	x	0.63	x	0.7	=	43.32	(82)
Rooflights	0.9x	1	x	0.59	x	176.88	x	0.63	x	0.7	=	41.42	(82)
Rooflights	0.9x	1	x	0.59	x	155.4	x	0.63	x	0.7	=	36.39	(82)
Rooflights	0.9x	1	x	0.59	x	126.86	x	0.63	x	0.7	=	29.71	(82)
Rooflights	0.9x	1	x	0.59	x	84.6	x	0.63	x	0.7	=	19.81	(82)
Rooflights	0.9x	1	x	0.59	x	48.93	x	0.63	x	0.7	=	11.46	(82)
Rooflights	0.9x	1	x	0.59	x	33.5	x	0.63	x	0.7	=	7.84	(82)

Solar gains in watts, calculated for each month

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

(83)m=	102.1	186.23	286.88	408.17	504.54	521.52	494.23	419.32	328.48	214.53	124.55	85.9	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	515.38	597.29	683.08	780.33	852.14	845.59	803.1	734.52	656.11	566.43	504.31	486.7	(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)
	1	1	0.99	0.95	0.86	0.68	0.51	0.58	0.84	0.98	1	1	

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

(87)m=	19.85	20	20.25	20.57	20.84	20.96	20.99	20.99	20.89	20.53	20.12	19.81	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	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	0.94	0.81	0.6	0.41	0.47	0.77	0.97	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=	18.52	18.74	19.11	19.56	19.91	20.05	20.07	20.07	19.98	19.52	18.93	18.47	(90)
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fLA = Living area ÷ (4) = 0.14 (91)

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

(92)m=	18.71	18.92	19.27	19.71	20.05	20.18	20.21	20.2	20.11	19.67	19.1	18.66	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.77	19.12	19.56	19.9	20.03	20.06	20.05	19.96	19.52	18.95	18.51	(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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DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.8	0.59	0.41	0.47	0.76	0.96	0.99	1	(94)
--------	---	------	------	------	-----	------	------	------	------	------	------	---	------

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

(95)m=	513.5	592.37	667.79	724.45	682.1	499.86	325.84	342.77	501.71	542.32	500.37	485.37	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1354.25	1315.04	1196.15	1009.99	776.8	514.87	327.48	346.14	555.76	845.27	1123.09	1356.49	(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=	625.52	485.63	393.1	205.59	70.45	0	0	0	0	225.39	448.36	648.12	(98)
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3102.16

Space heating requirement in kWh/m²/year

33.04

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1

Fraction of total heating from main system 1

(204) = (202) x [1 – (203)] =

1

Efficiency of main space heating system 1

90

Efficiency of secondary/supplementary heating system, %

0

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

Space heating requirement (calculated above)

625.52	485.63	393.1	205.59	70.45	0	0	0	0	225.39	448.36	648.12
--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------

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

695.02	539.59	436.78	228.43	78.28	0	0	0	0	250.43	498.18	720.13
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Total (kWh/year) =Sum(211)_{1...5,10...12} =

3446.84

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

0

Water heating

Output from water heater (calculated above)

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
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Efficiency of water heater

86.7

(217)m=	89.24	89.16	89	88.6	87.77	86.7	86.7	86.7	86.7	88.64	89.09	89.27	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.29	178.63	186.29	165.42	161.93	144	135.97	152.43	153.19	171.58	183.39	197.54	(219)
---------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	-------

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

2033.67

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3446.84

Water heating fuel used

2033.67

Electricity for pumps, fans and electric keep-hot

DER WorkSheet: New dwelling design stage

mechanical ventilation - balanced, extract or positive input from outside		70.61	(230a)
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	145.61	(231)
Electricity for lighting		396.75	(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	=	744.52	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	439.27	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1183.79	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	75.57	(267)
Electricity for lighting	(232) x	0.519	=	205.91	(268)
Total CO2, kg/year			sum of (265)...(271) =	1465.27	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =	15.61	(273)
El rating (section 14)				86	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type C (Plot 7)

Address : Type C (Plot 7)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.35 (1a)	x	2.5 (2a)	=	100.87 (3a)
First floor	36.07 (1b)	x	2.7 (2b)	=	97.39 (3b)
Second floor	17.47 (1c)	x	2.54 (2c)	=	44.32 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.89 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.59 (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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 ÷ (5) = 0.12 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

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)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.32 (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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TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

	0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (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			2.12	x 1.2	= 2.544		(26)
Windows Type 1			4.88	x 1/[1/(1.4) + 0.04]	= 6.47		(27)
Windows Type 2			7.47	x 1/[1/(1.4) + 0.04]	= 9.9		(27)
Windows Type 3			1.44	x 1/[1/(1.4) + 0.04]	= 1.91		(27)
Rooflights			0.59	x 1/[1/(1.7) + 0.04]	= 1.003		(27b)
Floor			40.35	x 0.13	= 5.2455		(28)
Walls Type1	47.71	14.47	33.24	x 0.18	= 5.98		(29)
Walls Type2	23.03	0	23.03	x 0.18	= 4.15		(29)
Walls Type3	3.97	1.44	2.53	x 0.18	= 0.46		(29)
Roof Type1	9.56	0	9.56	x 0.13	= 1.24		(30)
Roof Type2	4.28	0	4.28	x 0.13	= 0.56		(30)
Roof Type3	18.61	0	18.61	x 0.13	= 2.42		(30)
Roof Type4	8.33	0.59	7.74	x 0.13	= 1.01		(30)
Roof Type5	1.98	0	1.98	x 0.13	= 0.26		(30)
Total area of elements, m²			157.82				(31)
Party wall			122.47	x 0	= 0		(32)
Internal wall **			175.53				(32c)

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Internal floor	53.54		(32d)
Internal ceiling	53.54		(32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = 43.08 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 22127.27 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) 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 : $S (L \times Y)$ calculated using Appendix K 10.17 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss (33) + (36) = 53.25 (37)

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=	46.59	46.34	46.09	44.91	44.69	43.67	43.67	43.48	44.06	44.69	45.14	45.6	(38)

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

(39)m=	99.84	99.58	99.33	98.16	97.94	96.92	96.92	96.73	97.31	97.94	98.38	98.85	
	Average = $\text{Sum}(39)_{1...12} / 12 =$												98.16 (39)

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

(40)m=	1.06	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	
	Average = $\text{Sum}(40)_{1...12} / 12 =$												1.05 (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 2.68 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$ 97.74 (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=	107.51	103.6	99.69	95.78	91.87	87.96	87.96	91.87	95.78	99.69	103.6	107.51	
	Total = $\text{Sum}(44)_{1...12} =$												1172.86 (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=	159.44	139.45	143.9	125.45	120.37	103.87	96.25	110.45	111.77	130.26	142.19	154.41	
	Total = $\text{Sum}(45)_{1...12} =$												1537.81 (45)

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

(46)m=	23.92	20.92	21.58	18.82	18.06	15.58	14.44	16.57	16.77	19.54	21.33	23.16	(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:

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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)

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

(56)m=

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

(56)

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

(57)m=

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

(57)

Primary circuit loss (annual) from Table 3 (58)

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

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

(59)m=

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

(59)

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

(61)m=

50.96	46.03	50.8	47.24	46.82	43.38	44.83	46.82	47.24	50.8	49.32	50.96
-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------

(61)

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

(62)m=

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(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=

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(64)

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

2112.99

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

(65)m=

65.75	57.87	60.55	53.52	51.73	45.38	43.21	48.43	48.97	56.01	59.61	64.08
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77

(66)

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

(67)m=

22.47	19.95	16.23	12.29	9.18	7.75	8.38	10.89	14.62	18.56	21.66	23.09
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

246.06	248.61	242.17	228.48	211.19	194.93	184.08	181.53	187.96	201.66	218.95	235.2
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=

36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

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=

-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

88.38	86.12	81.38	74.34	69.53	63.03	58.08	65.09	68.02	75.28	82.79	86.13
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

423.03	420.81	405.91	381.23	356.03	331.85	316.66	323.64	336.72	361.63	389.52	410.55
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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	x	7.47	x	11.28	x	0.63	x	0.7	=	25.76	(75)
Northeast 0.9x	0.77	x	1.44	x	11.28	x	0.63	x	0.7	=	4.97	(75)
Northeast 0.9x	0.77	x	7.47	x	22.97	x	0.63	x	0.7	=	52.43	(75)
Northeast 0.9x	0.77	x	1.44	x	22.97	x	0.63	x	0.7	=	10.11	(75)
Northeast 0.9x	0.77	x	7.47	x	41.38	x	0.63	x	0.7	=	94.46	(75)
Northeast 0.9x	0.77	x	1.44	x	41.38	x	0.63	x	0.7	=	18.21	(75)
Northeast 0.9x	0.77	x	7.47	x	67.96	x	0.63	x	0.7	=	155.14	(75)
Northeast 0.9x	0.77	x	1.44	x	67.96	x	0.63	x	0.7	=	29.91	(75)
Northeast 0.9x	0.77	x	7.47	x	91.35	x	0.63	x	0.7	=	208.54	(75)
Northeast 0.9x	0.77	x	1.44	x	91.35	x	0.63	x	0.7	=	40.2	(75)
Northeast 0.9x	0.77	x	7.47	x	97.38	x	0.63	x	0.7	=	222.32	(75)
Northeast 0.9x	0.77	x	1.44	x	97.38	x	0.63	x	0.7	=	42.86	(75)
Northeast 0.9x	0.77	x	7.47	x	91.1	x	0.63	x	0.7	=	207.98	(75)
Northeast 0.9x	0.77	x	1.44	x	91.1	x	0.63	x	0.7	=	40.09	(75)
Northeast 0.9x	0.77	x	7.47	x	72.63	x	0.63	x	0.7	=	165.8	(75)
Northeast 0.9x	0.77	x	1.44	x	72.63	x	0.63	x	0.7	=	31.96	(75)
Northeast 0.9x	0.77	x	7.47	x	50.42	x	0.63	x	0.7	=	115.11	(75)
Northeast 0.9x	0.77	x	1.44	x	50.42	x	0.63	x	0.7	=	22.19	(75)
Northeast 0.9x	0.77	x	7.47	x	28.07	x	0.63	x	0.7	=	64.08	(75)
Northeast 0.9x	0.77	x	1.44	x	28.07	x	0.63	x	0.7	=	12.35	(75)
Northeast 0.9x	0.77	x	7.47	x	14.2	x	0.63	x	0.7	=	32.41	(75)
Northeast 0.9x	0.77	x	1.44	x	14.2	x	0.63	x	0.7	=	6.25	(75)
Northeast 0.9x	0.77	x	7.47	x	9.21	x	0.63	x	0.7	=	21.04	(75)
Northeast 0.9x	0.77	x	1.44	x	9.21	x	0.63	x	0.7	=	4.06	(75)
Southwest 0.9x	0.77	x	4.88	x	36.79		0.63	x	0.7	=	54.87	(79)
Southwest 0.9x	0.77	x	4.88	x	62.67		0.63	x	0.7	=	93.47	(79)
Southwest 0.9x	0.77	x	4.88	x	85.75		0.63	x	0.7	=	127.89	(79)
Southwest 0.9x	0.77	x	4.88	x	106.25		0.63	x	0.7	=	158.46	(79)
Southwest 0.9x	0.77	x	4.88	x	119.01		0.63	x	0.7	=	177.49	(79)
Southwest 0.9x	0.77	x	4.88	x	118.15		0.63	x	0.7	=	176.21	(79)

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Southwest	0.9x	0.77	x	4.88	x	113.91		0.63	x	0.7	=	169.88	(79)
Southwest	0.9x	0.77	x	4.88	x	104.39		0.63	x	0.7	=	155.69	(79)
Southwest	0.9x	0.77	x	4.88	x	92.85		0.63	x	0.7	=	138.48	(79)
Southwest	0.9x	0.77	x	4.88	x	69.27		0.63	x	0.7	=	103.31	(79)
Southwest	0.9x	0.77	x	4.88	x	44.07		0.63	x	0.7	=	65.73	(79)
Southwest	0.9x	0.77	x	4.88	x	31.49		0.63	x	0.7	=	46.96	(79)
Rooflights	0.9x	1	x	0.59	x	39.98	x	0.63	x	0.7	=	9.36	(82)
Rooflights	0.9x	1	x	0.59	x	73.48	x	0.63	x	0.7	=	17.21	(82)
Rooflights	0.9x	1	x	0.59	x	112.11	x	0.63	x	0.7	=	26.25	(82)
Rooflights	0.9x	1	x	0.59	x	153.81	x	0.63	x	0.7	=	36.02	(82)
Rooflights	0.9x	1	x	0.59	x	182.63	x	0.63	x	0.7	=	42.77	(82)
Rooflights	0.9x	1	x	0.59	x	184.99	x	0.63	x	0.7	=	43.32	(82)
Rooflights	0.9x	1	x	0.59	x	176.88	x	0.63	x	0.7	=	41.42	(82)
Rooflights	0.9x	1	x	0.59	x	155.4	x	0.63	x	0.7	=	36.39	(82)
Rooflights	0.9x	1	x	0.59	x	126.86	x	0.63	x	0.7	=	29.71	(82)
Rooflights	0.9x	1	x	0.59	x	84.6	x	0.63	x	0.7	=	19.81	(82)
Rooflights	0.9x	1	x	0.59	x	48.93	x	0.63	x	0.7	=	11.46	(82)
Rooflights	0.9x	1	x	0.59	x	33.5	x	0.63	x	0.7	=	7.84	(82)

Solar gains in watts, calculated for each month

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

(83)m=	94.96	173.22	266.82	379.53	468.99	484.71	459.37	389.84	305.48	199.54	115.84	79.89	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	517.99	594.03	672.73	760.75	825.02	816.56	776.04	713.48	642.2	561.17	505.37	490.44	(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)

	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	0.86	0.98	1	1	(86)

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

(87)m=	19.83	19.97	20.21	20.54	20.81	20.96	20.99	20.99	20.88	20.52	20.12	19.81	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.03	20.03	20.04	20.05	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.95	0.84	0.63	0.43	0.49	0.8	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	-----	------	---	---	------

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

(90)m=	18.46	18.67	19.02	19.49	19.86	20.03	20.05	20.05	19.95	19.48	18.89	18.43	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.14 (91)

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

(92)m=	18.66	18.86	19.19	19.64	20	20.16	20.19	20.19	20.09	19.63	19.07	18.63	(92)
--------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.66	18.86	19.19	19.64	20	20.16	20.19	20.19	20.09	19.63	19.07	18.63	(93)
--------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

(94)m=	1	0.99	0.98	0.95	0.84	0.64	0.45	0.51	0.8	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	-----	------	------	---	------

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

(95)m=	516.56	590.46	661.82	719.74	691.64	518.99	345.44	361.66	514.67	542.92	502.41	489.43	(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=	1433.63	1389.88	1260.87	1054.69	812.84	539.15	347.81	366.29	582.61	884.47	1177.68	1426.62	(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=	682.3	537.22	445.7	241.16	90.17	0	0	0	0	254.11	486.2	697.27	(98)
--------	-------	--------	-------	--------	-------	---	---	---	---	--------	-------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3434.13 (98)

Space heating requirement in kWh/m²/year

36.58 (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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

682.3	537.22	445.7	241.16	90.17	0	0	0	0	254.11	486.2	697.27
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(211)m = {[[(98)m x (204)] } x 100 ÷ (206)

730.51	575.18	477.19	258.21	96.55	0	0	0	0	272.07	520.56	746.54
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 3676.79 (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
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Total (kWh/year) =Sum(215)_{1...5,10...12} = 0 (215)

Water heating

Output from water heater (calculated above)

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
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Efficiency of water heater

80.3 (216)

(217)m=	87.8	87.57	87.07	85.89	83.57	80.3	80.3	80.3	80.3	85.9	87.3	87.88	(217)
---------	------	-------	-------	-------	-------	------	------	------	------	------	------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.64	211.79	223.61	201.05	200.06	183.38	175.69	195.85	198.02	210.77	219.37	233.68
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} = 2492.91 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3676.79

Water heating fuel used

2492.91

Electricity for pumps, fans and electric keep-hot

TER WorkSheet: New dwelling design stage

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		396.75	(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	794.19 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	538.47 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1332.66 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	205.91 (268)
Total CO2, kg/year	sum of (265)...(271) =		1577.49 (272)

TER =

16.8 (273)

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 27 January 2021 at 16:34:16

Project Information:

Assessed By: () **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 93.89m²

Site Reference : Swansea Road

Plot Reference: Type C (Plot 8)

Address : Type C (Plot 8)

Client Details:

Name: Helix

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

16.8 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

15.61 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

47.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

41.6 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.25 (max. 0.30)

0.25 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

0.11 (max. 0.25)

0.11 (max. 0.70)

Roof

0.12 (max. 0.20)

0.15 (max. 0.35)

Openings

1.37 (max. 2.00)

1.40 (max. 3.30)

OK

OK

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

4.65 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Database: (rev 471, product index 017616):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Potterton

Model: Promax Ultra

Model qualifier: Combi 33 ErP
(Combi)

Efficiency 89.1 % SEDBUK2009

Minimum 88.0 %

OK

Secondary heating system:

None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (South East England): Not significant **OK**

Based on:

Overshading: Average or unknown
 Windows facing: South West 4.88m²
 Windows facing: North East 7.47m²
 Windows facing: North East 1.44m²
 Roof windows facing: South West 0.59m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type C (Plot 8)

Address : Type C (Plot 8)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.35 (1a)	x	2.5 (2a)	=	100.87 (3a)
First floor	36.07 (1b)	x	2.7 (2b)	=	97.39 (3b)
Second floor	17.47 (1c)	x	2.54 (2c)	=	44.32 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.89 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.59 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4.65000009536743 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.2 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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 × 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(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			2.12	1.2	2.544		(26)
Windows Type 1			4.88	$\times 1/[1/(1.4) + 0.04]$	6.47		(27)
Windows Type 2			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Windows Type 3			1.44	$\times 1/[1/(1.4) + 0.04]$	1.91		(27)
Rooflights			0.59	$\times 1/[1/(1.2) + 0.04]$	0.708		(27b)
Floor			40.35	0.11	4.4385	75	3026.25 (28)
Walls Type1	47.71	14.47	33.24	0.25	8.31	60	1994.4 (29)
Walls Type2	23.03	0	23.03	0.25	5.76	9	207.27 (29)
Walls Type3	3.97	1.44	2.53	0.25	0.63	9	22.77 (29)
Roof Type1	9.56	0	9.56	0.11	1.05	9	86.04 (30)
Roof Type2	4.28	0	4.28	0.15	0.64	9	38.52 (30)
Roof Type3	18.61	0	18.61	0.11	2.05	9	167.49 (30)
Roof Type4	8.33	0.59	7.74	0.15	1.16	9	69.66 (30)
Roof Type5	1.98	0	1.98	0.15	0.3	9	17.82 (30)
Total area of elements, m²			157.82				(31)
Party wall			122.47	0	0	110	13471.7 (32)
Internal wall **			175.53			9	1579.77 (32c)

DER WorkSheet: New dwelling design stage

Internal floor	53.54	18	963.72 (32d)
Internal ceiling	53.54	9	481.86 (32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = 45.84 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 22127.27 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) ÷ (4) = 235.67 (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 : $S (L \times Y)$ calculated using Appendix K 8.92 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss (33) + (36) = 54.76 (37)

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=	40.18	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	40.03	(38)

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

(39)m=	94.94	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78		
Average = Sum(39) _{1...12} /12=													94.8	(39)

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

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	
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 2.68 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 97.74 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.51	103.6	99.69	95.78	91.87	87.96	87.96	91.87	95.78	99.69	103.6	107.51	
Total = Sum(44) _{1...12} =												1172.86	(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=	159.44	139.45	143.9	125.45	120.37	103.87	96.25	110.45	111.77	130.26	142.19	154.41		
Total = Sum(45) _{1...12} =													1537.81	(45)

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

(46)m=	23.92	20.92	21.58	18.82	18.06	15.58	14.44	16.57	16.77	19.54	21.33	23.16	(46)
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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:

DER WorkSheet: New dwelling design stage

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)

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

(56)m=

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

(56)

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

(57)m=

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

(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=

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

(59)

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

(61)m=

21.97	19.82	21.9	21.11	21.75	20.98	21.63	21.71	21.05	21.83	21.2	21.94
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(61)

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

(62)m=

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 1794.69 (64)

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

(65)m=

58.5	51.32	53.32	46.99	45.46	39.78	37.41	42.15	42.43	48.77	52.58	56.83
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77

(66)

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

(67)m=

22.47	19.95	16.23	12.29	9.18	7.75	8.38	10.89	14.62	18.56	21.66	23.09
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(67)

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

(68)m=

246.06	248.61	242.17	228.48	211.19	194.93	184.08	181.53	187.96	201.66	218.95	235.2
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=

36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

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

(70)

DER WorkSheet: New dwelling design stage

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

(71)m=

-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

78.64	76.37	71.67	65.26	61.1	55.25	50.29	56.66	58.92	65.55	73.03	76.38
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

413.29	411.06	396.2	372.15	347.6	324.07	308.87	315.2	327.63	351.89	379.76	400.8
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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	x	7.47	x	11.28	x	0.43	x	1.11	=	27.91	(75)
Northeast 0.9x	0.77	x	1.44	x	11.28	x	0.43	x	1.11	=	5.38	(75)
Northeast 0.9x	0.77	x	7.47	x	22.97	x	0.43	x	1.11	=	56.8	(75)
Northeast 0.9x	0.77	x	1.44	x	22.97	x	0.43	x	1.11	=	10.95	(75)
Northeast 0.9x	0.77	x	7.47	x	41.38	x	0.43	x	1.11	=	102.34	(75)
Northeast 0.9x	0.77	x	1.44	x	41.38	x	0.43	x	1.11	=	19.73	(75)
Northeast 0.9x	0.77	x	7.47	x	67.96	x	0.43	x	1.11	=	168.08	(75)
Northeast 0.9x	0.77	x	1.44	x	67.96	x	0.43	x	1.11	=	32.4	(75)
Northeast 0.9x	0.77	x	7.47	x	91.35	x	0.43	x	1.11	=	225.93	(75)
Northeast 0.9x	0.77	x	1.44	x	91.35	x	0.43	x	1.11	=	43.55	(75)
Northeast 0.9x	0.77	x	7.47	x	97.38	x	0.43	x	1.11	=	240.86	(75)
Northeast 0.9x	0.77	x	1.44	x	97.38	x	0.43	x	1.11	=	46.43	(75)
Northeast 0.9x	0.77	x	7.47	x	91.1	x	0.43	x	1.11	=	225.32	(75)
Northeast 0.9x	0.77	x	1.44	x	91.1	x	0.43	x	1.11	=	43.44	(75)
Northeast 0.9x	0.77	x	7.47	x	72.63	x	0.43	x	1.11	=	179.63	(75)
Northeast 0.9x	0.77	x	1.44	x	72.63	x	0.43	x	1.11	=	34.63	(75)
Northeast 0.9x	0.77	x	7.47	x	50.42	x	0.43	x	1.11	=	124.71	(75)
Northeast 0.9x	0.77	x	1.44	x	50.42	x	0.43	x	1.11	=	24.04	(75)
Northeast 0.9x	0.77	x	7.47	x	28.07	x	0.43	x	1.11	=	69.42	(75)
Northeast 0.9x	0.77	x	1.44	x	28.07	x	0.43	x	1.11	=	13.38	(75)
Northeast 0.9x	0.77	x	7.47	x	14.2	x	0.43	x	1.11	=	35.11	(75)
Northeast 0.9x	0.77	x	1.44	x	14.2	x	0.43	x	1.11	=	6.77	(75)
Northeast 0.9x	0.77	x	7.47	x	9.21	x	0.43	x	1.11	=	22.79	(75)
Northeast 0.9x	0.77	x	1.44	x	9.21	x	0.43	x	1.11	=	4.39	(75)
Southwest 0.9x	0.77	x	4.88	x	36.79		0.43	x	1.11	=	59.45	(79)
Southwest 0.9x	0.77	x	4.88	x	62.67		0.43	x	1.11	=	101.27	(79)
Southwest 0.9x	0.77	x	4.88	x	85.75		0.43	x	1.11	=	138.56	(79)
Southwest 0.9x	0.77	x	4.88	x	106.25		0.43	x	1.11	=	171.68	(79)
Southwest 0.9x	0.77	x	4.88	x	119.01		0.43	x	1.11	=	192.29	(79)
Southwest 0.9x	0.77	x	4.88	x	118.15		0.43	x	1.11	=	190.9	(79)

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Southwest	0.9x	0.77	x	4.88	x	113.91		0.43	x	1.11	=	184.05	(79)
Southwest	0.9x	0.77	x	4.88	x	104.39		0.43	x	1.11	=	168.67	(79)
Southwest	0.9x	0.77	x	4.88	x	92.85		0.43	x	1.11	=	150.03	(79)
Southwest	0.9x	0.77	x	4.88	x	69.27		0.43	x	1.11	=	111.92	(79)
Southwest	0.9x	0.77	x	4.88	x	44.07		0.43	x	1.11	=	71.21	(79)
Southwest	0.9x	0.77	x	4.88	x	31.49		0.43	x	1.11	=	50.88	(79)
Rooflights	0.9x	1	x	0.59	x	39.98	x	0.63	x	0.7	=	9.36	(82)
Rooflights	0.9x	1	x	0.59	x	73.48	x	0.63	x	0.7	=	17.21	(82)
Rooflights	0.9x	1	x	0.59	x	112.11	x	0.63	x	0.7	=	26.25	(82)
Rooflights	0.9x	1	x	0.59	x	153.81	x	0.63	x	0.7	=	36.02	(82)
Rooflights	0.9x	1	x	0.59	x	182.63	x	0.63	x	0.7	=	42.77	(82)
Rooflights	0.9x	1	x	0.59	x	184.99	x	0.63	x	0.7	=	43.32	(82)
Rooflights	0.9x	1	x	0.59	x	176.88	x	0.63	x	0.7	=	41.42	(82)
Rooflights	0.9x	1	x	0.59	x	155.4	x	0.63	x	0.7	=	36.39	(82)
Rooflights	0.9x	1	x	0.59	x	126.86	x	0.63	x	0.7	=	29.71	(82)
Rooflights	0.9x	1	x	0.59	x	84.6	x	0.63	x	0.7	=	19.81	(82)
Rooflights	0.9x	1	x	0.59	x	48.93	x	0.63	x	0.7	=	11.46	(82)
Rooflights	0.9x	1	x	0.59	x	33.5	x	0.63	x	0.7	=	7.84	(82)

Solar gains in watts, calculated for each month

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

(83)m=	102.1	186.23	286.88	408.17	504.54	521.52	494.23	419.32	328.48	214.53	124.55	85.9	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------	------

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

(84)m=	515.38	597.29	683.08	780.33	852.14	845.59	803.1	734.52	656.11	566.43	504.31	486.7	(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	0.86	0.68	0.51	0.58	0.84	0.98	1	1	

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

(87)m=	19.85	20	20.25	20.57	20.84	20.96	20.99	20.99	20.89	20.53	20.12	19.81	(87)
--------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.07	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	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	0.94	0.81	0.6	0.41	0.47	0.77	0.97	0.99	1	(89)
--------	---	------	------	------	------	-----	------	------	------	------	------	---	------

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

(90)m=	18.52	18.74	19.11	19.56	19.91	20.05	20.07	20.07	19.98	19.52	18.93	18.47	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.14 (91)

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

(92)m=	18.71	18.92	19.27	19.71	20.05	20.18	20.21	20.2	20.11	19.67	19.1	18.66	(92)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	------

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

(93)m=	18.56	18.77	19.12	19.56	19.9	20.03	20.06	20.05	19.96	19.52	18.95	18.51	(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=	1	0.99	0.98	0.93	0.8	0.59	0.41	0.47	0.76	0.96	0.99	1	(94)
--------	---	------	------	------	-----	------	------	------	------	------	------	---	------

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

(95)m=	513.5	592.37	667.79	724.45	682.1	499.86	325.84	342.77	501.71	542.32	500.37	485.37	(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 x [(93)m– (96)m]

(97)m=	1354.25	1315.04	1196.15	1009.99	776.8	514.87	327.48	346.14	555.76	845.27	1123.09	1356.49	(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=	625.52	485.63	393.1	205.59	70.45	0	0	0	0	225.39	448.36	648.12	(98)
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3102.16 (98)

Space heating requirement in kWh/m²/year

33.04 (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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

90 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

625.52	485.63	393.1	205.59	70.45	0	0	0	0	225.39	448.36	648.12
--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------

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

695.02	539.59	436.78	228.43	78.28	0	0	0	0	250.43	498.18	720.13
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 3446.84 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

181.41	159.27	165.79	146.56	142.12	124.85	117.88	132.16	132.82	152.09	163.39	176.35
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Efficiency of water heater

86.7 (216)

(217)m=	89.24	89.16	89	88.6	87.77	86.7	86.7	86.7	86.7	88.64	89.09	89.27	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.29	178.63	186.29	165.42	161.93	144	135.97	152.43	153.19	171.58	183.39	197.54	(219)
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Total = Sum(219a)_{1...12} = 2033.67 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3446.84

Water heating fuel used

2033.67

Electricity for pumps, fans and electric keep-hot

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mechanical ventilation - balanced, extract or positive input from outside		70.61	(230a)
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	145.61	(231)
Electricity for lighting		396.75	(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	=	744.52	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	439.27	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1183.79	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	75.57	(267)
Electricity for lighting	(232) x	0.519	=	205.91	(268)
Total CO2, kg/year			sum of (265)...(271) =	1465.27	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =	15.61	(273)
El rating (section 14)				86	(274)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.12

Property Address: Type C (Plot 8)

Address : Type C (Plot 8)

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.35 (1a)	x	2.5 (2a)	=	100.87 (3a)
First floor	36.07 (1b)	x	2.7 (2b)	=	97.39 (3b)
Second floor	17.47 (1c)	x	2.54 (2c)	=	44.32 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.89 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.59 (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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration	[(9)-1]x0.1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

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

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)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.32 (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

	0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57
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(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	1.2	2.544		(26)
Windows Type 1			4.88	$\times 1/[1/(1.4) + 0.04]$	6.47		(27)
Windows Type 2			7.47	$\times 1/[1/(1.4) + 0.04]$	9.9		(27)
Windows Type 3			1.44	$\times 1/[1/(1.4) + 0.04]$	1.91		(27)
Rooflights			0.59	$\times 1/[1/(1.7) + 0.04]$	1.003		(27b)
Floor			40.35	0.13	5.2455		(28)
Walls Type1	47.71	14.47	33.24	0.18	5.98		(29)
Walls Type2	23.03	0	23.03	0.18	4.15		(29)
Walls Type3	3.97	1.44	2.53	0.18	0.46		(29)
Roof Type1	9.56	0	9.56	0.13	1.24		(30)
Roof Type2	4.28	0	4.28	0.13	0.56		(30)
Roof Type3	18.61	0	18.61	0.13	2.42		(30)
Roof Type4	8.33	0.59	7.74	0.13	1.01		(30)
Roof Type5	1.98	0	1.98	0.13	0.26		(30)
Total area of elements, m²			157.82				(31)
Party wall			122.47	0	0		(32)
Internal wall **			175.53				(32c)

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Internal floor	53.54		(32d)
Internal ceiling	53.54		(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = 43.08 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 22127.27 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) 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 : $S (L \times Y)$ calculated using Appendix K 10.17 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss (33) + (36) = 53.25 (37)

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=	46.59	46.34	46.09	44.91	44.69	43.67	43.67	43.48	44.06	44.69	45.14	45.6	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	99.84	99.58	99.33	98.16	97.94	96.92	96.92	96.73	97.31	97.94	98.38	98.85	
	Average = $\text{Sum}(39)_{1...12} / 12 =$												98.16 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	
	Average = $\text{Sum}(40)_{1...12} / 12 =$												1.05 (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 2.68 (42)

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if $TFA \leq 13.9$, $N = 1$

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$ 97.74 (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=	107.51	103.6	99.69	95.78	91.87	87.96	87.96	91.87	95.78	99.69	103.6	107.51	
	Total = $\text{Sum}(44)_{1...12} =$												1172.86 (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=	159.44	139.45	143.9	125.45	120.37	103.87	96.25	110.45	111.77	130.26	142.19	154.41	
	Total = $\text{Sum}(45)_{1...12} =$												1537.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.92	20.92	21.58	18.82	18.06	15.58	14.44	16.57	16.77	19.54	21.33	23.16	(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:

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a) If manufacturer's declared loss factor is known (kWh/day): (48)

0

Temperature factor from Table 2b

0

Energy lost from water storage, kWh/year (48) x (49) =

0

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

If community heating see section 4.3

Volume factor from Table 2a

0

Temperature factor from Table 2b

0

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0

Enter (50) or (54) in (55)

0

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m

(61)m=

50.96	46.03	50.8	47.24	46.82	43.38	44.83	46.82	47.24	50.8	49.32	50.96
-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(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=

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual)_{1...12} 2112.99 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

65.75	57.87	60.55	53.52	51.73	45.38	43.21	48.43	48.97	56.01	59.61	64.08
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77	133.77

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

22.47	19.95	16.23	12.29	9.18	7.75	8.38	10.89	14.62	18.56	21.66	23.09
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

246.06	248.61	242.17	228.48	211.19	194.93	184.08	181.53	187.96	201.66	218.95	235.2
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38	36.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

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=

-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01	-107.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

88.38	86.12	81.38	74.34	69.53	63.03	58.08	65.09	68.02	75.28	82.79	86.13
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

423.03	420.81	405.91	381.23	356.03	331.85	316.66	323.64	336.72	361.63	389.52	410.55
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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	x	7.47	x	11.28	x	0.63	x	0.7	=	25.76	(75)
Northeast 0.9x	0.77	x	1.44	x	11.28	x	0.63	x	0.7	=	4.97	(75)
Northeast 0.9x	0.77	x	7.47	x	22.97	x	0.63	x	0.7	=	52.43	(75)
Northeast 0.9x	0.77	x	1.44	x	22.97	x	0.63	x	0.7	=	10.11	(75)
Northeast 0.9x	0.77	x	7.47	x	41.38	x	0.63	x	0.7	=	94.46	(75)
Northeast 0.9x	0.77	x	1.44	x	41.38	x	0.63	x	0.7	=	18.21	(75)
Northeast 0.9x	0.77	x	7.47	x	67.96	x	0.63	x	0.7	=	155.14	(75)
Northeast 0.9x	0.77	x	1.44	x	67.96	x	0.63	x	0.7	=	29.91	(75)
Northeast 0.9x	0.77	x	7.47	x	91.35	x	0.63	x	0.7	=	208.54	(75)
Northeast 0.9x	0.77	x	1.44	x	91.35	x	0.63	x	0.7	=	40.2	(75)
Northeast 0.9x	0.77	x	7.47	x	97.38	x	0.63	x	0.7	=	222.32	(75)
Northeast 0.9x	0.77	x	1.44	x	97.38	x	0.63	x	0.7	=	42.86	(75)
Northeast 0.9x	0.77	x	7.47	x	91.1	x	0.63	x	0.7	=	207.98	(75)
Northeast 0.9x	0.77	x	1.44	x	91.1	x	0.63	x	0.7	=	40.09	(75)
Northeast 0.9x	0.77	x	7.47	x	72.63	x	0.63	x	0.7	=	165.8	(75)
Northeast 0.9x	0.77	x	1.44	x	72.63	x	0.63	x	0.7	=	31.96	(75)
Northeast 0.9x	0.77	x	7.47	x	50.42	x	0.63	x	0.7	=	115.11	(75)
Northeast 0.9x	0.77	x	1.44	x	50.42	x	0.63	x	0.7	=	22.19	(75)
Northeast 0.9x	0.77	x	7.47	x	28.07	x	0.63	x	0.7	=	64.08	(75)
Northeast 0.9x	0.77	x	1.44	x	28.07	x	0.63	x	0.7	=	12.35	(75)
Northeast 0.9x	0.77	x	7.47	x	14.2	x	0.63	x	0.7	=	32.41	(75)
Northeast 0.9x	0.77	x	1.44	x	14.2	x	0.63	x	0.7	=	6.25	(75)
Northeast 0.9x	0.77	x	7.47	x	9.21	x	0.63	x	0.7	=	21.04	(75)
Northeast 0.9x	0.77	x	1.44	x	9.21	x	0.63	x	0.7	=	4.06	(75)
Southwest 0.9x	0.77	x	4.88	x	36.79		0.63	x	0.7	=	54.87	(79)
Southwest 0.9x	0.77	x	4.88	x	62.67		0.63	x	0.7	=	93.47	(79)
Southwest 0.9x	0.77	x	4.88	x	85.75		0.63	x	0.7	=	127.89	(79)
Southwest 0.9x	0.77	x	4.88	x	106.25		0.63	x	0.7	=	158.46	(79)
Southwest 0.9x	0.77	x	4.88	x	119.01		0.63	x	0.7	=	177.49	(79)
Southwest 0.9x	0.77	x	4.88	x	118.15		0.63	x	0.7	=	176.21	(79)

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Southwest	0.9x	0.77	x	4.88	x	113.91		0.63	x	0.7	=	169.88	(79)
Southwest	0.9x	0.77	x	4.88	x	104.39		0.63	x	0.7	=	155.69	(79)
Southwest	0.9x	0.77	x	4.88	x	92.85		0.63	x	0.7	=	138.48	(79)
Southwest	0.9x	0.77	x	4.88	x	69.27		0.63	x	0.7	=	103.31	(79)
Southwest	0.9x	0.77	x	4.88	x	44.07		0.63	x	0.7	=	65.73	(79)
Southwest	0.9x	0.77	x	4.88	x	31.49		0.63	x	0.7	=	46.96	(79)
Rooflights	0.9x	1	x	0.59	x	39.98	x	0.63	x	0.7	=	9.36	(82)
Rooflights	0.9x	1	x	0.59	x	73.48	x	0.63	x	0.7	=	17.21	(82)
Rooflights	0.9x	1	x	0.59	x	112.11	x	0.63	x	0.7	=	26.25	(82)
Rooflights	0.9x	1	x	0.59	x	153.81	x	0.63	x	0.7	=	36.02	(82)
Rooflights	0.9x	1	x	0.59	x	182.63	x	0.63	x	0.7	=	42.77	(82)
Rooflights	0.9x	1	x	0.59	x	184.99	x	0.63	x	0.7	=	43.32	(82)
Rooflights	0.9x	1	x	0.59	x	176.88	x	0.63	x	0.7	=	41.42	(82)
Rooflights	0.9x	1	x	0.59	x	155.4	x	0.63	x	0.7	=	36.39	(82)
Rooflights	0.9x	1	x	0.59	x	126.86	x	0.63	x	0.7	=	29.71	(82)
Rooflights	0.9x	1	x	0.59	x	84.6	x	0.63	x	0.7	=	19.81	(82)
Rooflights	0.9x	1	x	0.59	x	48.93	x	0.63	x	0.7	=	11.46	(82)
Rooflights	0.9x	1	x	0.59	x	33.5	x	0.63	x	0.7	=	7.84	(82)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	94.96	173.22	266.82	379.53	468.99	484.71	459.37	389.84	305.48	199.54	115.84	79.89	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	517.99	594.03	672.73	760.75	825.02	816.56	776.04	713.48	642.2	561.17	505.37	490.44	(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)

	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	0.86	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	19.97	20.21	20.54	20.81	20.96	20.99	20.99	20.88	20.52	20.12	19.81	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.04	20.05	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.84	0.63	0.43	0.49	0.8	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	-----	------	---	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.46	18.67	19.02	19.49	19.86	20.03	20.05	20.05	19.95	19.48	18.89	18.43	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.14 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.66	18.86	19.19	19.64	20	20.16	20.19	20.19	20.09	19.63	19.07	18.63	(92)
--------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.66	18.86	19.19	19.64	20	20.16	20.19	20.19	20.09	19.63	19.07	18.63	(93)
--------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.84	0.64	0.45	0.51	0.8	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	-----	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	516.56	590.46	661.82	719.74	691.64	518.99	345.44	361.66	514.67	542.92	502.41	489.43	(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=	1433.63	1389.88	1260.87	1054.69	812.84	539.15	347.81	366.29	582.61	884.47	1177.68	1426.62	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	682.3	537.22	445.7	241.16	90.17	0	0	0	0	254.11	486.2	697.27	(98)
--------	-------	--------	-------	--------	-------	---	---	---	---	--------	-------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3434.13 (98)

Space heating requirement in kWh/m²/year

36.58 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

682.3	537.22	445.7	241.16	90.17	0	0	0	0	254.11	486.2	697.27
-------	--------	-------	--------	-------	---	---	---	---	--------	-------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

730.51	575.18	477.19	258.21	96.55	0	0	0	0	272.07	520.56	746.54
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 3676.79 (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)

210.4	185.47	194.7	172.69	167.19	147.25	141.08	157.27	159.01	181.06	191.5	205.37
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Efficiency of water heater

80.3 (216)

(217)m=	87.8	87.57	87.07	85.89	83.57	80.3	80.3	80.3	80.3	85.9	87.3	87.88	(217)
---------	------	-------	-------	-------	-------	------	------	------	------	------	------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.64	211.79	223.61	201.05	200.06	183.38	175.69	195.85	198.02	210.77	219.37	233.68
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} = 2492.91 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3676.79

Water heating fuel used

2492.91

Electricity for pumps, fans and electric keep-hot

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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		396.75	(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	794.19 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	538.47 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1332.66 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	205.91 (268)
Total CO2, kg/year	sum of (265)...(271) =		1577.49 (272)

TER =

16.8 (273)

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