231 Watford Road
London
HA1 3TU

Energy Strategy Report and Sustainability Statement

ELKOMS Consulting Ltd.

352 Fulham Road
London
SW10 9UH

Tel: 020 8123 8152
bratantic@ elkomsconsulting.com

rev 03
Sep 2021

Contents

Appendices

1.0 Executive Summary

The proposed development project at 231 Watford Road involves the redevelopment of the existing site to create 43 new dwellings arranged across a new build block arranged over ground floor and 4 upper floors.

It has been designed to achieve the highest of environmental performance standards following the Energy Hierarchy as set down by the London Plan and the London Borough of Brent's local plan policies.

The report takes on board the latest GLA guidance on writing energy statements (April 2020) as well as taking into account matters raised with the newly adopted London Plan.

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

A 'Lean, Clean, Green' approach has been adopted and the development achieves an overall improvement (DER/TER) in regulated emissions at over **72.97%** above Part L 2013 standard, through the adoption of high standards of insulation, heat pump driven heating and hot water systems to the flats and a roof mounted PV array.

The adoption of the above strategy, along with a carbon off-set payment of **£35,568.00** for this major scheme will meet with London Plan "Zero Carbon" requirements.

Tables 1 and 2 demonstrate how the Watford Road project complies with the London Plan requirements and the GLA guidance relating to zero carbon development.

Table 1: CO_2 Emissions Breakdown – (figures adjusted to SAP 10)

	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	Regulated	Unregulated
Base Line: (1) Building Regulations 2013 Part L2A Compliant Development (Notional Building)	46.16	19.76
CO2 emissions after energy demand reduction (be lean)	36.71	19.76
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	36.71	19.76
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	12.48	19.76

Table 2 – Regulated Emissions Savings – domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	9.45	20.47
Savings from heat network	0.00	0.00
Savings from renewable energy	24.24	52.50
Total Cumulative Savings	33.69	72.97
	(Tonnes CO_2)	
Carbon Shortfall	12.48	
Cumulative savings for off-set payment	374.4	
Cash-in-lieu Contribution	£35,568.00	

Figure 1 below sets out how the Proposed Development energy efficiency measures and LZC systems reduce CO_2 emissions in line with the London Plan Energy Hierarchy.

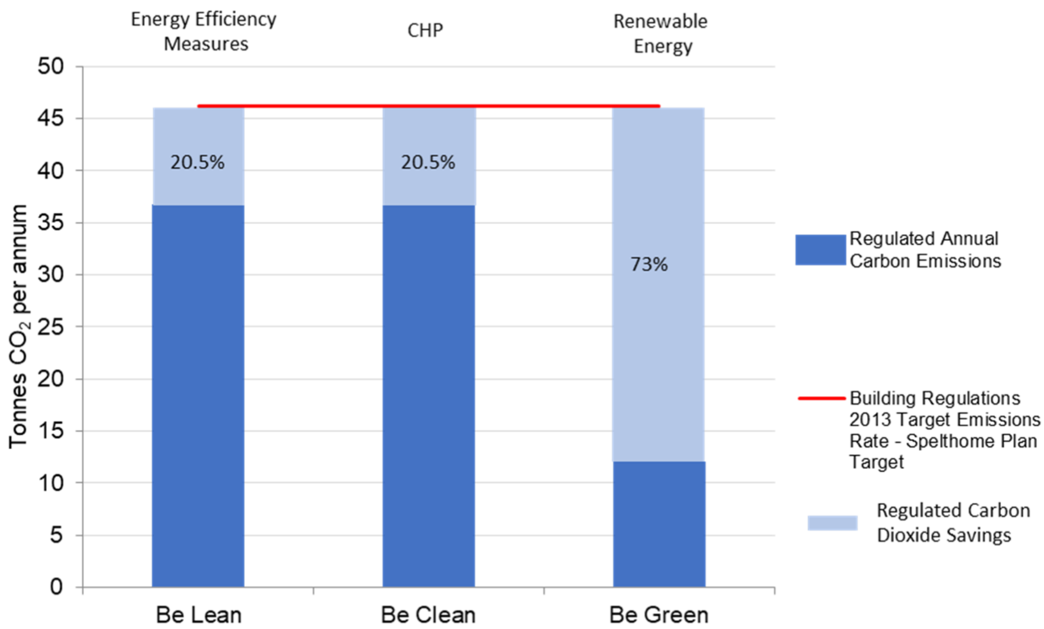


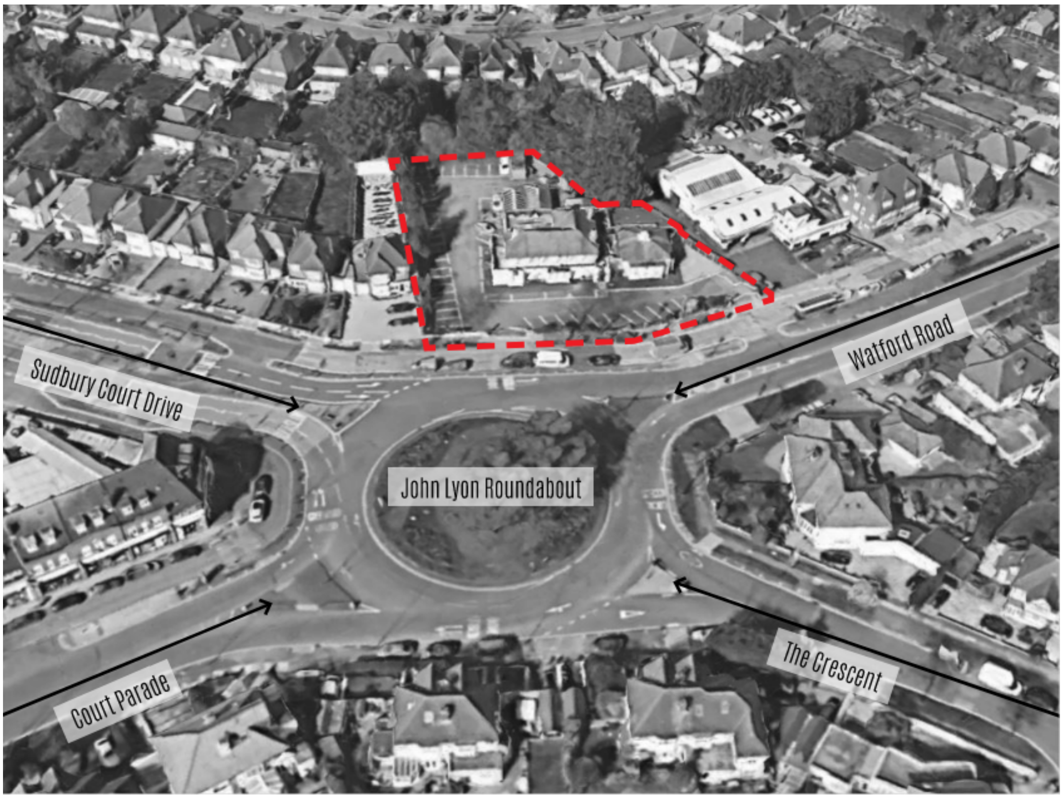
Figure 1: The Site Wide Energy Hierarchy and target

2.0 The Site & Proposal

The site is located in the London Borough of Brent, in front of the John Lyon roundabout and at the junction between Watford Road and Sudbury Court Drive. It is bound by 135 Sudbury Court to the south, Formula One Autocentres to the north and no 15 and 17 Amery Road to the west.

The closest tube and overground station is South Kenton and the site has a PTAL rating of 1b indicating a low level of access to public transport. A few hundred meters north is Northwick Park.

The site comprises an existing restaurant, Mumbai Junction, and its car parking facilities.



The redevelopment proposals are for the demolition of the existing structures to be replaced by a residential development over ground and 4 upper floors with associated parking, cycling and bin storage.

Overall, the proposed scheme will deliver some 43 new flats.

2.1 Local Planning Context

The site sits within the Borough of Brent Council (Brent).

Section 38(6) of the Planning and Compulsory Purchase Act 2004 requires that the determination of planning applications is made in accordance with the Development Plan unless material considerations indicate otherwise.

The Development Plan for the Site comprises:

- The London Plan (2021);
- Brent Core Strategy (2010);
- Brent Development Management Policies (2016); and
- Brent Policies Map.

Other material considerations include the Draft Brent Local Plan – Main Modifications Version (July 2021); the Brent Design Guide SPD (2018); the Brent Residential Extensions and Alterations SPD (2018); the Mayor of London Housing SPG (2016); the Mayor of London Affordable Housing and Viability SPG (2017); the Mayor of London Sustainable Design and Construction SPG (2014); the Mayor of London Play and Informal Recreation SPG (2012); the Mayor of London Character and Context SPG (2014); the National Planning Policy Framework (NPPF) (2021); and the National Planning Practice Guide (NPPG) (2021).

The London Plan (2021)

The London Plan ('LP') was adopted in March 2021 and sets out the spatial development strategy for Greater London.

Key LP policies relevant to the determination of this application are listed below:

- GG1 (Building strong and inclusive communities);
- GG2 (Making the best use of land);
- GG3 (Creating a healthy city);
- GG4 (Delivering the homes Londoners need);
- GG6 (Increasing efficiency and resilience);
- D2 (Infrastructure requirements for sustainable densities);
- D3 (Optimising site capacity through the design-led approach);
- D4 (Delivering good design);
- D5 (Inclusive design);
- D6 (Housing quality and standards);
- D7 (Accessible housing);
- D12 (Fire safety);
- D14 (Noise);
- H1 (Increasing housing supply);
- H4 (Delivering affordable housing);
- H5 (Threshold approach to applications);
- H6 (Affordable housing tenure);
- H7 (Monitoring of affordable housing);
- H10 (Housing size mix);

- S4 (Play and informal recreation);
- HC1 (Heritage conservation and growth);
- Policy G5 (Urban greening);
- G6 (Biodiversity and access to nature);
- G7 (Trees and woodland);
- SI 1 (Improving air quality);
- SI 2 (Minimising greenhouse gas emissions);
- SI 4 (Managing heat risk);
- SI 12 (Flood risk management);
- SI 13 (Sustainable drainage);
- T4 (Assessing and mitigating transport impacts);
- T5 (Cycling);
- T6 (Car parking);
- T6.1 (Residential parking); and
- T7 (Deliveries, servicing and construction).

Brent Core Strategy (2010)

The Brent Core Strategy ('BCS') was adopted in July 2010 and sets out the overarching spatial strategy and key planning policies which will shape new development in the borough.

Key BCS policies relevant to the determination of this application are listed below:

- CP1 (Spatial development strategy);
- CP2 (Population and housing growth);
- CP5 (Placemaking);
- CP6 (Design and density in place shaping);
- CP17 (Protecting and enhancing the suburban character of Brent);
- CP19 (Brent strategic climate change mitigation and adaptation measures); and
- CP21 (A balanced housing stock);

Brent Development Management Policies (2016)

The Brent Development Management Policies ('BDMP') was adopted in November 2016 and contains detailed planning policies which will guide the future development of the Borough.

Key BDMP policies relevant to the determination of this application are listed below:

- DMP 1 (General development management policy);
- DMP 7 (Brent's Heritage Assets);
- DMP 9 A (Managing Flood Risk);
- DMP 9 B (On Site Water Management and Surface Water Attenuation);
- DMP 12 (Parking);
- DMP 15 (Affordable Housing);
- DMP 13 (Movement of Goods and Materials);
- DMP 18 (Dwelling Size and Residential Outbuildings); and
- DMP 19 (Residential Amenity Space);

Draft Brent Local Plan

LBB submitted the Draft Brent Local Plan ('DBLP') for Examination in March 2020 and the Examination Hearings took place during September and October 2020. LBB consulted on the Main Modifications to the DBLP from the 8th July – 19th August 2021. The DBLP is at an advanced stage of preparation and weight can therefore be attached to the draft policies.

Key DBLP policies relevant to the determination of this application are listed below:

- DMP1 (Development management general policy)
- BP4 (North West);
- BD1 (Leading the way in good urban design);
- BH1 (Increasing housing supply in Brent);
- BH5 (Affordable housing);
- BH6 (Housing size mix);
- BH13 (Residential amenity space);
- BHC1 (Brent's heritage assets);
- BGI1 (Green and blue infrastructure in Brent);
- BGI2 (Trees and woodlands);
- BSUI1 (Creating a resilient and efficient Brent);
- BSUI2 (Air quality);
- BSUI3 (Managing flood risk)
- BSUI4 (On-site water management and surface water attenuation);
- BT1 (Sustainable travel choice);
- BT2 (Parking and car free development);

Responding to Climate Change

The Development Management Policies DPD and the Area Action Plan will compliment London Plan policies by establishing requirements for sustainable design and construction techniques that maximise the energy efficiency of new buildings, minimise the use of mains water, minimise carbon dioxide emissions in accordance with the London Plan energy hierarchy, and seek to promote and secure opportunities for decentralised energy, especially within the Brent and Wealdstone Intensification Area, onsite renewable energy generation and urban greening.

Premier House sits within the Brent and Wealdstone Intensification Area.

Brent's Development Management policies were adopted in July 2013.

Section 4 deals with Environmental Sustainability:-

Policy DM 12: Sustainable Design and Layout

A. The design and layout of development proposals should:
a. utilise natural systems such as passive solar design and, wherever possible, incorporate high performing energy retention materials, to supplement the benefits of traditional measures such as insulation and double glazing;
b. make provision for natural ventilation and shading to prevent internal overheating;
c. incorporate techniques that enhance biodiversity, such as green roofs and green walls (such techniques will benefit other sustainability objectives including surface water attenuation and the avoidance of internal and urban overheating); and
d. where relevant, the design and layout of buildings should incorporate measures to mitigate any significant noise or air pollution arising from the future use of the development.

B. Proposals that fail to take reasonable steps to secure a sustainable design and layout of development will be resisted.

C. Appropriate alterations and adaptations that would reduce carbon dioxide emissions from existing homes and non-residential buildings will be supported.

Policy DM 13: Decentralised Energy Systems

A. Proposals for decentralised energy networks will be supported.

B. Development proposals should connect to existing decentralised energy networks where feasible.

Policy DM 14: Renewable Energy Technology

A. Development proposals should incorporate renewable energy technology where feasible.

B. Proposals for appropriate renewable energy technology on existing homes and non-residential buildings will be supported.

2.2 The London Plan

Chapter 9 deals with Sustainable Infrastructure:-

Policy SI1 Improving air quality

A London's air quality should be significantly improved and exposure to poor air quality, especially for vulnerable people, should be reduced:

Development proposals should not:

a) lead to further deterioration of existing poor air quality

b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits

c) reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality

d) create unacceptable risk of high levels of exposure to poor air quality.

5) Air Quality Assessments (AQAs) should be submitted with all major developments, unless they can demonstrate that transport and building emissions will be less than the previous or existing use.

Policy SI2 Minimising greenhouse gas emissions

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

1) Be lean: use less energy and manage demand during construction and operation.

2) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.

3) Be green: generate, store and use renewable energy on-site.

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

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

1) through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or

2) off-site provided that an alternative proposal is identified and delivery is certain.

Policy SI3 Energy infrastructure

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

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

a) connect to local existing or planned heat networks

b) use available local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system)

c) generate clean heat and/or power from zero-emission sources

d) use fuel cells (if using natural gas in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)

e) use low emission combined heat and power (CHP) (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)

f) use ultra-low NOx gas boilers.

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

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

Policy SI4 Managing heat risk

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

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

1) minimise internal heat generation through energy efficient design

2) reduce the amount of heat entering a building through orientation, shading, albedo, fenestration, insulation and the provision of green roofs and walls

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

4) provide passive ventilation

5) provide mechanical ventilation

6) Provide active cooling systems.

Policy SI5 Water infrastructure

C Development proposals should:

1) minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)

2) achieve at least the BREEAM excellent standard (commercial development)

3) be encouraged to incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future proofing.

As a major development scheme, the project at Watford Road will comply with the requirements of the London Plan utilising SAP10 methodology in line with the GLA guidance on the preparation of Energy Statements.

3.0 Baseline energy results

The first stage of the Mayor's Energy Hierarchy is to consider the baseline energy model.

The following section details the baseline energy requirements for the development – the starting point when considering the energy hierarchy.

3.1 New Build Dwellings

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

Table 4 Summary of concurrent notional dwelling specification

Element or System	Values
Opening areas (windows and doors)	Same as actual dwelling up to a maximum proportion of 25% of total floor area [1]
External Walls (including opaque elements of curtain walls) [6]	0.18 W/m²K
Party Walls	0.0 W/m²K
Floor	0.13 W/m²K
Roof	0.13 W/m²K
Windows, roof windows, glazed rooflights and glazed doors	1.4 W/m²K [2] (Whole window U-value)
	g-value = 0.63 [3]
Opaque doors	1.0 W/m²K
Semi glazed doors	1.2 W/m²K
Air tightness	5.0 m³/hr/m²
Linear thermal transmittance	Standardised psi values – See SAP Appendix R, except use of y=0.05 W/m²K if the default value of y=0.15 W/m²K is used in the actual dwelling
Ventilation type	Natural (with extract fans) [4]
Air conditioning	None

Element or System	Values
Heating System	Mains gas If combi boiler in actual dwelling, combi boiler; otherwise regular boiler Radiators
	Room sealed
	Fan flue
	SEDBUK 2009 89.5% efficient
Controls	Time and temperature zone control [5] Weather compensation
	Modulating boiler with interlock
Hot water storage system	Heated by boiler (regular or combi as above) If cylinder specified in actual dwelling, volume of cylinder in actual dwelling. If combi boiler, no cylinder. Otherwise 150 litres. Located in heated space. Thermostat controlled Separate time control for space and water heating
Primary Pipework	Fully Insulated
Hot water cylinder loss factor (if specified)	Declared loss factor equal or better than 0.85 x (0.2 + 0.051 V2/3) kWh/day
Secondary Space Heating	None
Low Energy Lighting	100% Low Energy Lighting
Thermal Mass Parameter	Medium (TMP=250)

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

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

For the project at Watford Road, a sample of 10 apartments has been selected at lower floor, mid floors and top floor to offer a representative selection to enable an accurate figure for emissions/m^2 which can then be applied to the full gross internal residential floor area.

In line with the GLA guidance on the preparation of energy statements, the baseline model will assume the use of a centralised heating and LTHW distribution system.

3.3 Unregulated Energy Use

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

Appliances = $E_A = 207.8 \times (TFA \times N)^{0.4714}$
Cooking = (119 + 24N)/TFA
N = no of occupant SAP table 1B
TFA – Total Floor Areas

The emissions associated with unregulated energy use per sqm is summarised in Table 1 below, with both the SAP2012 and SAP10 levels presented.

Table 3 – Unregulated Energy Use

Unit	CO_2 emissions - Unregulated Energy Use SAP2012 Kg/sqm	CO_2 emissions - Unregulated Energy Use SAP10 Kg/sqm
Sample 1	15.06	6.78
Sample 2	15.60	7.02
Sample 3	15.13	6.81
Sample 4	15.60	7.02
Sample 5	15.31	6.89
Sample 6	15.13	6.81
Sample 7	15.60	7.02
Sample 8	15.31	6.89
Sample 9	15.69	7.06
Sample 10	15.64	7.04

The un-regulated emission rates are added to the baseline regulated emission rates (as calculated under 3.1 above) in order to set the total baseline emission rates before then applying the energy hierarchy in line with The London Plan and Brent policies.

3.3 Baseline Results

The baseline building results have been calculated and are presented in Table 2 below.

The Baseline SAP outputs (which summarise the key data) are attached at **Appendix A**. the SAP10 conversion is attached at **Appendix D.**

Table 4 – Baseline energy consumption and CO2 emissions

Unit	Target Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total baseline emissions Kg/sqm	Total baseline emissions Kg
Sample 1	15.7	6.78	22.50	2256.08
Sample 2	15.2	7.02	22.23	1177.98
Sample 3	17.9	6.81	24.68	2281.36
Sample 4	15.2	7.02	22.23	1177.98
Sample 5	14.3	6.89	21.19	1579.57
Sample 6	15.6	6.81	22.42	2072.62
Sample 7	15.2	7.02	22.23	1177.98
Sample 8	14.3	6.89	21.19	1579.57
Sample 9	19.1	7.06	26.19	1257.25
Sample 10	20.1	7.04	27.12	1366.16
Development Total				**65933**

4.0 Design for energy efficiency

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

This section sets out the measures included within the design of the development, to reduce the demand for energy, both gas and electricity (not including energy from renewable sources). The table at the end of this section details the amount of energy used and CO_2 produced by the building after the energy efficiency measures have been included. From these figures the overall reduction in CO_2 emissions, as a result of passive design measures, can be calculated. To achieve reductions in energy demand the following measures have been included within the design and specification of the building:

4.1 Passive Design

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

Accordingly, designers are to ensure buildings are designed and constructed to be comfortable in higher temperatures, without resorting to energy intensive air conditioning.

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

1. **minimise internal heat generation through energy efficient design**

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

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

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

The development site is within a relatively low-rise townscape, located on the west side of Watford Road and accordingly there is little by way of local topographical shading.

The proposed development has an essentially east-west aspect, but flats have orientation in all directions, however there are very few units with a direct southern aspect.

The livings area have the benefit of large, glazed areas arranged predominantly to the east and west – thus avoiding the peak southern aspect, whilst also introducing natural daylight and attracting useful solar gain.

These same large, glazed area are afforded protection from excessive solar gain during the summer months via the shading offered by the balconies above.

Across the scheme, the glazing to the secondary spaces – bedrooms and bathrooms – is much reduced in keeping with the reduced heat demand associated.

Glazing specification has been a significant consideration as part of the overheating risk mitigation and the specified new glazing will achieve a g-value of 0.55 or better in order to further assist in reducing overheating risk from excessive solar gain.

The top floor units have a higher spec of glazing (g value at circa 0.4) to overcome the lack of shading.

The landscaped grounds and green roof at top floor levels will aid local evaporative cooling.

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

All flats are designed with floor to floor heights at circa 2.6m.

The new build structure is expected to be an RC frame with cast in-situ concrete floors (method of construction to be confirmed), offering very significant thermal mass able to absorb heat during the summer months, which can then be ventilated during the evening or overnight.

4. **passive ventilation**

All glazing is designed to have opening areas to introduce high levels of natural levels of "purge" ventilation to further assist in the reduction of overheating risks in appropriate areas.

4.1 mechanical ventilation

Background ventilation will be provided by MVHR units built in the all-in-one ASHP. These units will incorporate a summer by-pass, which will allow the unit to supply fresh air without heat being transferred from the extract air into the supply air.

4.2 Heating System

All-in-one exhaust and supply air source heat pump which provides heating, ventilation, heat recovery and hot water efficiently. With built-in hot water tank, immersion heater, circulation pump, fans and control system, the heat pump provides source of heat.

The ventilation air's energy is converted to residential heating in a three different circuits. From the outgoing ventilation air (1), heating energy is recovered from the dwelling and transported to the heat pump. The heat pump increases the recovered heat's low temperature to a high temperature in the refrigerant circuit (2). The heat is distributed around the house in the heating medium circuit (3).

4.3 Fabric heat loss

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

- New wall constructions will be of a concrete frame with an insulated panelling and will target a U-Value of 0.16W/m^{2}k or better.
- New flat roof constructions are to be of a warm-roof type, achieving a U-Value of 0.12W/m^{2}k
- The newly laid floors will achieve a minimum u value of 0.14/0.15W/m^{2}k subject to perimeter/area ratios

Glazing

- The new glazing for windows and doors will be triple glazed with an area weighted average U-Value of 1.1W/m^{2}K or better.

Air Tightness

- The project be tested to 3.5m^3/hr/m^2 in line with very best practice for naturally ventilated dwellings.

Construction Details

- Heat loss via non-repeating thermal bridging within the new build elements will be minimised by the use of Accredited Construction Details for these new build units. An overall Y-Value <0.07 is targeted.

- Table5: Passive Elements

Element		Domestic
Floor U - Value (W/m²K)		0.14 – 0.15
Roof U - Value (W/m²K)		0.12
External Walls U - Value (W/m²K)		0.16
Walls between heated spaces (W/m²K)		Solid or Fully filled cavity with sealed edges
Walls between stairs/lifts/risers (W/m²K)		Solid or Fully filled cavity with sealed edges
Walls to unheated spaces (W/m²K)		Solid or Fully filled cavity with sealed edges
Glazing Glazed doors	U-value (W/m²K)	1.1
	G-value	0.4
	Frame type	Metal
	Frame Factor	20%
Opaque Door		1.0 W/m²K
Air permeability (m³/hm² (@ 50Pa)		3.5
Thermal Bridge Specification		Accredited Construction Details

4.4 Ventilation

Background ventilation will be provided by MVHR units built in the all-in-one ASHP. These units will incorporate a summer by-pass, which will allow the unit to supply fresh air without heat being transferred from the extract air into the supply air.

4.5 Lighting and appliances

The development will incorporate high efficiency light fittings utilising LED lamps.

Common/circulation areas will also have an absence detection system to ensure lights cannot be left on when not in occupation.

The use of LED lighting will also minimise the internal gains commonly associated with tungsten and fluorescent lighting systems and thereby further reduce the potential for the flats to overheat.

4.6 Energy efficiency results

The above data has been used to update the SAP models, the SAP2012 Dwelling Emission Rate outputs of which are attached at **Appendix B**.

The SAP 10 emission calculations are attached at **Appendix D.**

Table 6 – Energy Efficient emission levels

Unit	Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total baseline emissions Kg/sqm	Total baseline emissions Kg
Sample 1	12.8	6.78	19.54	1959.60
Sample 2	12.1	7.02	19.10	1011.71
Sample 3	14.8	6.81	21.56	1992.84
Sample 4	12.1	7.02	19.10	1011.71
Sample 5	11.3	6.89	18.19	1356.14
Sample 6	12.4	6.81	19.16	1771.14
Sample 7	12.1	7.02	19.10	1011.71
Sample 8	11.3	6.89	18.19	1356.14
Sample 9	14.6	7.06	21.69	1041.14
Sample 10	15.4	7.04	22.45	1131.18
Development Total				**56481**

The results show that the energy efficiency measures introduced have resulted in the reduction in CO_2 emissions from the development of **14.34%.**

Regulated emissions have been reduced by **20.47%** via the passive design measures highlighted above.

The energy demands of the proposed development are tabulated below.

Table 7– Energy Demand, "Be-Lean"

Building	**Energy demand following energy efficiency measures (Mwh/year)**						
	Space Heating	Hot Water	Lighting	Cooling	Auxiliary	Unregulated electricity	Unregulated gas
Watford Road	87573	53373	13465	N/A	N/A	50.21	N/A

5.0 Supplying Energy Efficiently

5.1 Community Heating/Combined Heat and Power (CHP)

The London Plan, Chapter 9, requires that major developments exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.

Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.

Therefore, this report must consider the availability of heat networks in the Brent area.

The extract from the London Heat Map (reproduced below) identifies that the site is not within a heat map study area, but is within a Heat Network Priority Area.

Extract from London Heat Map

Clearly, there is a longer term opportunity for the Watford Road project to connect to a DEN, so consideration has to be given to the potential to connect to a DEN.

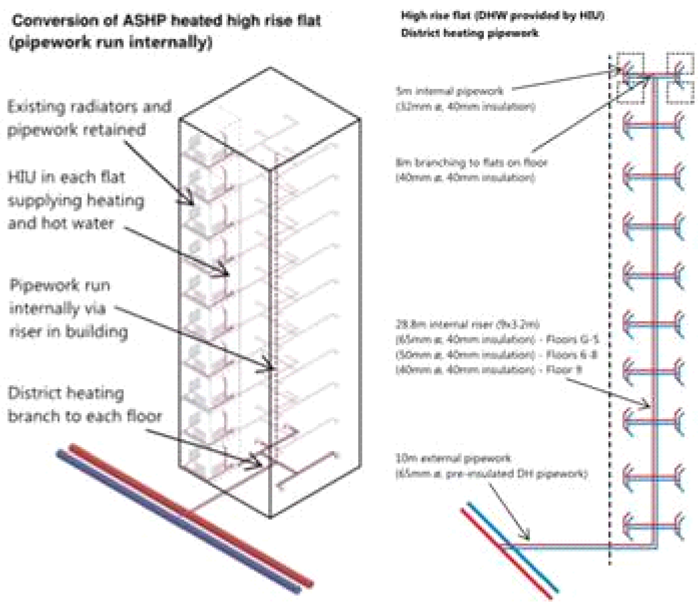
The possibility for the connection to DH network is taken into consideration within the space provision. The design safeguarding an identified route from the plant room to the property boundary at ground floor level, roadway or similar for flow and return pipes to enable connection to a future area wide DEN.

New developments where the detailed connection arrangement to a DEN is unknown, require physical space to be allocated for installation of heat exchangers and any other equipment required to allow connection.

The DHW demand can be met via a packaged skid with dimension at 1.5m x 0.5m x 2.0m (h). With an allowance for a 1m servicing area around the unit, the drawings demonstrate an allocated plantroom is provided for future DH connections.

As there is no district heating network immediately planned or feasible, a apartment air source heat pumps are proposed for space heating and hot water production. As detailed in the Be Green stage the system will incorporate air source heat pumps technology to maximise efficiency.

If district heating is connected to the building in the future, the individual ASHP and domestic hot water cylinder could be replaced with a new HIU in each apartment, providing heat to the existing underfloor heating manifold network, as well as instantaneous hot water.



In the meantime, in the medium term, the design team have considered decentralised stand-alone Air Source Heat Pumps system.

The proposed solution provides benefit for the tenants such as; standalone systems not require central energy metering and billing system.

The proposed system does not require centralised landlords equipment and relieves roof space to maximise installation of the PV systems.

The system is significantly more efficient than district heating energy network and has negligible distribution losses. The key advantages over DHEN is shown in the table below:

Table 8– Stand Alone ASHP vs DHEN

	Stand Alone Air Source Heat Pump Nibe F730	District Heating Energy Network DHEN
Efficiency COP (coefficient of performance)	2.4-5.3	0.6-0.7 (CHP) (Dependant of the District Heating Network leading Source)
Energy Distribution losses	none	15-50% distribution losses subject to the pipework lengths
CO2 reduction	73 % over Part L	Dependant of the District Heating Network Source. If CHP led DHEL is unlikely to pass Part L under SAP10 Assessment
Billing system required	No	Yes (Heat meters required for each apartment)
Means of paying the bills	Through electricity bill	Electricity paid by landlord, cost passed to tenant based on energy meter readings

5.2 On-site CHP/Community Heating

A community heating network comprises a series of insulated pipes used to deliver heat, in the form of hot water or steam, to a number of different locations or dwellings. They range from small, providing heat to a house and a couple of holiday cottages for example, to large scale systems supplying housing estates or blocks of flats.

The heat production facility for a community scheme is generally considered to include heat only boilers (HOB) and/or the production of both electricity and heat i.e. CHP.

CHP systems are essentially biomass or fossil fuel fired electricity generators that use the heat by-product to provide space and water heating. The electricity generated can be used directly within the host buildings or sold to electricity suppliers on the national grid.

CHP is, as a rule of thumb, is only operated as a base load as, depending on the technology, it may be difficult and/or inefficient to operate according to daily variations in demand. In a well-designed district heating network heat from CHP will provide between 60% and 80%

of the annual baseline heat (heating and hot water) requirement with heat-only boiler plants providing the peak load and back-up.

To maximise efficiency of the engine it needs to run for at least 17 hours a day; therefore, the heat load needs to be present for this period.

Clearly, as a domestic development, with only the limited year round DHW demand to support a CHP installation (only 2-4 hours per day in the May – October period), the economy of scale, in terms of year-round demand, simply isn't present and as such the potential use of on-site CHP is very limited.

We must also consider the net carbon benefits from such a system as the de-carbonisation of national grid dilutes the benefits obtained from the higher efficiency of larger-scale CHP led system.

Reference is made to the latest CIBSE Symposium on the topic; "An operational lifetime assessment of the carbon performance of gas fired CHP led district heating" (2016).
This paper sets out a calculation methodology to determine the greenhouse gas emissions associated with district heat networks which use gas fired CHP as a heat source.

Currently, Part L calculations and CHP emissions savings are based on the grid based emission rate taken from the SAP 2012 3-year average - 519g/kWhCO2; SAP 2012 introduced a 15-year average at 381g/kWhCO2 to assist designers considering the longer term impacts.

Such a difference will markedly affect the relative calculated performance of a gas CHP engine versus a gas boiler, particularly if any community network losses are removed from the equation through the use of localised boilers.

The CIBSE paper further advises that "Using a typical good practice assumption of 40% thermal efficiency of the CHP, the threshold for net benefit is a grid carbon factor of around 338 gCO2/kWh. Below that threshold, CHP is found to be worse than a gas boiler and grid electricity."

DECC provides data for treating energy and emissions in their guidance; this provides projections of grid emissions factors over the next 85 years. With the rapid and recent introduction of renewable technologies to the grid – wind power and PV - DECC's "Green Book" guidance projects that grid carbon intensity will reach 338 gCO2/kWh by 2017/18 and will reach 300gCO_2/kWh by 2018/19.

This report is based upon the SAP10 figure of 233gCO2/kWh, and it is acknowledged that the carbon content of grid electricity is steadily reducing.

So it can be surmised, that by the time an CHP led community network at Watford Road has reached maturity in 2 or 3 years, the carbon benefits will already have been lost.

However, this report must also consider the potential for heat only boilers to drive a community heating system; in more recent times, the difference between the actual and assumed efficiency of DH networks has come under the spotlight from a number of different sources.

Indeed, in a recent studies collated by Innovate UK in the Building Data Exchange, inappropriately installed community heating systems were suffering heat losses of 50% or more.

However, when it comes to small scale networks as least, it is becoming very apparent that there is a difference between theoretical and real-world system efficiencies.

In the CBSE Technical symposium "CHP and District Heating - how efficient are these technologies?" (2011), further commentary is made on this issue.

This paper defines an 'equivalent heat efficiency' parameter and a CO_2 content of heat supply to enable Combined Heat and Power (CHP) to be compared to boilers and heat pumps

This report identifies and acknowledge that the heat losses within a well-designed DH network will be at minimum of 15%, so immediately it can be seen that, a large scale modular boiler system offering gross efficiencies at circa 96%, will be less efficient than a local condensing boiler with a gross efficiency of 92%-93% at point of delivery.

It can be summarised, an a medium scale scheme with limited DEN potential connection potential, the installation of a centralised LTHW system would be counterproductive, with year on year heat losses outweighing the less then certain potential connection to a low carbon DEN.

6.0 Renewable Energy Options

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

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

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

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

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

6.1 Government incentives

6.1.1 Renewable Heat Incentive

New applications for the Renewable Heat Incentive (RHI) for commercial development were withdrawn on 31st March 2021.

6.2 Wind turbines

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

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

- Wind speed
- Wind turbulence

- Visual impact
- Noise impact
- Impact upon ecology

The availability and consistency of wind in urban environments is largely dependent upon the proximity, scale and orientation of surrounding obstructions. To receive practical amounts of non-turbulent wind, the blades of a wind turbine would need to be placed significantly above the roof level of the proposed project at Watford Road itself, standing some 30m + above ground floor level.

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

6.3 Solar Energy

The proposed development has areas of low pitched roof that could accommodate solar panels orientated to the south.

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

6.3.1 Solar water heating

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

Both collector types can capture heat whether the sky is overcast or clear. Depending on location, approximately 900–1100 kWh of solar energy falls on each m^2 of unshaded UK roof surface annually. The usable energy output per m^2 of solar panel as a result of this amount of insolation ranges from between 380 – 550 kWh/yr.

Solar hot water systems are of course, displacing gas for DHW provision (as noted above), and due to the low cost of gas as a source of energy, solar thermal systems tend to have a very poor pay back model unless there is a reliable and consultant demand for hot water; a medium size residential scheme simply does not provide this

Accordingly, given the limited roof space available and the strategy to off-set the electrical use, solar PV may be a stronger candidate (see below) and offer a greater return in terms of a return on investment.

6.3.2 Photovoltaics (PV)

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

Despite the withdrawal of the Feed in Tariff, the returns on PV installations are still able to achieve 3-4% returns via the reduction in electricity consumption.

Accordingly, the design team are proposing to utilise the significant roof space to accommodate 106 x 330W PV panels – a total array at 34.98kWp.

The array will produce some 39,000kWh/annum, off-setting a further 9.13 tonnes of CO_2/annum (SAP10 emission levels).

6.4 Biomass heating

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

Biomass heating systems require space to site a boiler and fuel hopper along with a supply of fuel – which can be very bulky items. There also needs to be a local source of biomass fuel that can be delivered on a regular basis. There are also issues with fuel storage and delivery which mitigate against this technology.

Additionally, a boiler of this type would replace the need for a conventional gas boiler and therefore offset all the gas energy typically used for space and water heating. However, biomass releases high levels of NO_x emissions and particulate matters, as well as other pollutants and would therefore have to be considered carefully against the high standard of air quality requirements within Brent's Borough wide AQMA. Accordingly, the use of biomass is not considered appropriate for this project.

6.6 Ground source heat pump

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

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

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

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

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

Clearly, there is insufficient land area to install low level collector loops, leaving deep bore GSHP as the only potential option.

Normally the boreholes would need to be 6 to 8 metres apart and a 100-metre-deep borehole will only provide about 5kw of heat. The borehole should also be formed around 3m away from the perimeter of the building and most specialists don't recommend using the structural boreholes.

Clearly, in the case of the proposed development, there is little scope for the locating of the ground collector devices and as such, ground source heating cannot be considered.

6.7 Air source heat pump

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

It must be remembered that heat pumps utilise grid based electricity and the associated emissions, so that actual the reduction in emissions can be limited. Assuming a seasonal system efficiency of 320% (Coefficient of Performance of 3.2) and that the air source heat pump will replace 100% of the space heating/hot water demand, then the system would reduce the overall CO_2 emissions by approximately 60%. The table below demonstrates, on the assumption of a demand of 1000kWh/year for heating and hot water.

Table 9 – Air Source Heat Pump Performance

Type of Array	Energy Consumption (kWh/yr.)	Emission factor (SAP10) ($kgCO_2/h$)	Total CO_2 emissions (kg/annum)
90% efficient gas boiler	11111	0.210	2333
320% efficient ASHP	2813	0.233	655
100% efficient immersion (back-up)	1000	0.233	233

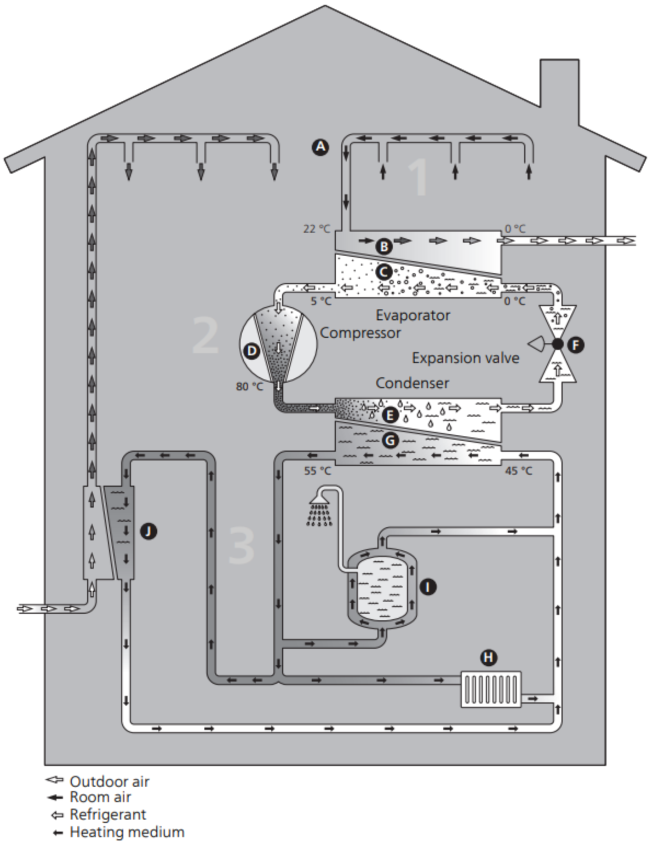
A theoretical carbon saving of 62%

Accordingly, the design team are proposing to utilise NIBE Fighter heat pump systems, providing heating and how water to individual flats, via a heat exchange process with the exhausted internal air, with fresh external make-up air drawn in via wall mounted vents.

Because of the enhanced ventilation systems, the flats are able to air test down to levels below that normally associated with naturally ventilated units.

NIBE F730

All-in-one exhaust and supply air source heat pump which provides heating, ventilation, heat recovery and hot water efficiently. With built-in hot water tank, immersion heater, circulation pump, fans and control system, the heat pump provides source of heat.
The ventilation air's energy is converted to residential heating in three different circuits. From the outgoing ventilation air (1), heating energy is recovered from the dwelling and transported to the heat pump. The heat pump increases the recovered heat's low temperature to a high temperature in the refrigerant circuit (2). The heat is distributed around the house in the heating medium circuit (3).



Ventilation air

A. The hot air is transferred from the rooms to the heat pump via the house ventilation system.

B. The fan then routes the air to the heat pump's evaporator. Here, the air releases the heating energy and the air's temperature drops significantly. The cold air is then blown out of the house.

Refrigerant circuit

C. A liquid, a refrigerant, circulates in a closed system in the heat pump which also passes the evaporator. The refrigerant has a very low boiling point. In the evaporator the refrigerant receives the heat energy from the ventilation air and starts to boil.

D. The gas that is produced during boiling is routed into an electrically powered compressor. When the gas is compressed, the pressure increases and the gas's temperature increases considerably, from approx. 5°C to approx. 80°C.

E. From the compressor, the gas is forced into a heat exchanger, condenser, where it releases heat energy to the heat pump’s heating section, whereupon the gas is cooled and condenses to liquid form again.

F. As the pressure is still high, the refrigerant can pass an expansion valve, where the pressure drops so that the refrigerant returns to its original temperature. The refrigerant has now completed a full cycle. It is routed to the evaporator again and the process is repeated.

Heat medium circuit

G. The heat energy that the refrigerant produces in the condenser is retrieved by the climate system's water, heating medium, which is heated to 35 °C (supply temperature).

H. The hot water circulates in a closed system and is pumped out to the radiators/heating coils of the house.

I. The heat pump’s integrated water heater is in the heating section. The heating medium heats the hot water.

Pre-heated supply air

J. The hot water also circulates to the heat pump’s supply air coil. The supply air coil heats up the air that is blown out into the rooms that have supply air inlets.

6.8 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the above noted NIBE heat pump system to generate the heating and hot water systems for the flats and a 106 panel roof mounted PV array to utilise the available roof space.

The final table – Table 6 – summarises the final outputs from the SAP models; attached at **Appendix C.** The SAP 10 emission calculations are attached at **Appendix D.**

Table 10 – "Be Green" emission levels

Unit	Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total baseline emissions Kg/sqm	Total baseline emissions Kg
Sample 1	4.7	6.78	11.46	1149.67
Sample 2	3.5	7.02	10.57	559.76
Sample 3	5.6	6.81	12.45	1151.13
Sample 4	3.5	7.02	10.57	559.76
Sample 5	3.6	6.89	10.51	783.87
Sample 6	4.7	6.81	11.51	1063.59
Sample 7	3.5	7.02	10.57	559.76
Sample 8	3.6	6.89	10.51	783.87
Sample 9	4.7	7.06	11.73	562.94
Sample 10	5.2	7.04	12.21	614.92
Development Total				**32246**

The data at Table 5 confirms that overall emissions – including unregulated energy use - have been reduced by **51.09%** over and above the baseline model, with a **42.91%** reduction in emissions directly from the use of energy generating and renewable technologies, i.e. over and above the energy efficient model.

Excluding the un-regulated use, i.e. considering emissions controlled under AD Part L, then the final reduction in DER/TER equates to **72.97%.**

7.0 Sustainable Design & Construction

The Sustainability credentials of the proposed residential development are set out below; based on the assessment criteria developed by the Building Research Establishment

Materials

New build construction techniques will be considered against the BRE Green Guide to ensure that, where practical, the most environmentally friendly construction techniques are deployed.

Construction materials will be sourced from suppliers capable of demonstrating a culture of responsible sourcing via environmental management certification, such as BES6001

Insulation materials will be selected that demonstrate the use of blowing agents with a low global warming potential, specifically, a rating of 5 or less. Additionally, all insulants used will demonstrate responsible sourcing of material and key processes.

The principle contractor with be required to produce a site waste management plan and sustainable procure plan, in line with BREEAM requirements – this will include a pre-demolition audit to identify demolition materials to reuse on-site or salvage appropriate materials to enable their reuse or recycling off-site. The procurement plan will follow the waste hierarchy Reduce; Reuse & Recycle.

A Site Waste Management Plan (SWMP) will be developed prior to commencement of development stage to inform the adoption of good practice waste minimisation in design. This will set targets to minimise the generation of non-hazardous construction waste using the sustainable procurement plan to avoid over-ordering and to use just-in-time delivery policies.

Operational waste and recycling – appropriate internal and external storage space will be provided to ensure that residents can sort, store and dispose of waste and recyclable materials in line with Brent’s collection policies.

Pollution

The contractor will also monitor the use of energy and water use during the construction phase and incorporate best site practices to reduce the potential for air (dust) and ground water pollution.

The completed dwellings will use zero emission heat pump systems for heating and hot water.

The main contractor will be required to register the site with the Considerate Constructors Scheme and achieve a best practice score of 25 or more.

To void the issue of noise pollution, the development will comply with Building Regulations Part E, providing a good level of sound insulation between the proposed development and surrounding buildings.

Energy

The dwelling will incorporate renewables technologies as noted in the main report above.

The new homes will also be supplied with a Home User Guide offering practical advice on how to use the home economically and efficiently, including specific advise on how to reduce unregulated energy uses.

This will be further enhanced by the installation of smart energy metering, enabling occupants to accurately assess their energy usage and thereby, manage it.

Water

The development minimise water use as far as practicable by incorporating appropriate water efficiency and water recycling measures. The applicants will ensure that all dwellings meet the required level of 105 litres maximum daily allowable usage per person in accordance with Level 4 of the Code for Sustainable Homes.

Sustainable Urban Drainage (SuDs)

The existing site is currently made up entirely of building and hard surfaces. Accordingly, the introduction of new planted areas and green roof areas will help to reduce the levels of surface water run-off.

A formal flood risk assessment and SuDs strategy is submitted under separate cover.

Ecology and Biodiversity

Clearly, the existing site is 100% previously developed, so any improvement on this situation would increase biodiversity.

The development would employ an ecologist to consider the planting regime for the communal landscaped areas and an overall improvement in the levels of fauna and flora utilising indigenous species where possible and appropriate.

8.0 Conclusions

This report has detailed the baseline energy requirements for the proposed development, the reduction in energy demand as a result of energy efficiency measures and the potential to achieve further CO_2 reductions using renewable energy technologies.

The baseline results have shown that if the development was built to a standard to meet only the minimum requirements of current building regulations, the total amount of CO_2 emissions would be **65933Kg/year**.

Following the introduction of passive energy efficiency measures into the development, as detailed in section 4, the total amount of CO_2 emissions would be reduced to **56481Kg/year**

There is also a requirement to reduce CO_2 emissions across the development using renewable or low-carbon energy sources. Therefore, the report has considered the feasibility of the following technologies:

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

The results of the assessment of suitable technologies relative to the nature, locations and type of development suggest that the most suitable solution to meeting reduction in CO_2 emissions would be via the generation of electricity on site via an 44.81kWp PV array, with the development's heat generated via exhaust air source heat pump technology.

This has been used in the SAP models (reproduced at **Appendix C**) for the development. The SAP 10 emission calculations are attached at **Appendix D,** which have also been detailed above in Table 6, which show a final gross emission level of **32246Kg/year**, representing a total reduction in emission over the baseline model, taking into account unregulated energy, of **51.09%.**

In addition, the final SAP outputs at Appendix C demonstrate that the building achieves an overall improvement in regulated emissions over the Building Regulations Part L standards for regulated emissions of minimum of 72.97%.

Tables 11 & 12 Demonstrate how the Watford Road project complies with the London Plan requirements and the GLA guidance relating to zero carbon development.

Table 11 – Carbon Emission Reductions – Domestic Buildings

	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	Regulated	Unregulated
Base Line: (1) Building Regulations 2013 Part L2A Compliant Development (Notional Building)	46.16	19.76
CO2 emissions after energy demand reduction (be lean)	36.71	19.76
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	36.71	19.76
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	12.48	19.76

Table 12 – Regulated Emissions Savings – domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	9.45	20.47
Savings from heat network	0.00	0.00
Savings from renewable energy	24.24	52.50
Total Cumulative Savings	33.69	72.97
	(Tonnes CO_2)	
Carbon Shortfall	12.48	
Cumulative savings for off-set payment	374.4	
Cash-in-lieu Contribution	£35,568	

Figure 1 below sets out how the Proposed Development energy efficiency measures and LZC systems reduce CO_2 emissions in line with the London Plan Energy Hierarchy.

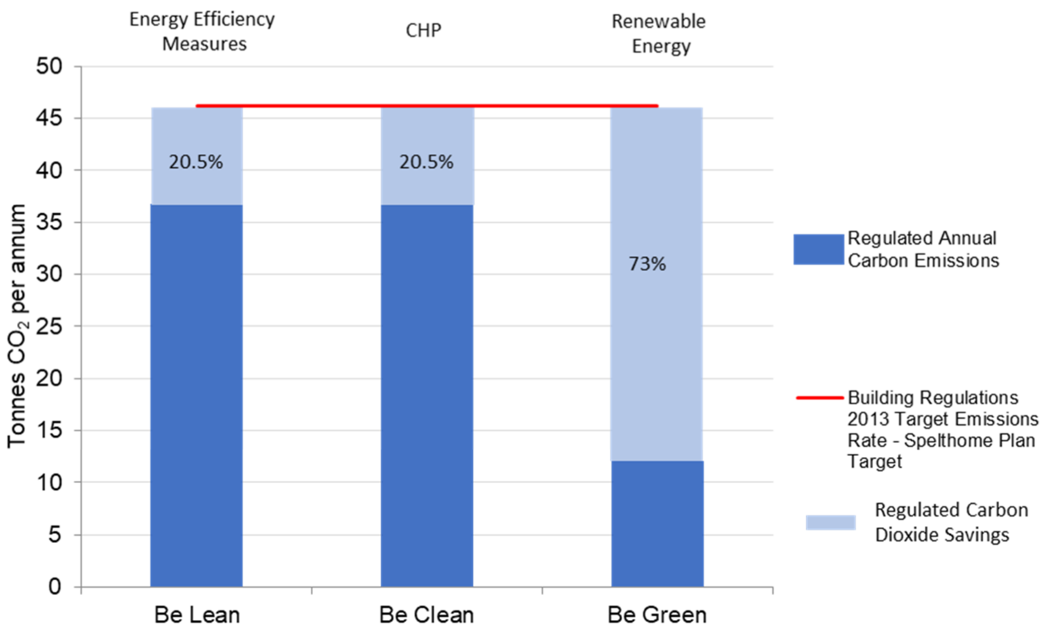


Figure 1: The Site Wide Energy Hierarchy and target

Appendix A

Baseline/Un-regulated Energy Use:-

SAP Outputs & Target Emission Rates

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:12

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 100.28m²

Site Reference : 231 Watford Road - BASE **Plot Reference:** Sample 1

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	17.55 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.85 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	44.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Combi boiler
Efficiency 89.5 % SEDBUK2009
Minimum 88.0 % OK

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: South East	15.34m²
Windows facing: South West	1.28m²
Ventilation rate:	3.00

10 Key features

Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	100.28	(1a) x	2.75	(2a) =	275.77	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.28	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	275.77	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.15	(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)	0.4	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

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

0.5	0.49	0.48	0.43	0.42	0.38	0.38	0.37	0.4	0.42	0.44	0.46

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=	0.63	0.62	0.62	0.59	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

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

(25)m=	0.63	0.62	0.62	0.59	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.34	x1/[1/(1.4)+ 0.04]	=	20.34			(27)
Windows Type 2			1.28	x1/[1/(1.4)+ 0.04]	=	1.7			(27)
Floor			100.28	x 0.13	=	13.0364			(28)
Walls Type1	68.22	16.62	51.6	x 0.18	=	9.29			(29)
Walls Type2	43.24	0	43.24	x 0.18	=	7.78			(29)
Total area of elements, m²			211.74						(31)
Party wall			15.21	x 0	=	0			(32)
Party ceiling			100.28						(32b)
Internal wall **			175.18						(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 52.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21990.67 (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 13.5 (36)

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

Total fabric heat loss (33) + (36) = 65.64 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	57.05	56.6	56.16	54.09	53.71	51.91	51.91	51.58	52.6	53.71	54.49	55.31	(38)

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

(39)m=	122.68	122.23	121.8	119.73	119.35	117.55	117.55	117.22	118.24	119.35	120.13	120.94	

Average = Sum(39)$_{1…12}$ /12= 119.73 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	1.22	1.22	1.21	1.19	1.19	1.17	1.17	1.17	1.18	1.19	1.2	1.21		
										Average = Sum(40)$_{1…12}$ /12=			1.19	(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 2.74 (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 99.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	109.26	105.28	101.31	97.34	93.37	89.39	89.39	93.37	97.34	101.31	105.28	109.26		
										Total = Sum(44)$_{1…12}$ =			1191.9	(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=	162.03	141.71	146.23	127.49	122.33	105.56	97.82	112.25	113.59	132.37	144.5	156.91		
										Total = Sum(45)$_{1…12}$ =			1562.77	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	24.3	21.26	21.93	19.12	18.35	15.83	14.67	16.84	17.04	19.86	21.67	23.54		(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

TER WorkSheet: New dwelling design stage

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

(61)m=	50.96	46.03	50.96	48	47.58	44.08	45.55	47.58	48	50.96	49.32	50.96	(61)

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

(62)m=	212.98	187.74	197.19	175.49	169.91	149.64	143.37	159.82	161.59	183.33	193.81	207.87	(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=	212.98	187.74	197.19	175.49	169.91	149.64	143.37	159.82	161.59	183.33	193.81	207.87	

Output from water heater (annual)$_{1...12}$ 2142.74 (64)

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

(65)m=	66.61	58.62	61.36	54.39	52.57	46.12	43.91	49.22	49.77	56.75	60.37	64.91	(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):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.72	21.07	17.13	12.97	9.7	8.19	8.85	11.5	15.43	19.59	22.87	24.38	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	256.78	259.44	252.73	238.43	220.39	203.43	192.1	189.44	196.15	210.45	228.49	245.45	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	(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=	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	(71)
Water heating gains (Table 5)													
(72)m=	89.53	87.24	82.48	75.54	70.66	64.05	59.02	66.15	69.12	76.28	83.85	87.25	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	437.17	434.88	419.47	394.08	367.87	342.8	327.1	334.22	347.84	373.45	402.34	424.21	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	15.34	x	36.79	x	0.63	x	0.7	=	172.49	(77)
Southeast 0.9x	0.77	x	15.34	x	62.67	x	0.63	x	0.7	=	293.82	(77)
Southeast 0.9x	0.77	x	15.34	x	85.75	x	0.63	x	0.7	=	402.02	(77)
Southeast 0.9x	0.77	x	15.34	x	106.25	x	0.63	x	0.7	=	498.12	(77)
Southeast 0.9x	0.77	x	15.34	x	119.01	x	0.63	x	0.7	=	557.93	(77)

TER WorkSheet: New dwelling design stage

Southeast	0.9x	0.77	x	15.34	x	118.15	x	0.63	x	0.7	=	553.9	(77)
Southeast	0.9x	0.77	x	15.34	x	113.91	x	0.63	x	0.7	=	534.02	(77)
Southeast	0.9x	0.77	x	15.34	x	104.39	x	0.63	x	0.7	=	489.39	(77)
Southeast	0.9x	0.77	x	15.34	x	92.85	x	0.63	x	0.7	=	435.3	(77)
Southeast	0.9x	0.77	x	15.34	x	69.27	x	0.63	x	0.7	=	324.73	(77)
Southeast	0.9x	0.77	x	15.34	x	44.07	x	0.63	x	0.7	=	206.61	(77)
Southeast	0.9x	0.77	x	15.34	x	31.49	x	0.63	x	0.7	=	147.62	(77)
Southwest	0.9x	0.77	x	1.28	x	36.79		0.63	x	0.7	=	14.39	(79)
Southwest	0.9x	0.77	x	1.28	x	62.67		0.63	x	0.7	=	24.52	(79)
Southwest	0.9x	0.77	x	1.28	x	85.75		0.63	x	0.7	=	33.55	(79)
Southwest	0.9x	0.77	x	1.28	x	106.25		0.63	x	0.7	=	41.56	(79)
Southwest	0.9x	0.77	x	1.28	x	119.01		0.63	x	0.7	=	46.56	(79)
Southwest	0.9x	0.77	x	1.28	x	118.15		0.63	x	0.7	=	46.22	(79)
Southwest	0.9x	0.77	x	1.28	x	113.91		0.63	x	0.7	=	44.56	(79)
Southwest	0.9x	0.77	x	1.28	x	104.39		0.63	x	0.7	=	40.84	(79)
Southwest	0.9x	0.77	x	1.28	x	92.85		0.63	x	0.7	=	36.32	(79)
Southwest	0.9x	0.77	x	1.28	x	69.27		0.63	x	0.7	=	27.1	(79)
Southwest	0.9x	0.77	x	1.28	x	44.07		0.63	x	0.7	=	17.24	(79)
Southwest	0.9x	0.77	x	1.28	x	31.49		0.63	x	0.7	=	12.32	(79)

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

(83)m=	186.89	318.34	435.56	539.68	604.49	600.12	578.58	530.23	471.62	351.83	223.85	159.94	(83)

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

(84)m=	624.05	753.22	855.03	933.76	972.36	942.92	905.68	864.45	819.46	725.28	626.19	584.15	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.88	0.73	0.56	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=	19.68	19.87	20.14	20.48	20.76	20.94	20.99	20.98	20.87	20.5	20.03	19.66	(87)

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

(88)m=	19.9	19.9	19.91	19.92	19.93	19.94	19.94	19.94	19.94	19.93	19.92	19.92	(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	0.47	0.75	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=	18.15	18.43	18.83	19.32	19.7	19.9	19.94	19.94	19.84	19.35	18.67	18.13	(90)

fLA = Living area ÷ (4) = 0.23 (91)

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

(92)m=	18.51	18.77	19.13	19.59	19.94	20.14	20.18	20.18	20.08	19.62	18.99	18.48	(92)

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

(93)m=	18.51	18.77	19.13	19.59	19.94	20.14	20.18	20.18	20.08	19.62	18.99	18.48	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.93	0.84	0.65	0.46	0.5	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	621.1	744.6	831.79	869.44	811.97	615.04	415.8	435.01	626.46	687.25	619.77	582.11	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1743.03	1694.96	1538.74	1279.93	983.81	651.33	420.94	443	706.78	1076.44	1427.95	1727.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	834.71	638.64	525.97	295.55	127.85	0	0	0	0	289.55	581.9	851.96	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4146.15 (98)

Space heating requirement in kWh/m²/year 41.35 (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)													
	834.71	638.64	525.97	295.55	127.85	0	0	0	0	289.55	581.9	851.96	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	893.7	683.77	563.14	316.44	136.89	0	0	0	0	310.01	623.01	912.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4439.13 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

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

Water heating

Output from water heater (calculated above)													
	212.98	187.74	197.19	175.49	169.91	149.64	143.37	159.82	161.59	183.33	193.81	207.87	
Efficiency of water heater												80.3	(216)
(217)m=	88.15	87.89	87.4	86.35	84.35	80.3	80.3	80.3	80.3	86.2	87.65	88.22	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	241.63	213.61	225.61	203.22	201.44	186.35	178.54	199.03	201.23	212.69	221.13	235.62	

Total = Sum(219a)$_{1...12}$ = 2520.11 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4439.13

TER WorkSheet: New dwelling design stage

Water heating fuel used			2520.11	
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			418.92	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			7453.16	(338)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	958.85	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1503.19	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	217.42	(268)
Total CO2, kg/year			sum of (265)…(271) =		1759.54	(272)

TER =	17.55	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:10

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 52.98m²

Site Reference : 231 Watford Road - BASE **Plot Reference:** Sample 2

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	17.47 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.07 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South East	6.39m²
Ventilation rate:	6.00

10 Key features

Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.98	(1a) x	2.75	(2a) =	145.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	145.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(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)	0.39	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

TER WorkSheet: New dwelling design stage

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

0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			6.39	x1/[1/(1.4)+ 0.04]		=	8.47			(27)
Walls Type1	22.17	6.39	15.78	x	0.18	=	2.84			(29)
Walls Type2	17.22	0	17.22	x	0.18	=	3.1			(29)
Total area of elements, m²			39.39							(31)
Party wall			46.48	x	0	=	0			(32)
Party floor			52.98							(32a)
Party ceiling			52.98							(32b)
Internal wall **			97.63							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 14.41 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8658.87 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 5.71 (36)

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

Total fabric heat loss (33) + (36) = 20.13 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.67	29.45	28.4	28.21	27.29	27.29	27.12	27.65	28.21	28.6	29.02	(38)

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

(39)m=	50.03	49.8	49.58	48.53	48.33	47.42	47.42	47.25	47.77	48.33	48.73	49.14	

Average = Sum(39)$_{1…12}$ /12= 48.53 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	0.94	0.94	0.94	0.92	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.93

Average = Sum(40)$_{1...12}$ /12= 0.92 (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 1.78 (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 76.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	84.07	81.01	77.96	74.9	71.84	68.78	68.78	71.84	74.9	77.96	81.01	84.07	
											Total = Sum(44)$_{1...12}$ =	917.12	(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=	124.67	109.04	112.52	98.1	94.13	81.22	75.27	86.37	87.4	101.86	111.18	120.74	
											Total = Sum(45)$_{1...12}$ =	1202.49	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.7	16.36	16.88	14.71	14.12	12.18	11.29	12.96	13.11	15.28	16.68	18.11	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

TER WorkSheet: New dwelling design stage

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

(61)m=	42.84	37.29	39.73	36.94	36.61	33.92	35.05	36.61	36.94	39.73	39.95	42.84	(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=	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58	(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=	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58	

Output from water heater (annual)$_{1...12}$ 1660.93 (64)

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

(65)m=	52.16	45.58	47.34	41.85	40.45	35.49	33.79	37.87	38.29	43.8	46.96	50.86	(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=	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	(66)

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

(67)m=	15.32	13.6	11.06	8.38	6.26	5.29	5.71	7.42	9.96	12.65	14.77	15.74	(67)

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

(68)m=	154.97	156.57	152.52	143.9	133.01	122.77	115.93	114.32	118.38	127	137.89	148.13	(68)

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

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(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=	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	(71)

Water heating gains (Table 5)

(72)m=	70.11	67.82	63.63	58.13	54.37	49.29	45.42	50.9	53.19	58.87	65.22	68.35	(72)

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

(73)m=	293.07	290.67	279.89	263.07	246.3	230.01	219.73	225.32	234.2	251.2	270.55	284.9	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	6.39	x	36.79	x	0.63	x	0.7	=	71.85	(77)
Southeast 0.9x	0.77	x	6.39	x	62.67	x	0.63	x	0.7	=	122.39	(77)
Southeast 0.9x	0.77	x	6.39	x	85.75	x	0.63	x	0.7	=	167.46	(77)
Southeast 0.9x	0.77	x	6.39	x	106.25	x	0.63	x	0.7	=	207.5	(77)
Southeast 0.9x	0.77	x	6.39	x	119.01	x	0.63	x	0.7	=	232.41	(77)

TER WorkSheet: New dwelling design stage

Southeast	0.9x	0.77	x	6.39	x	118.15	x	0.63	x	0.7	=	230.73	(77)
Southeast	0.9x	0.77	x	6.39	x	113.91	x	0.63	x	0.7	=	222.45	(77)
Southeast	0.9x	0.77	x	6.39	x	104.39	x	0.63	x	0.7	=	203.86	(77)
Southeast	0.9x	0.77	x	6.39	x	92.85	x	0.63	x	0.7	=	181.33	(77)
Southeast	0.9x	0.77	x	6.39	x	69.27	x	0.63	x	0.7	=	135.27	(77)
Southeast	0.9x	0.77	x	6.39	x	44.07	x	0.63	x	0.7	=	86.06	(77)
Southeast	0.9x	0.77	x	6.39	x	31.49	x	0.63	x	0.7	=	61.49	(77)

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

(83)m=	71.85	122.39	167.46	207.5	232.41	230.73	222.45	203.86	181.33	135.27	86.06	61.49	(83)

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

(84)m=	364.92	413.07	447.35	470.56	478.72	460.74	442.18	429.18	415.53	386.47	356.61	346.39	(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	0.93	0.83	0.64	0.47	0.5	0.74	0.94	0.99	1	(86)

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

(87)m=	20.13	20.28	20.48	20.73	20.9	20.98	21	21	20.96	20.75	20.4	20.11	(87)

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

(88)m=	20.13	20.13	20.14	20.15	20.16	20.17	20.17	20.17	20.17	20.16	20.15	20.14	(88)

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

(89)m=	0.99	0.99	0.97	0.91	0.78	0.57	0.38	0.41	0.67	0.92	0.99	1	(89)

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

(90)m=	18.97	19.19	19.48	19.84	20.06	20.16	20.17	20.17	20.14	19.87	19.38	18.96	(90)

fLA = Living area ÷ (4) = 0.4 (91)

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

(92)m=	19.44	19.63	19.89	20.2	20.4	20.49	20.51	20.51	20.47	20.22	19.79	19.42	(92)

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

(93)m=	19.44	19.63	19.89	20.2	20.4	20.49	20.51	20.51	20.47	20.22	19.79	19.42	(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=	0.99	0.99	0.97	0.91	0.8	0.6	0.42	0.45	0.7	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	362.36	406.94	432.42	430.5	381.87	274.35	184.7	193.26	290.84	357.44	351.05	344.53	(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=	757.47	733.43	663.62	548.28	420.7	279.52	185.2	194.04	304.37	465.2	618.52	748.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	293.96	219.4	172.01	84.8	28.89	0	0	0	0	80.17	192.58	300.33	

TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)1...5,9...12 =	1372.14	(98)
Space heating requirement in kWh/m²/year	25.9	(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)	293.96	219.4	172.01	84.8	28.89	0	0	0	0	80.17	192.58	300.33		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	314.73	234.9	184.17	90.8	30.93	0	0	0	0	85.83	206.19	321.55		(211)
Total (kWh/year) =Sum(211)1...5,10...12=													1469.1	(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		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58		
Efficiency of water heater													80.3	(216)
(217)m=	86.45	86.07	85.36	83.92	81.96	80.3	80.3	80.3	80.3	83.68	85.66	86.56		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	193.76	170.01	178.36	160.91	159.52	143.39	137.38	153.15	154.84	169.19	176.43	188.98		
Total = Sum(219a)1...12 =													1985.93	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1469.1	
Water heating fuel used			1985.93	
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			270.51	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			3800.53	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	317.32	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	428.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			746.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	140.39	(268)
Total CO2, kg/year		sum of (265)…(271) =		925.6	(272)

TER = 17.47 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:08

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 92.44m²

Site Reference : 231 Watford Road - BASE **Plot Reference:** Sample 3

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.96 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	50.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	3.85m²	
Windows facing: North West	5.11m²	
Ventilation rate:	6.00	

10 Key features

Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 3

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.44	(1a) x	2.75	(2a) =	254.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.44	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		254.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12	(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		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

TER WorkSheet: New dwelling design stage

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

0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			3.85	x1/[1/(1.4)+ 0.04]		=	5.1			(27)
Windows Type 2			5.11	x1/[1/(1.4)+ 0.04]		=	6.77			(27)
Floor			92.44	x	0.13	=	12.0172			(28)
Walls Type1	35.28	8.96	26.32	x	0.18	=	4.74			(29)
Walls Type2	82.44	0	82.44	x	0.18	=	14.84			(29)
Total area of elements, m²			210.16							(31)
Party wall			15.98	x	0	=	0			(32)
Party ceiling			92.44							(32b)
Internal wall **			154.44							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 18340.86 (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 13.4 (36)

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

Total fabric heat loss (33) + (36) = 56.87 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.18	50.82	50.47	48.82	48.51	47.07	47.07	46.81	47.63	48.51	49.13	49.79	(38)

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

(39)m=	108.05	107.69	107.34	105.69	105.38	103.94	103.94	103.68	104.5	105.38	106.01	106.66	

Average = Sum(39)$_{1…12}$ /12= 105.69 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	1.17	1.16	1.16	1.14	1.14	1.12	1.12	1.12	1.13	1.14	1.15	1.15

Average = Sum(40)$_{1…12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	107.05	103.16	99.27	95.37	91.48	87.59	87.59	91.48	95.37	99.27	103.16	107.05

Total = Sum(44)$_{1…12}$ = 1167.84 (44)

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

(45)m=	158.75	138.85	143.28	124.91	119.86	103.43	95.84	109.98	111.29	129.7	141.58	153.75

Total = Sum(45)$_{1…12}$ = 1531.22 (45)

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

(46)m=	23.81	20.83	21.49	18.74	17.98	15.51	14.38	16.5	16.69	19.46	21.24	23.06

(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

TER WorkSheet: New dwelling design stage

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

(61)m=	50.96	46.03	50.58	47.03	46.62	43.19	44.63	46.62	47.03	50.58	49.32	50.96	(61)

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

(62)m=	209.71	184.87	193.86	171.95	166.47	146.62	140.47	156.6	158.33	180.29	190.89	204.7	(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=	209.71	184.87	193.86	171.95	166.47	146.62	140.47	156.6	158.33	180.29	190.89	204.7	

Output from water heater (annual)$_{1...12}$ 2104.78 (64)

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

(65)m=	65.53	57.67	60.29	53.29	51.51	45.19	43.03	48.22	48.76	55.77	59.4	63.86	(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=	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	(66)

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

(67)m=	25.23	22.41	18.22	13.8	10.31	8.71	9.41	12.23	16.41	20.84	24.33	25.93	(67)

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

(68)m=	243.5	246.02	239.66	226.1	208.99	192.91	182.16	179.64	186	199.56	216.67	232.75	(68)

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

(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(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=	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	(71)

Water heating gains (Table 5)

(72)m=	88.07	85.82	81.03	74.02	69.23	62.76	57.83	64.82	67.73	74.96	82.51	85.83	(72)

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

(73)m=	422.66	420.12	404.77	379.78	354.4	330.24	315.27	322.55	336.01	361.23	389.37	410.38	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	3.85	x	11.28	x	0.63	x	0.7	=	13.28	(75)
Northeast	0.9x	0.77	x	3.85	x	22.97	x	0.63	x	0.7	=	27.02	(75)
Northeast	0.9x	0.77	x	3.85	x	41.38	x	0.63	x	0.7	=	48.69	(75)
Northeast	0.9x	0.77	x	3.85	x	67.96	x	0.63	x	0.7	=	79.96	(75)
Northeast	0.9x	0.77	x	3.85	x	91.35	x	0.63	x	0.7	=	107.48	(75)

Northeast 0.9x	0.77	x	3.85	x	97.38	x	0.63	x	0.7	=	114.58	(75)
Northeast 0.9x	0.77	x	3.85	x	91.1	x	0.63	x	0.7	=	107.19	(75)
Northeast 0.9x	0.77	x	3.85	x	72.63	x	0.63	x	0.7	=	85.45	(75)
Northeast 0.9x	0.77	x	3.85	x	50.42	x	0.63	x	0.7	=	59.33	(75)
Northeast 0.9x	0.77	x	3.85	x	28.07	x	0.63	x	0.7	=	33.02	(75)
Northeast 0.9x	0.77	x	3.85	x	14.2	x	0.63	x	0.7	=	16.7	(75)
Northeast 0.9x	0.77	x	3.85	x	9.21	x	0.63	x	0.7	=	10.84	(75)
Northwest 0.9x	0.77	x	5.11	x	11.28	x	0.63	x	0.7	=	17.62	(81)
Northwest 0.9x	0.77	x	5.11	x	22.97	x	0.63	x	0.7	=	35.87	(81)
Northwest 0.9x	0.77	x	5.11	x	41.38	x	0.63	x	0.7	=	64.62	(81)
Northwest 0.9x	0.77	x	5.11	x	67.96	x	0.63	x	0.7	=	106.13	(81)
Northwest 0.9x	0.77	x	5.11	x	91.35	x	0.63	x	0.7	=	142.65	(81)
Northwest 0.9x	0.77	x	5.11	x	97.38	x	0.63	x	0.7	=	152.08	(81)
Northwest 0.9x	0.77	x	5.11	x	91.1	x	0.63	x	0.7	=	142.27	(81)
Northwest 0.9x	0.77	x	5.11	x	72.63	x	0.63	x	0.7	=	113.42	(81)
Northwest 0.9x	0.77	x	5.11	x	50.42	x	0.63	x	0.7	=	78.74	(81)
Northwest 0.9x	0.77	x	5.11	x	28.07	x	0.63	x	0.7	=	43.83	(81)
Northwest 0.9x	0.77	x	5.11	x	14.2	x	0.63	x	0.7	=	22.17	(81)
Northwest 0.9x	0.77	x	5.11	x	9.21	x	0.63	x	0.7	=	14.39	(81)

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

(83)m=	30.9	62.89	113.31	186.08	250.13	266.67	249.46	198.87	138.07	76.86	38.88	25.23	(83)

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

(84)m=	453.56	483.01	518.08	565.86	604.53	596.91	564.73	521.42	474.08	438.08	428.24	435.61	(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	1	1	0.99	0.96	0.88	0.74	0.8	0.96	0.99	1	1	(86)

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

(87)m=	19.63	19.73	19.95	20.27	20.6	20.86	20.96	20.94	20.73	20.33	19.94	19.62	(87)

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

(88)m=	19.94	19.95	19.95	19.97	19.97	19.98	19.98	19.98	19.98	19.97	19.96	19.96	(88)

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

(89)m=	1	1	1	0.99	0.95	0.81	0.6	0.67	0.92	0.99	1	1	(89)

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

(90)m=	18.11	18.26	18.57	19.05	19.52	19.87	19.96	19.95	19.71	19.14	18.57	18.11	(90)

fLA = Living area ÷ (4) = 0.3 (91)

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

(92)m=	18.57	18.7	18.99	19.42	19.84	20.16	20.26	20.25	20.02	19.5	18.98	18.56	(92)

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

TER WorkSheet: New dwelling design stage

(93)m=	18.57	18.7	18.99	19.42	19.84	20.16	20.26	20.25	20.02	19.5	18.98	18.56	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.94	0.82	0.64	0.71	0.92	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	452.82	481.79	515.29	556.53	570.08	491.24	362.5	369.45	438.45	433.08	427	435.04	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1541.56	1486.28	1340.2	1111.82	858.27	578.26	380.58	398.88	618.33	937.81	1259.32	1531.72	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	810.02	675.01	613.73	399.81	214.41	0	0	0	0	375.52	599.26	815.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4503.7 (98)

Space heating requirement in kWh/m²/year 48.72 (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)													
	810.02	675.01	613.73	399.81	214.41	0	0	0	0	375.52	599.26	815.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	867.26	722.71	657.1	428.06	229.56	0	0	0	0	402.05	641.61	873.58	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4821.95 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)													
	209.71	184.87	193.86	171.95	166.47	146.62	140.47	156.6	158.33	180.29	190.89	204.7	
Efficiency of water heater												80.3	(216)
(217)m=	88.12	88.02	87.75	87.11	85.69	80.3	80.3	80.3	80.3	86.86	87.73	88.18	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	237.98	210.04	220.93	197.4	194.28	182.59	174.94	195.01	197.17	207.57	217.58	232.15	

Total = Sum(219a)$_{1...12}$ = 2467.64 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4821.95

TER WorkSheet: New dwelling design stage

Water heating fuel used		2467.64	
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		445.58	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		7810.17	(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1041.54	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1574.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	231.25	(268)
Total CO2, kg/year		sum of (265)…(271) =		1844.73	(272)

TER = 19.96 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:07

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 52.98m²

Site Reference : 231 Watford Road - BASE **Plot Reference:** Sample 4

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	17.47 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.07 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South East	6.39m²
Ventilation rate:	6.00

10 Key features

Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 4

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	52.98	(1a)	x	2.75	(2a)	=	145.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.98	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	145.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(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)	0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

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

0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			6.39	x1/[1/(1.4)+ 0.04]		=	8.47			(27)
Walls Type1	22.17	6.39	15.78	x	0.18	=	2.84			(29)
Walls Type2	17.22	0	17.22	x	0.18	=	3.1			(29)
Total area of elements, m²			39.39							(31)
Party wall			46.48	x	0	=	0			(32)
Party floor			52.98							(32a)
Party ceiling			52.98							(32b)
Internal wall **			97.63							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 14.41 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8658.87 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 5.71 (36)

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

Total fabric heat loss (33) + (36) = 20.13 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.67	29.45	28.4	28.21	27.29	27.29	27.12	27.65	28.21	28.6	29.02	(38)

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

(39)m=	50.03	49.8	49.58	48.53	48.33	47.42	47.42	47.25	47.77	48.33	48.73	49.14	

Average = Sum(39)$_{1…12}$ /12= 48.53 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	0.94	0.94	0.94	0.92	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.93

Average = Sum(40)1…12 /12= 0.92 (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 1.78 (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 76.43 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	84.07	81.01	77.96	74.9	71.84	68.78	68.78	71.84	74.9	77.96	81.01	84.07

Total = Sum(44)1…12 = 917.12 (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=	124.67	109.04	112.52	98.1	94.13	81.22	75.27	86.37	87.4	101.86	111.18	120.74

Total = Sum(45)1…12 = 1202.49 (45)

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

(46)m=	18.7	16.36	16.88	14.71	14.12	12.18	11.29	12.96	13.11	15.28	16.68	18.11

(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

TER WorkSheet: New dwelling design stage

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

(61)m=	42.84	37.29	39.73	36.94	36.61	33.92	35.05	36.61	36.94	39.73	39.95	42.84	(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=	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58	(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=	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58	

Output from water heater (annual)$_{1...12}$ 1660.93 (64)

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

(65)m=	52.16	45.58	47.34	41.85	40.45	35.49	33.79	37.87	38.29	43.8	46.96	50.86	(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=	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	(66)

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

(67)m=	15.32	13.6	11.06	8.38	6.26	5.29	5.71	7.42	9.96	12.65	14.77	15.74	(67)

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

(68)m=	154.97	156.57	152.52	143.9	133.01	122.77	115.93	114.32	118.38	127	137.89	148.13	(68)

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

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(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=	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	(71)

Water heating gains (Table 5)

(72)m=	70.11	67.82	63.63	58.13	54.37	49.29	45.42	50.9	53.19	58.87	65.22	68.35	(72)

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

(73)m=	293.07	290.67	279.89	263.07	246.3	230.01	219.73	225.32	234.2	251.2	270.55	284.9	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	6.39	x	36.79	x	0.63	x	0.7	=	71.85	(77)
Southeast 0.9x	0.77	x	6.39	x	62.67	x	0.63	x	0.7	=	122.39	(77)
Southeast 0.9x	0.77	x	6.39	x	85.75	x	0.63	x	0.7	=	167.46	(77)
Southeast 0.9x	0.77	x	6.39	x	106.25	x	0.63	x	0.7	=	207.5	(77)
Southeast 0.9x	0.77	x	6.39	x	119.01	x	0.63	x	0.7	=	232.41	(77)

Southeast	0.9x	0.77	x	6.39	x	118.15	x	0.63	x	0.7	=	230.73	(77)
Southeast	0.9x	0.77	x	6.39	x	113.91	x	0.63	x	0.7	=	222.45	(77)
Southeast	0.9x	0.77	x	6.39	x	104.39	x	0.63	x	0.7	=	203.86	(77)
Southeast	0.9x	0.77	x	6.39	x	92.85	x	0.63	x	0.7	=	181.33	(77)
Southeast	0.9x	0.77	x	6.39	x	69.27	x	0.63	x	0.7	=	135.27	(77)
Southeast	0.9x	0.77	x	6.39	x	44.07	x	0.63	x	0.7	=	86.06	(77)
Southeast	0.9x	0.77	x	6.39	x	31.49	x	0.63	x	0.7	=	61.49	(77)

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

(83)m=	71.85	122.39	167.46	207.5	232.41	230.73	222.45	203.86	181.33	135.27	86.06	61.49	(83)

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

(84)m=	364.92	413.07	447.35	470.56	478.72	460.74	442.18	429.18	415.53	386.47	356.61	346.39	(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	0.93	0.83	0.64	0.47	0.5	0.74	0.94	0.99	1	(86)

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

(87)m=	20.13	20.28	20.48	20.73	20.9	20.98	21	21	20.96	20.75	20.4	20.11	(87)

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

(88)m=	20.13	20.13	20.14	20.15	20.16	20.17	20.17	20.17	20.17	20.16	20.15	20.14	(88)

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

(89)m=	0.99	0.99	0.97	0.91	0.78	0.57	0.38	0.41	0.67	0.92	0.99	1	(89)

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

(90)m=	18.97	19.19	19.48	19.84	20.06	20.16	20.17	20.17	20.14	19.87	19.38	18.96	(90)

fLA = Living area ÷ (4) = 0.4 (91)

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

(92)m=	19.44	19.63	19.89	20.2	20.4	20.49	20.51	20.51	20.47	20.22	19.79	19.42	(92)

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

(93)m=	19.44	19.63	19.89	20.2	20.4	20.49	20.51	20.51	20.47	20.22	19.79	19.42	(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=	0.99	0.99	0.97	0.91	0.8	0.6	0.42	0.45	0.7	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	362.36	406.94	432.42	430.5	381.87	274.35	184.7	193.26	290.84	357.44	351.05	344.53	(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=	757.47	733.43	663.62	548.28	420.7	279.52	185.2	194.04	304.37	465.2	618.52	748.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	293.96	219.4	172.01	84.8	28.89	0	0	0	0	80.17	192.58	300.33	(98)

TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1372.14	(98)
Space heating requirement in kWh/m²/year	25.9	(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)	293.96	219.4	172.01	84.8	28.89	0	0	0	0	80.17	192.58	300.33		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	314.73	234.9	184.17	90.8	30.93	0	0	0	0	85.83	206.19	321.55		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1469.1	(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		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58		
Efficiency of water heater													80.3	(216)
(217)m=	86.45	86.07	85.36	83.92	81.96	80.3	80.3	80.3	80.3	83.68	85.66	86.56		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	193.76	170.01	178.36	160.91	159.52	143.39	137.38	153.15	154.84	169.19	176.43	188.98		
Total = Sum(219a)$_{1...12}$ =													1985.93	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1469.1	
Water heating fuel used			1985.93	
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			270.51	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			3800.53	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	317.32	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	428.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			746.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	140.39	(268)
Total CO2, kg/year		sum of (265)…(271) =		925.6	(272)

TER = 17.47 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:06

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 74.55m²

Site Reference : 231 Watford Road - BASE **Plot Reference:** Sample 5

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.23 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.76 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	39.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	32.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: South East	12.79m²
Windows facing: South	1.28m²
Ventilation rate:	6.00

10 Key features

Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 5

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	74.55	(1a)	x	2.75	(2a)	=	205.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.55	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	205.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(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)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

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

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

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=	0.63	0.62	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

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

(25)m=	0.63	0.62	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.79	x1/[1/(1.4)+ 0.04]	=	16.96			(27)
Windows Type 2			1.28	x1/[1/(1.4)+ 0.04]	=	1.7			(27)
Walls Type1	41.85	14.07	27.78	x 0.18	=	5			(29)
Walls Type2	24.37	0	24.37	x 0.18	=	4.39			(29)
Total area of elements, m²			66.22						(31)
Party wall			41.82	x 0	=	0			(32)
Party floor			74.55						(32a)
Party ceiling			74.55						(32b)
Internal wall **			131.12						(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.04 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11409.48 (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 7.76 (36)

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

Total fabric heat loss (33) + (36) = 35.8 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.46	42.13	41.8	40.26	39.97	38.62	38.62	38.37	39.14	39.97	40.55	41.16	(38)

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

(39)m=	78.26	77.93	77.6	76.05	75.76	74.42	74.42	74.17	74.94	75.76	76.35	76.96	

Average = Sum(39)$_{1…12}$ /12= 76.05 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	1.05	1.05	1.04	1.02	1.02	1	1	0.99	1.01	1.02	1.02	1.03

Average = Sum(40)$_{1...12}$ /12= 1.02 (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 2.35 (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 90.04 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	99.05	95.45	91.85	88.24	84.64	81.04	81.04	84.64	88.24	91.85	95.45	99.05

Total = Sum(44)$_{1...12}$ = 1080.53 (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=	146.89	128.47	132.57	115.58	110.9	95.7	88.68	101.76	102.97	120	130.99	142.25

Total = Sum(45)$_{1...12}$ = 1416.75 (45)

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

(46)m=	22.03	19.27	19.89	17.34	16.63	14.35	13.3	15.26	15.45	18	19.65	21.34	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (41)m

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

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

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

(61)m=	50.47	43.93	46.8	43.52	43.13	39.96	41.3	43.13	43.52	46.8	47.07	50.47	(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=	197.36	172.4	179.37	159.09	154.03	135.66	129.97	144.89	146.49	166.81	178.06	192.73	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	197.36	172.4	179.37	159.09	154.03	135.66	129.97	144.89	146.49	166.81	178.06	192.73	

Output from water heater (annual)$_{1...12}$ 1956.87 (64)

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

(65)m=	61.46	53.7	55.78	49.31	47.66	41.81	39.81	44.62	45.12	51.6	55.32	59.92	(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=	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	(66)

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

(67)m=	18.78	16.68	13.56	10.27	7.68	6.48	7	9.1	12.22	15.51	18.1	19.3	(67)

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

(68)m=	207.68	209.83	204.4	192.84	178.25	164.53	155.37	153.21	158.64	170.2	184.8	198.51	(68)

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

(69)m=	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	(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=	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	(71)

Water heating gains (Table 5)

(72)m=	82.61	79.91	74.97	68.48	64.05	58.07	53.51	59.97	62.66	69.36	76.84	80.53	(72)

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

(73)m=	370.33	367.69	354.21	332.86	311.25	290.35	277.14	283.55	294.79	316.34	341.01	359.62	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	12.79	x	36.79	x	0.63	x	0.7	=	143.82	(77)
Southeast	0.9x	0.77	x	12.79	x	62.67	x	0.63	x	0.7	=	244.98	(77)
Southeast	0.9x	0.77	x	12.79	x	85.75	x	0.63	x	0.7	=	335.19	(77)
Southeast	0.9x	0.77	x	12.79	x	106.25	x	0.63	x	0.7	=	415.32	(77)
Southeast	0.9x	0.77	x	12.79	x	119.01	x	0.63	x	0.7	=	465.19	(77)

Southeast	0.9x	0.77	x	12.79	x	118.15	x	0.63	x	0.7	=	461.82	(77)
Southeast	0.9x	0.77	x	12.79	x	113.91	x	0.63	x	0.7	=	445.25	(77)
Southeast	0.9x	0.77	x	12.79	x	104.39	x	0.63	x	0.7	=	408.04	(77)
Southeast	0.9x	0.77	x	12.79	x	92.85	x	0.63	x	0.7	=	362.94	(77)
Southeast	0.9x	0.77	x	12.79	x	69.27	x	0.63	x	0.7	=	270.75	(77)
Southeast	0.9x	0.77	x	12.79	x	44.07	x	0.63	x	0.7	=	172.26	(77)
Southeast	0.9x	0.77	x	12.79	x	31.49	x	0.63	x	0.7	=	123.08	(77)
South	0.9x	0.77	x	1.28	x	46.75	x	0.63	x	0.7	=	18.29	(78)
South	0.9x	0.77	x	1.28	x	76.57	x	0.63	x	0.7	=	29.95	(78)
South	0.9x	0.77	x	1.28	x	97.53	x	0.63	x	0.7	=	38.15	(78)
South	0.9x	0.77	x	1.28	x	110.23	x	0.63	x	0.7	=	43.12	(78)
South	0.9x	0.77	x	1.28	x	114.87	x	0.63	x	0.7	=	44.94	(78)
South	0.9x	0.77	x	1.28	x	110.55	x	0.63	x	0.7	=	43.24	(78)
South	0.9x	0.77	x	1.28	x	108.01	x	0.63	x	0.7	=	42.25	(78)
South	0.9x	0.77	x	1.28	x	104.89	x	0.63	x	0.7	=	41.03	(78)
South	0.9x	0.77	x	1.28	x	101.89	x	0.63	x	0.7	=	39.86	(78)
South	0.9x	0.77	x	1.28	x	82.59	x	0.63	x	0.7	=	32.31	(78)
South	0.9x	0.77	x	1.28	x	55.42	x	0.63	x	0.7	=	21.68	(78)
South	0.9x	0.77	x	1.28	x	40.4	x	0.63	x	0.7	=	15.8	(78)

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

(83)m=	162.11	274.93	373.34	458.44	510.12	505.07	487.5	449.07	402.79	303.06	193.94	138.88	(83)

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

(84)m=	532.44	642.62	727.55	791.3	821.37	795.42	764.64	732.63	697.59	619.4	534.95	498.5	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.78	0.58	0.43	0.46	0.7	0.93	0.99	1	(86)

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

(87)m=	20	20.2	20.46	20.73	20.91	20.99	21	21	20.96	20.73	20.31	19.98	(87)

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

(88)m=	20.04	20.05	20.05	20.07	20.07	20.08	20.08	20.09	20.08	20.07	20.06	20.06	(88)

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

(89)m=	0.99	0.98	0.95	0.88	0.72	0.51	0.34	0.37	0.62	0.9	0.98	1	(89)

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

(90)m=	18.72	19.01	19.38	19.77	19.99	20.08	20.08	20.09	20.05	19.77	19.19	18.69	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

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

(92)m=	19.23	19.49	19.8	20.15	20.36	20.44	20.45	20.45	20.41	20.15	19.63	19.2	(92)

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

TER WorkSheet: New dwelling design stage

(93)m=	19.23	19.49	19.8	20.15	20.36	20.44	20.45	20.45	20.41	20.15	19.63	19.2	(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	0.95	0.88	0.74	0.54	0.37	0.41	0.65	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	528.28	629.65	691.89	694.91	606.74	427.73	285.54	299.04	454.38	560.53	525.22	495.65	(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=	1168.39	1136.58	1032.43	855.81	655.82	434.35	286.24	300.19	473.08	723.46	957	1154.42	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	476.24	340.65	253.36	115.85	36.51	0	0	0	0	121.22	310.88	490.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2144.83 (98)

Space heating requirement in kWh/m²/year 28.77 (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)													
	476.24	340.65	253.36	115.85	36.51	0	0	0	0	121.22	310.88	490.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	509.89	364.73	271.26	124.03	39.09	0	0	0	0	129.78	332.85	524.75	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2296.39 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)													
	197.36	172.4	179.37	159.09	154.03	135.66	129.97	144.89	146.49	166.81	178.06	192.73	
Efficiency of water heater												80.3	(216)
(217)m=	87.19	86.73	85.92	84.27	82.06	80.3	80.3	80.3	80.3	84.26	86.44	87.3	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	226.36	198.77	208.76	188.8	187.71	168.94	161.86	180.44	182.43	197.96	206	220.76	

Total = Sum(219a)$_{1...12}$ = 2328.79 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2296.39

TER WorkSheet: New dwelling design stage

Water heating fuel used			2328.79	
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			331.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5031.79	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	496.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =			999.04	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	172.1	(268)
Total CO2, kg/year		sum of (265)…(271) =		1210.07	(272)

TER = 16.23 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:04

Project Information:

Assessed By:	Neil Ingham (STRO010943)	**Building Type:**	Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE		Total Floor Area: 92.44m²	
Site Reference :	231 Watford Road - BASE	**Plot Reference:**	Sample 6
Address :			

Client Details:

Name:
Address :

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

1a TER and DER

Fuel for main heating system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.63 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.80 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	39.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	$3.85m^2$	
Windows facing: North West	$5.11m^2$	
Ventilation rate:	6.00	

10 Key features

Windows U-value	1.1 W/m^2K
Party Walls U-value	0 W/m^2K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.44	(1a) x	2.75	(2a) =	254.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.44	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	254.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12	(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		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

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

0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			3.85	x1/[1/(1.4)+ 0.04]		=	5.1			(27)
Windows Type 2			5.11	x1/[1/(1.4)+ 0.04]		=	6.77			(27)
Walls Type1	35.28	8.96	26.32	x	0.18	=	4.74			(29)
Walls Type2	82.44	0	82.44	x	0.18	=	14.84			(29)
Total area of elements, m²			117.72							(31)
Party wall			15.98	x	0	=	0			(32)
Party floor			92.44							(32a)
Party ceiling			92.44							(32b)
Internal wall **			154.44							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15105.46 (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 9.02 (36)

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

Total fabric heat loss (33) + (36) = 40.48 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.18	50.82	50.47	48.82	48.51	47.07	47.07	46.81	47.63	48.51	49.13	49.79	(38)

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

(39)m=	91.66	91.3	90.95	89.3	88.99	87.55	87.55	87.28	88.1	88.99	89.61	90.27	

Average = $Sum(39)_{1…12}$ /12= 89.29 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	0.99	0.99	0.98	0.97	0.96	0.95	0.95	0.94	0.95	0.96	0.97	0.98

Average = Sum(40)$_{1…12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.32 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	107.05	103.16	99.27	95.37	91.48	87.59	87.59	91.48	95.37	99.27	103.16	107.05

Total = Sum(44)$_{1…12}$ = 1167.84 (44)

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

(45)m=	158.75	138.85	143.28	124.91	119.86	103.43	95.84	109.98	111.29	129.7	141.58	153.75

Total = Sum(45)$_{1…12}$ = 1531.22 (45)

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

(46)m=	23.81	20.83	21.49	18.74	17.98	15.51	14.38	16.5	16.69	19.46	21.24	23.06	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

TER WorkSheet: New dwelling design stage

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

(61)m=	50.96	46.03	50.58	47.03	46.62	43.19	44.63	46.62	47.03	50.58	49.32	50.96	(61)

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

(62)m=	209.71	184.87	193.86	171.95	166.47	146.62	140.47	156.6	158.33	180.29	190.89	204.7	(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=	209.71	184.87	193.86	171.95	166.47	146.62	140.47	156.6	158.33	180.29	190.89	204.7	

Output from water heater (annual)$_{1...12}$ 2104.78 (64)

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

(65)m=	65.53	57.67	60.29	53.29	51.51	45.19	43.03	48.22	48.76	55.77	59.4	63.86	(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=	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	25.23	22.41	18.22	13.8	10.31	8.71	9.41	12.23	16.41	20.84	24.33	25.93	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	243.5	246.02	239.66	226.1	208.99	192.91	182.16	179.64	186	199.56	216.67	232.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(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=	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	(71)
Water heating gains (Table 5)													
(72)m=	88.07	85.82	81.03	74.02	69.23	62.76	57.83	64.82	67.73	74.96	82.51	85.83	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	422.66	420.12	404.77	379.78	354.4	330.24	315.27	322.55	336.01	361.23	389.37	410.38	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.85	x	11.28	x	0.63	x	0.7	=	13.28	(75)
Northeast 0.9x	0.77	x	3.85	x	22.97	x	0.63	x	0.7	=	27.02	(75)
Northeast 0.9x	0.77	x	3.85	x	41.38	x	0.63	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	3.85	x	67.96	x	0.63	x	0.7	=	79.96	(75)
Northeast 0.9x	0.77	x	3.85	x	91.35	x	0.63	x	0.7	=	107.48	(75)

Northeast 0.9x	0.77	x	3.85	x	97.38	x	0.63	x	0.7	=	114.58	(75)
Northeast 0.9x	0.77	x	3.85	x	91.1	x	0.63	x	0.7	=	107.19	(75)
Northeast 0.9x	0.77	x	3.85	x	72.63	x	0.63	x	0.7	=	85.45	(75)
Northeast 0.9x	0.77	x	3.85	x	50.42	x	0.63	x	0.7	=	59.33	(75)
Northeast 0.9x	0.77	x	3.85	x	28.07	x	0.63	x	0.7	=	33.02	(75)
Northeast 0.9x	0.77	x	3.85	x	14.2	x	0.63	x	0.7	=	16.7	(75)
Northeast 0.9x	0.77	x	3.85	x	9.21	x	0.63	x	0.7	=	10.84	(75)
Northwest 0.9x	0.77	x	5.11	x	11.28	x	0.63	x	0.7	=	17.62	(81)
Northwest 0.9x	0.77	x	5.11	x	22.97	x	0.63	x	0.7	=	35.87	(81)
Northwest 0.9x	0.77	x	5.11	x	41.38	x	0.63	x	0.7	=	64.62	(81)
Northwest 0.9x	0.77	x	5.11	x	67.96	x	0.63	x	0.7	=	106.13	(81)
Northwest 0.9x	0.77	x	5.11	x	91.35	x	0.63	x	0.7	=	142.65	(81)
Northwest 0.9x	0.77	x	5.11	x	97.38	x	0.63	x	0.7	=	152.08	(81)
Northwest 0.9x	0.77	x	5.11	x	91.1	x	0.63	x	0.7	=	142.27	(81)
Northwest 0.9x	0.77	x	5.11	x	72.63	x	0.63	x	0.7	=	113.42	(81)
Northwest 0.9x	0.77	x	5.11	x	50.42	x	0.63	x	0.7	=	78.74	(81)
Northwest 0.9x	0.77	x	5.11	x	28.07	x	0.63	x	0.7	=	43.83	(81)
Northwest 0.9x	0.77	x	5.11	x	14.2	x	0.63	x	0.7	=	22.17	(81)
Northwest 0.9x	0.77	x	5.11	x	9.21	x	0.63	x	0.7	=	14.39	(81)

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

(83)m=	30.9	62.89	113.31	186.08	250.13	266.67	249.46	198.87	138.07	76.86	38.88	25.23	(83)

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

(84)m=	453.56	483.01	518.08	565.86	604.53	596.91	564.73	521.42	474.08	438.08	428.24	435.61	(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	1	1	0.99	0.95	0.83	0.66	0.72	0.94	0.99	1	1	(86)

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

(87)m=	19.87	19.97	20.16	20.45	20.73	20.93	20.99	20.98	20.83	20.48	20.14	19.87	(87)

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

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

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

(89)m=	1	1	1	0.98	0.93	0.75	0.54	0.61	0.9	0.99	1	1	(89)

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

(90)m=	18.57	18.71	18.99	19.43	19.82	20.07	20.12	20.12	19.96	19.48	18.97	18.57	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

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

(92)m=	18.96	19.08	19.34	19.74	20.1	20.33	20.38	20.38	20.22	19.78	19.32	18.96	(92)

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

TER WorkSheet: New dwelling design stage

(93)m=	18.96	19.08	19.34	19.74	20.1	20.33	20.38	20.38	20.22	19.78	19.32	18.96	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.93	0.77	0.58	0.64	0.9	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	452.92	481.9	515.28	555.07	560.41	460.5	324.96	335.82	428.15	432.56	427.09	435.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1343.62	1295.02	1167.94	967.54	747.31	501.72	331.01	346.98	539.27	816.91	1095.38	1331.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	662.68	546.42	485.58	296.97	139.05	0	0	0	0	285.96	481.17	667.26	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3565.09 (98)

Space heating requirement in kWh/m²/year 38.57 (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)													
	662.68	546.42	485.58	296.97	139.05	0	0	0	0	285.96	481.17	667.26	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	709.51	585.03	519.89	317.96	148.87	0	0	0	0	306.16	515.17	714.41	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3817.01 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)													
	209.71	184.87	193.86	171.95	166.47	146.62	140.47	156.6	158.33	180.29	190.89	204.7	
Efficiency of water heater												80.3	(216)
(217)m=	87.75	87.61	87.27	86.41	84.6	80.3	80.3	80.3	80.3	86.21	87.28	87.81	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	239	211.01	222.15	198.98	196.77	182.59	174.94	195.01	197.17	209.13	218.71	233.13	

Total = Sum(219a)$_{1...12}$ = 2478.59 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3817.01

TER WorkSheet: New dwelling design stage

Water heating fuel used			2478.59	
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			445.58	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6816.18	(338)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	824.47	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	535.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1359.85	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	231.25	(268)
Total CO2, kg/year			sum of (265)…(271) =		1630.03	(272)

TER = 17.63 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:03

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 52.98m²

Site Reference : 231 Watford Road - BASE **Plot Reference:** Sample 7

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	17.47 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.07 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South East	6.39m²
Ventilation rate:	6.00

10 Key features

Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 7

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	52.98	(1a)	x	2.75	(2a)	=	145.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.98	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	145.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(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)	0.39	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			6.39	x1/[1/(1.4)+ 0.04]		=	8.47			(27)
Walls Type1	22.17	6.39	15.78	x	0.18	=	2.84			(29)
Walls Type2	17.22	0	17.22	x	0.18	=	3.1			(29)
Total area of elements, m²			39.39							(31)
Party wall			46.48	x	0	=	0			(32)
Party floor			52.98							(32a)
Party ceiling			52.98							(32b)
Internal wall **			97.63							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 14.41 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8658.87 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 5.71 (36)

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

Total fabric heat loss (33) + (36) = 20.13 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.67	29.45	28.4	28.21	27.29	27.29	27.12	27.65	28.21	28.6	29.02	(38)

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

(39)m=	50.03	49.8	49.58	48.53	48.33	47.42	47.42	47.25	47.77	48.33	48.73	49.14	

Average = Sum(39)$_{1…12}$ /12= 48.53 (39)

TER WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(40)m=	0.94	0.94	0.94	0.92	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.93		

Average = Sum(40)$_{1...12}$ /12= 0.92 (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 1.78 (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 76.43 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.07	81.01	77.96	74.9	71.84	68.78	68.78	71.84	74.9	77.96	81.01	84.07	

Total = Sum(44)$_{1...12}$ = 917.12 (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=	124.67	109.04	112.52	98.1	94.13	81.22	75.27	86.37	87.4	101.86	111.18	120.74

Total = Sum(45)$_{1...12}$ = 1202.49 (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=	18.7	16.36	16.88	14.71	14.12	12.18	11.29	12.96	13.11	15.28	16.68	18.11	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (41)m

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

TER WorkSheet: New dwelling design stage

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

(61)m=	42.84	37.29	39.73	36.94	36.61	33.92	35.05	36.61	36.94	39.73	39.95	42.84	(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=	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58	(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=	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58	

Output from water heater (annual)$_{1...12}$ 1660.93 (64)

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

(65)m=	52.16	45.58	47.34	41.85	40.45	35.49	33.79	37.87	38.29	43.8	46.96	50.86	(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=	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	(66)

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

(67)m=	15.32	13.6	11.06	8.38	6.26	5.29	5.71	7.42	9.96	12.65	14.77	15.74	(67)

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

(68)m=	154.97	156.57	152.52	143.9	133.01	122.77	115.93	114.32	118.38	127	137.89	148.13	(68)

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

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(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=	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	(71)

Water heating gains (Table 5)

(72)m=	70.11	67.82	63.63	58.13	54.37	49.29	45.42	50.9	53.19	58.87	65.22	68.35	(72)

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

(73)m=	293.07	290.67	279.89	263.07	246.3	230.01	219.73	225.32	234.2	251.2	270.55	284.9	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	6.39	x	36.79	x	0.63	x	0.7	=	71.85	(77)
Southeast	0.9x	0.77	x	6.39	x	62.67	x	0.63	x	0.7	=	122.39	(77)
Southeast	0.9x	0.77	x	6.39	x	85.75	x	0.63	x	0.7	=	167.46	(77)
Southeast	0.9x	0.77	x	6.39	x	106.25	x	0.63	x	0.7	=	207.5	(77)
Southeast	0.9x	0.77	x	6.39	x	119.01	x	0.63	x	0.7	=	232.41	(77)

TER WorkSheet: New dwelling design stage

Southeast	0.9x	0.77	x	6.39	x	118.15	x	0.63	x	0.7	=	230.73	(77)
Southeast	0.9x	0.77	x	6.39	x	113.91	x	0.63	x	0.7	=	222.45	(77)
Southeast	0.9x	0.77	x	6.39	x	104.39	x	0.63	x	0.7	=	203.86	(77)
Southeast	0.9x	0.77	x	6.39	x	92.85	x	0.63	x	0.7	=	181.33	(77)
Southeast	0.9x	0.77	x	6.39	x	69.27	x	0.63	x	0.7	=	135.27	(77)
Southeast	0.9x	0.77	x	6.39	x	44.07	x	0.63	x	0.7	=	86.06	(77)
Southeast	0.9x	0.77	x	6.39	x	31.49	x	0.63	x	0.7	=	61.49	(77)

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

(83)m=	71.85	122.39	167.46	207.5	232.41	230.73	222.45	203.86	181.33	135.27	86.06	61.49	(83)

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

(84)m=	364.92	413.07	447.35	470.56	478.72	460.74	442.18	429.18	415.53	386.47	356.61	346.39	(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	0.93	0.83	0.64	0.47	0.5	0.74	0.94	0.99	1	(86)

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

(87)m=	20.13	20.28	20.48	20.73	20.9	20.98	21	21	20.96	20.75	20.4	20.11	(87)

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

(88)m=	20.13	20.13	20.14	20.15	20.16	20.17	20.17	20.17	20.17	20.16	20.15	20.14	(88)

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

(89)m=	0.99	0.99	0.97	0.91	0.78	0.57	0.38	0.41	0.67	0.92	0.99	1	(89)

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

(90)m=	18.97	19.19	19.48	19.84	20.06	20.16	20.17	20.17	20.14	19.87	19.38	18.96	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

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

(92)m=	19.44	19.63	19.89	20.2	20.4	20.49	20.51	20.51	20.47	20.22	19.79	19.42	(92)

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

(93)m=	19.44	19.63	19.89	20.2	20.4	20.49	20.51	20.51	20.47	20.22	19.79	19.42	(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=	0.99	0.99	0.97	0.91	0.8	0.6	0.42	0.45	0.7	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	362.36	406.94	432.42	430.5	381.87	274.35	184.7	193.26	290.84	357.44	351.05	344.53	(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=	757.47	733.43	663.62	548.28	420.7	279.52	185.2	194.04	304.37	465.2	618.52	748.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	293.96	219.4	172.01	84.8	28.89	0	0	0	0	80.17	192.58	300.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1372.14	(98)
Space heating requirement in kWh/m²/year	25.9	(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)	293.96	219.4	172.01	84.8	28.89	0	0	0	0	80.17	192.58	300.33		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	314.73	234.9	184.17	90.8	30.93	0	0	0	0	85.83	206.19	321.55		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1469.1	(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		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58		
Efficiency of water heater													80.3	(216)
(217)m=	86.45	86.07	85.36	83.92	81.96	80.3	80.3	80.3	80.3	83.68	85.66	86.56		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	193.76	170.01	178.36	160.91	159.52	143.39	137.38	153.15	154.84	169.19	176.43	188.98		
Total = Sum(219a)$_{1...12}$ =													1985.93	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1469.1	
Water heating fuel used			1985.93	
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			270.51	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			3800.53	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	317.32	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	428.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			746.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	140.39	(268)
Total CO2, kg/year		sum of (265)…(271) =		925.6	(272)

TER = 17.47 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:02

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 74.55m²

Site Reference : 231 Watford Road - BASE **Plot Reference:** Sample 8

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	16.23 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.76 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	39.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	32.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	12.79m²	
Windows facing: South	1.28m²	
Ventilation rate:	6.00	

10 Key features

Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 8

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.55	(1a) x	2.75	(2a) =	205.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(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)	0.4	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

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=	0.63	0.62	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

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

(25)m=	0.63	0.62	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.79	x1/[1/(1.4)+ 0.04]	=	16.96			(27)
Windows Type 2			1.28	x1/[1/(1.4)+ 0.04]	=	1.7			(27)
Walls Type1	41.85	14.07	27.78	x 0.18	=	5			(29)
Walls Type2	24.37	0	24.37	x 0.18	=	4.39			(29)
Total area of elements, m²			66.22						(31)
Party wall			41.82	x 0	=	0			(32)
Party floor			74.55						(32a)
Party ceiling			74.55						(32b)
Internal wall **			131.12						(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.04 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11409.48 (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 7.76 (36)

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

Total fabric heat loss (33) + (36) = 35.8 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.46	42.13	41.8	40.26	39.97	38.62	38.62	38.37	39.14	39.97	40.55	41.16	(38)

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

(39)m=	78.26	77.93	77.6	76.05	75.76	74.42	74.42	74.17	74.94	75.76	76.35	76.96	

Average = Sum(39)$_{1…12}$ /12= 76.05 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	1.05	1.05	1.04	1.02	1.02	1	1	0.99	1.01	1.02	1.02	1.03

Average = Sum(40)$_{1…12}$ /12= 1.02 (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 2.35 (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 90.04 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	99.05	95.45	91.85	88.24	84.64	81.04	81.04	84.64	88.24	91.85	95.45	99.05

Total = Sum(44)$_{1…12}$ = 1080.53 (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=	146.89	128.47	132.57	115.58	110.9	95.7	88.68	101.76	102.97	120	130.99	142.25

Total = Sum(45)$_{1…12}$ = 1416.75 (45)

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

(46)m=	22.03	19.27	19.89	17.34	16.63	14.35	13.3	15.26	15.45	18	19.65	21.34	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (41)m

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

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

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

(61)m=	50.47	43.93	46.8	43.52	43.13	39.96	41.3	43.13	43.52	46.8	47.07	50.47	(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=	197.36	172.4	179.37	159.09	154.03	135.66	129.97	144.89	146.49	166.81	178.06	192.73	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	197.36	172.4	179.37	159.09	154.03	135.66	129.97	144.89	146.49	166.81	178.06	192.73	

Output from water heater (annual)$_{1...12}$ | 1956.87 | (64)

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

(65)m=	61.46	53.7	55.78	49.31	47.66	41.81	39.81	44.62	45.12	51.6	55.32	59.92	(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=	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	(66)

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

(67)m=	18.78	16.68	13.56	10.27	7.68	6.48	7	9.1	12.22	15.51	18.1	19.3	(67)

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

(68)m=	207.68	209.83	204.4	192.84	178.25	164.53	155.37	153.21	158.64	170.2	184.8	198.51	(68)

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

(69)m=	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	(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=	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	(71)

Water heating gains (Table 5)

(72)m=	82.61	79.91	74.97	68.48	64.05	58.07	53.51	59.97	62.66	69.36	76.84	80.53	(72)

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

(73)m=	370.33	367.69	354.21	332.86	311.25	290.35	277.14	283.55	294.79	316.34	341.01	359.62	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.79	x	36.79	x	0.63	x	0.7	=	143.82	(77)
Southeast 0.9x	0.77	x	12.79	x	62.67	x	0.63	x	0.7	=	244.98	(77)
Southeast 0.9x	0.77	x	12.79	x	85.75	x	0.63	x	0.7	=	335.19	(77)
Southeast 0.9x	0.77	x	12.79	x	106.25	x	0.63	x	0.7	=	415.32	(77)
Southeast 0.9x	0.77	x	12.79	x	119.01	x	0.63	x	0.7	=	465.19	(77)

Southeast	0.9x	0.77	x	12.79	x	118.15	x	0.63	x	0.7	=	461.82	(77)
Southeast	0.9x	0.77	x	12.79	x	113.91	x	0.63	x	0.7	=	445.25	(77)
Southeast	0.9x	0.77	x	12.79	x	104.39	x	0.63	x	0.7	=	408.04	(77)
Southeast	0.9x	0.77	x	12.79	x	92.85	x	0.63	x	0.7	=	362.94	(77)
Southeast	0.9x	0.77	x	12.79	x	69.27	x	0.63	x	0.7	=	270.75	(77)
Southeast	0.9x	0.77	x	12.79	x	44.07	x	0.63	x	0.7	=	172.26	(77)
Southeast	0.9x	0.77	x	12.79	x	31.49	x	0.63	x	0.7	=	123.08	(77)
South	0.9x	0.77	x	1.28	x	46.75	x	0.63	x	0.7	=	18.29	(78)
South	0.9x	0.77	x	1.28	x	76.57	x	0.63	x	0.7	=	29.95	(78)
South	0.9x	0.77	x	1.28	x	97.53	x	0.63	x	0.7	=	38.15	(78)
South	0.9x	0.77	x	1.28	x	110.23	x	0.63	x	0.7	=	43.12	(78)
South	0.9x	0.77	x	1.28	x	114.87	x	0.63	x	0.7	=	44.94	(78)
South	0.9x	0.77	x	1.28	x	110.55	x	0.63	x	0.7	=	43.24	(78)
South	0.9x	0.77	x	1.28	x	108.01	x	0.63	x	0.7	=	42.25	(78)
South	0.9x	0.77	x	1.28	x	104.89	x	0.63	x	0.7	=	41.03	(78)
South	0.9x	0.77	x	1.28	x	101.89	x	0.63	x	0.7	=	39.86	(78)
South	0.9x	0.77	x	1.28	x	82.59	x	0.63	x	0.7	=	32.31	(78)
South	0.9x	0.77	x	1.28	x	55.42	x	0.63	x	0.7	=	21.68	(78)
South	0.9x	0.77	x	1.28	x	40.4	x	0.63	x	0.7	=	15.8	(78)

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

(83)m=	162.11	274.93	373.34	458.44	510.12	505.07	487.5	449.07	402.79	303.06	193.94	138.88	(83)

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

(84)m=	532.44	642.62	727.55	791.3	821.37	795.42	764.64	732.63	697.59	619.4	534.95	498.5	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.78	0.58	0.43	0.46	0.7	0.93	0.99	1	(86)

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

(87)m=	20	20.2	20.46	20.73	20.91	20.99	21	21	20.96	20.73	20.31	19.98	(87)

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

(88)m=	20.04	20.05	20.05	20.07	20.07	20.08	20.08	20.09	20.08	20.07	20.06	20.06	(88)

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

(89)m=	0.99	0.98	0.95	0.88	0.72	0.51	0.34	0.37	0.62	0.9	0.98	1	(89)

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

(90)m=	18.72	19.01	19.38	19.77	19.99	20.08	20.08	20.09	20.05	19.77	19.19	18.69	(90)

fLA = Living area ÷ (4) = 0.4 (91)

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

(92)m=	19.23	19.49	19.8	20.15	20.36	20.44	20.45	20.45	20.41	20.15	19.63	19.2	(92)

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

TER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	19.23	19.49	19.8	20.15	20.36	20.44	20.45	20.45	20.41	20.15	19.63	19.2		(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	0.95	0.88	0.74	0.54	0.37	0.41	0.65	0.9	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	528.28	629.65	691.89	694.91	606.74	427.73	285.54	299.04	454.38	560.53	525.22	495.65		(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=	1168.39	1136.58	1032.43	855.81	655.82	434.35	286.24	300.19	473.08	723.46	957	1154.42		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	476.24	340.65	253.36	115.85	36.51	0	0	0	0	121.22	310.88	490.12		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													2144.83	(98)
Space heating requirement in kWh/m²/year													28.77	(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)														
	476.24	340.65	253.36	115.85	36.51	0	0	0	0	121.22	310.88	490.12		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	509.89	364.73	271.26	124.03	39.09	0	0	0	0	129.78	332.85	524.75		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2296.39	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	197.36	172.4	179.37	159.09	154.03	135.66	129.97	144.89	146.49	166.81	178.06	192.73		
Efficiency of water heater													80.3	(216)
(217)m=	87.19	86.73	85.92	84.27	82.06	80.3	80.3	80.3	80.3	84.26	86.44	87.3		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	226.36	198.77	208.76	188.8	187.71	168.94	161.86	180.44	182.43	197.96	206	220.76		
Total = Sum(219a)$_{1...12}$ =													2328.79	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2296.39

TER WorkSheet: New dwelling design stage

Water heating fuel used			2328.79	
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			331.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5031.79	(338)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	496.02	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	503.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =				999.04	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	172.1	(268)
Total CO2, kg/year			sum of (265)…(271) =		1210.07	(272)

TER = 16.23 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:02

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 48m²

Site Reference : 231 Watford Road - BASE **Plot Reference:** Sample 9

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	21.48 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.05 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	44.0 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	7.68m²	
Ventilation rate:	6.00	

10 Key features

Windows U-value	1.1 W/m²K
Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 9

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48	(1a) x	2.75	(2a) =	132	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	48	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	132	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(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)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

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

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

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=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

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

(25)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			7.68	x1/[1/(1.4)+ 0.04]		=	10.18			(27)
Walls Type1	28.95	7.68	21.27	x	0.18	=	3.83			(29)
Walls Type2	40.29	0	40.29	x	0.18	=	7.25			(29)
Roof	48	0	48	x	0.13	=	6.24			(30)
Total area of elements, m²			117.24							(31)
Party wall			22.38	x	0	=	0			(32)
Party floor			48							(32a)
Internal wall **			97.35							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.5 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7928.85 (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 6.81 (36)

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

Total fabric heat loss (33) + (36) = 34.31 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.49	27.27	27.05	26.03	25.84	24.95	24.95	24.78	25.29	25.84	26.22	26.63	(38)

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

(39)m=	61.8	61.58	61.36	60.34	60.15	59.26	59.26	59.1	59.6	60.15	60.54	60.94	

Average = Sum(39)$_{1…12}$ /12= 60.34 (39)

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

(40)m=	1.29	1.28	1.28	1.26	1.25	1.23	1.23	1.23	1.24	1.25	1.26	1.27

Average = Sum(40)$_{1…12}$ /12= 1.26 (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 1.63 (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 72.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	80.24	77.32	74.4	71.49	68.57	65.65	65.65	68.57	71.49	74.4	77.32	80.24

Total = Sum(44)$_{1…12}$ = 875.35 (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=	118.99	104.07	107.39	93.63	89.84	77.52	71.84	82.44	83.42	97.22	106.12	115.24

Total = Sum(45)$_{1…12}$ = 1147.73 (45)

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

(46)m=	17.85	15.61	16.11	14.04	13.48	11.63	10.78	12.37	12.51	14.58	15.92	17.29	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

TER WorkSheet: New dwelling design stage

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

(61)m=	40.89	35.59	37.92	35.25	34.94	32.38	33.46	34.94	35.25	37.92	38.13	40.89	(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=	159.88	139.66	145.31	128.88	124.78	109.9	105.29	117.38	118.67	135.13	144.25	156.13	(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=	159.88	139.66	145.31	128.88	124.78	109.9	105.29	117.38	118.67	135.13	144.25	156.13	

Output from water heater (annual)$_{1…12}$ 1585.28 (64)

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

(65)m=	49.79	43.5	45.19	39.95	38.61	33.87	32.25	36.15	36.55	41.8	44.82	48.54	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	(66)

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

(67)m=	13.21	11.73	9.54	7.22	5.4	4.56	4.93	6.4	8.59	10.91	12.74	13.58	(67)

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

(68)m=	142.04	143.52	139.8	131.89	121.91	112.53	106.26	104.79	108.5	116.41	126.39	135.77	(68)

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

(69)m=	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	(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=	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	(71)

Water heating gains (Table 5)

(72)m=	66.92	64.73	60.74	55.48	51.89	47.04	43.35	48.58	50.76	56.19	62.25	65.24	(72)

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

(73)m=	272.64	270.46	260.55	245.07	229.68	214.6	205.01	210.25	218.33	233.98	251.85	265.07	(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 m²		Flux Table 6a	g_ Table 6b		FF Table 6c		Gains (W)	
Southwest 0.9x	0.77	x	7.68	x	36.79	0.63	x	0.7	=	86.36	(79)
Southwest 0.9x	0.77	x	7.68	x	62.67	0.63	x	0.7	=	147.1	(79)
Southwest 0.9x	0.77	x	7.68	x	85.75	0.63	x	0.7	=	201.27	(79)
Southwest 0.9x	0.77	x	7.68	x	106.25	0.63	x	0.7	=	249.38	(79)
Southwest 0.9x	0.77	x	7.68	x	119.01	0.63	x	0.7	=	279.33	(79)

Southwest	0.9x	0.77	x	7.68	x	118.15	0.63	x	0.7	=	277.31	(79)
Southwest	0.9x	0.77	x	7.68	x	113.91	0.63	x	0.7	=	267.36	(79)
Southwest	0.9x	0.77	x	7.68	x	104.39	0.63	x	0.7	=	245.02	(79)
Southwest	0.9x	0.77	x	7.68	x	92.85	0.63	x	0.7	=	217.93	(79)
Southwest	0.9x	0.77	x	7.68	x	69.27	0.63	x	0.7	=	162.58	(79)
Southwest	0.9x	0.77	x	7.68	x	44.07	0.63	x	0.7	=	103.44	(79)
Southwest	0.9x	0.77	x	7.68	x	31.49	0.63	x	0.7	=	73.91	(79)

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

(83)m=	86.36	147.1	201.27	249.38	279.33	277.31	267.36	245.02	217.93	162.58	103.44	73.91	(83)

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

(84)m=	359	417.56	461.82	494.45	509.01	491.92	472.37	455.26	436.27	396.56	355.29	338.97	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.94	0.86	0.7	0.54	0.58	0.8	0.95	0.99	1	(86)

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

(87)m=	19.71	19.9	20.16	20.49	20.77	20.94	20.99	20.98	20.88	20.52	20.06	19.69	(87)

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

(88)m=	19.85	19.85	19.86	19.87	19.88	19.89	19.89	19.9	19.89	19.88	19.87	19.86	(88)

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

(89)m=	0.99	0.99	0.97	0.92	0.81	0.61	0.41	0.45	0.72	0.93	0.99	0.99	(89)

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

(90)m=	18.16	18.43	18.81	19.29	19.65	19.85	19.89	19.89	19.8	19.35	18.68	18.13	(90)

fLA = Living area ÷ (4) = 0.42 (91)

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

(92)m=	18.82	19.05	19.39	19.8	20.13	20.31	20.35	20.35	20.26	19.85	19.27	18.79	(92)

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

(93)m=	18.82	19.05	19.39	19.8	20.13	20.31	20.35	20.35	20.26	19.85	19.27	18.79	(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	0.92	0.82	0.65	0.46	0.5	0.75	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	355.79	410.11	445	454.26	418.72	318.26	219.11	228.67	326.03	369.34	349.08	336.59	(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=	897.27	871.41	790.68	657.81	506.84	338.51	222.44	233.52	366.93	556.22	736.59	889.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	402.86	309.99	257.19	146.55	65.56	0	0	0	0	139.03	279	411.18	

TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ =	2011.38	(98)
Space heating requirement in kWh/m²/year	41.9	(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)	402.86	309.99	257.19	146.55	65.56	0	0	0	0	139.03	279	411.18		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	431.33	331.9	275.36	156.91	70.19	0	0	0	0	148.86	298.72	440.23		(211)
Total (kWh/year) = $Sum(211)_{1...5,10....12}$ =													2153.51	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) = $Sum(215)_{1...5,10....12}$ =													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	159.88	139.66	145.31	128.88	124.78	109.9	105.29	117.38	118.67	135.13	144.25	156.13		
Efficiency of water heater													80.3	(216)
(217)m=	87.28	87	86.47	85.38	83.51	80.3	80.3	80.3	80.3	85.12	86.68	87.38		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	183.18	160.53	168.04	150.96	149.41	136.86	131.12	146.17	147.79	158.75	166.41	178.69		
Total = $Sum(219a)_{1...12}$ =													1877.93	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2153.51	
Water heating fuel used			1877.93	
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			233.31	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			4339.75	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	465.16	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	405.63	(264)
Space and water heating	(261) + (262) + (263) + (264) =			870.79	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	121.09	(268)
Total CO2, kg/year		sum of (265)…(271) =		1030.8	(272)

TER =	21.48	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 11:01:01

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.38m²

Site Reference : 231 Watford Road - BASE **Plot Reference:** Sample 10

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	22.37 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.30 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	49.0 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (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	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: North West	6.39m²
Windows facing: North East	3.85m²
Ventilation rate:	6.00

10 Key features

Windows U-value	1.1 W/m²K
Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.38	(1a) x	2.75	(2a) =	138.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.38	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	138.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(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)	0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

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

0.5	0.49	0.48	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46

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=	0.63	0.62	0.62	0.59	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

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

(25)m=	0.63	0.62	0.62	0.59	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.39	x1/[1/(1.4)+ 0.04]	=	8.47			(27)
Windows Type 2			3.85	x1/[1/(1.4)+ 0.04]	=	5.1			(27)
Walls Type1	39.98	10.24	29.74	x 0.18	=	5.35			(29)
Walls Type2	20.07	0	20.07	x 0.18	=	3.61			(29)
Roof	50.38	0	50.38	x 0.13	=	6.55			(30)
Total area of elements, m²			110.43						(31)
Party wall			25.9	x 0	=	0			(32)
Party floor			50.38						(32a)
Internal wall **			108.68						(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.09 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7600.84 (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 6.72 (36)

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

Total fabric heat loss (33) + (36) = 35.81 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.64	28.41	28.19	27.16	26.97	26.07	26.07	25.9	26.42	26.97	27.36	27.77	(38)

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

(39)m=	64.45	64.23	64.01	62.97	62.78	61.88	61.88	61.71	62.23	62.78	63.17	63.58	

Average = Sum(39)$_{1…12}$ /12= 62.97 (39)

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

(40)m=	1.28	1.27	1.27	1.25	1.25	1.23	1.23	1.22	1.24	1.25	1.25	1.26

Average = Sum(40)$_{1…12}$ /12= 1.25 (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 1.7 (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 74.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	82.07	79.08	76.1	73.11	70.13	67.15	67.15	70.13	73.11	76.1	79.08	82.07

Total = Sum(44)$_{1…12}$ = 895.27 (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=	121.7	106.44	109.84	95.76	91.88	79.29	73.47	84.31	85.32	99.43	108.53	117.86

Total = Sum(45)$_{1…12}$ = 1173.84 (45)

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

(46)m=	18.26	15.97	16.48	14.36	13.78	11.89	11.02	12.65	12.8	14.91	16.28	17.68	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

TER WorkSheet: New dwelling design stage

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

(61)m=	41.82	36.4	38.78	36.06	35.74	33.11	34.22	35.74	36.06	38.78	39	41.82	(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=	163.52	142.84	148.62	131.82	127.62	112.4	107.69	120.05	121.37	138.21	147.53	159.68	(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=	163.52	142.84	148.62	131.82	127.62	112.4	107.69	120.05	121.37	138.21	147.53	159.68	

Output from water heater (annual)$_{1...12}$ 1621.35 (64)

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

(65)m=	50.92	44.49	46.22	40.85	39.49	34.64	32.98	36.97	37.38	42.75	45.84	49.64	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.29	11.8	9.6	7.27	5.43	4.58	4.95	6.44	8.64	10.97	12.81	13.66	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	148.22	149.76	145.88	137.63	127.22	117.43	110.89	109.35	113.22	121.48	131.89	141.68	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(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=	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	(71)
Water heating gains (Table 5)													
(72)m=	68.44	66.21	62.12	56.74	53.07	48.11	44.33	49.69	51.92	57.47	63.66	66.73	(72)
Total internal gains =					(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m								
(73)m=	281.47	279.29	269.12	253.16	237.24	221.64	211.69	217	225.31	241.44	259.88	273.58	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.85	x	11.28	x	0.63	x	0.7	=	13.28	(75)
Northeast 0.9x	0.77	x	3.85	x	22.97	x	0.63	x	0.7	=	27.02	(75)
Northeast 0.9x	0.77	x	3.85	x	41.38	x	0.63	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	3.85	x	67.96	x	0.63	x	0.7	=	79.96	(75)
Northeast 0.9x	0.77	x	3.85	x	91.35	x	0.63	x	0.7	=	107.48	(75)

Northeast	0.9x	0.77	x	3.85	x	97.38	x	0.63	x	0.7	=	114.58	(75)
Northeast	0.9x	0.77	x	3.85	x	91.1	x	0.63	x	0.7	=	107.19	(75)
Northeast	0.9x	0.77	x	3.85	x	72.63	x	0.63	x	0.7	=	85.45	(75)
Northeast	0.9x	0.77	x	3.85	x	50.42	x	0.63	x	0.7	=	59.33	(75)
Northeast	0.9x	0.77	x	3.85	x	28.07	x	0.63	x	0.7	=	33.02	(75)
Northeast	0.9x	0.77	x	3.85	x	14.2	x	0.63	x	0.7	=	16.7	(75)
Northeast	0.9x	0.77	x	3.85	x	9.21	x	0.63	x	0.7	=	10.84	(75)
Northwest	0.9x	0.77	x	6.39	x	11.28	x	0.63	x	0.7	=	22.03	(81)
Northwest	0.9x	0.77	x	6.39	x	22.97	x	0.63	x	0.7	=	44.85	(81)
Northwest	0.9x	0.77	x	6.39	x	41.38	x	0.63	x	0.7	=	80.81	(81)
Northwest	0.9x	0.77	x	6.39	x	67.96	x	0.63	x	0.7	=	132.71	(81)
Northwest	0.9x	0.77	x	6.39	x	91.35	x	0.63	x	0.7	=	178.39	(81)
Northwest	0.9x	0.77	x	6.39	x	97.38	x	0.63	x	0.7	=	190.18	(81)
Northwest	0.9x	0.77	x	6.39	x	91.1	x	0.63	x	0.7	=	177.91	(81)
Northwest	0.9x	0.77	x	6.39	x	72.63	x	0.63	x	0.7	=	141.83	(81)
Northwest	0.9x	0.77	x	6.39	x	50.42	x	0.63	x	0.7	=	98.46	(81)
Northwest	0.9x	0.77	x	6.39	x	28.07	x	0.63	x	0.7	=	54.81	(81)
Northwest	0.9x	0.77	x	6.39	x	14.2	x	0.63	x	0.7	=	27.72	(81)
Northwest	0.9x	0.77	x	6.39	x	9.21	x	0.63	x	0.7	=	17.99	(81)

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

(83)m=	35.31	71.87	129.49	212.67	285.87	304.76	285.1	227.28	157.79	87.84	44.43	28.84	(83)

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

(84)m=	316.78	351.16	398.61	465.82	523.1	526.41	496.79	444.28	383.1	329.27	304.31	302.42	(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	0.87	0.69	0.53	0.61	0.87	0.98	1	1	(86)

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

(87)m=	19.62	19.75	20.03	20.42	20.76	20.94	20.99	20.98	20.82	20.39	19.95	19.6	(87)

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

(88)m=	19.86	19.86	19.86	19.88	19.88	19.9	19.9	19.9	19.89	19.88	19.88	19.87	(88)

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

(89)m=	1	0.99	0.98	0.94	0.82	0.6	0.41	0.48	0.8	0.97	0.99	1	(89)

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

(90)m=	18.02	18.23	18.63	19.2	19.65	19.86	19.89	19.89	19.75	19.18	18.52	18.01	(90)

fLA = Living area ÷ (4) = 0.48 (91)

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

(92)m=	18.78	18.95	19.29	19.79	20.18	20.38	20.41	20.41	20.26	19.76	19.2	18.77	(92)

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

TER WorkSheet: New dwelling design stage

(93)m=	18.78	18.95	19.29	19.79	20.18	20.38	20.41	20.41	20.26	19.76	19.2	18.77	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.83	0.64	0.47	0.54	0.83	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	315.35	348.44	391.26	438.56	435.35	337.16	232.43	240.44	316.55	318.67	301.87	301.32	(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=	933.46	902.68	818.91	685.49	532.45	357.44	236.04	247.35	383.33	574.89	764.58	926.31	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	459.87	372.45	318.17	177.79	72.24	0	0	0	0	190.63	333.15	464.99	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2389.3 (98)

Space heating requirement in kWh/m²/year 47.43 (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)														
	459.87	372.45	318.17	177.79	72.24	0	0	0	0	190.63	333.15	464.99		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	492.37	398.77	340.66	190.35	77.34	0	0	0	0	204.1	356.69	497.85		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2558.13	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	163.52	142.84	148.62	131.82	127.62	112.4	107.69	120.05	121.37	138.21	147.53	159.68		
Efficiency of water heater													80.3	(216)
(217)m=	87.51	87.35	86.92	85.81	83.68	80.3	80.3	80.3	80.3	85.86	87.04	87.58		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	186.86	163.52	170.98	153.62	152.51	139.98	134.11	149.5	151.15	160.97	169.5	182.32		
Total = Sum(219a)$_{1...12}$ =													1915.01	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2558.13

TER WorkSheet: New dwelling design stage

Water heating fuel used			1915.01	
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			234.63	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			4782.78	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	552.56	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	413.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			966.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	121.77	(268)
Total CO2, kg/year		sum of (265)…(271) =		1126.9	(272)

TER = 22.37 (273)

Appendix B

Energy Efficient Design:-

SAP Outputs & Dwelling Emission Rates

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:56

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 100.28m²

Site Reference : 231 Watford Road - LEAN **Plot Reference:** Sample 1

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	17.55 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.78 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	42.3 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	Fail

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South East	15.34m²
Windows facing: South West	1.28m²
Ventilation rate:	3.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	100.28	(1a) x	2.75	(2a) =	275.77	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.28	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	275.77	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			15.34	x1/[1/(1.1)+ 0.04]		=	16.16			(27)
Windows Type 2			1.28	x1/[1/(1.1)+ 0.04]		=	1.35			(27)
Floor			100.28	x	0.14	=	14.0392	110	11030.8	(28)
Walls Type1	68.22	16.62	51.6	x	0.16	=	8.26	60	3096	(29)
Walls Type2	43.24	0	43.24	x	0.15	=	6.47	60	2594.4	(29)
Total area of elements, m²			211.74							(31)
Party wall			15.21	x	0	=	0	45	684.45	(32)
Party ceiling			100.28					30	3008.4	(32b)
Internal wall **			175.18					9	1576.62	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21990.67 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 219.29 (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 15.42 (36)

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

Total fabric heat loss (33) + (36) = 61.7 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	(38)

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

(39)m=	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	

Average = Sum(39)$_{1…12}$ /12= 107.2 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07

Average = Sum(40)$_{1…12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.74 (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 99.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	109.26	105.28	101.31	97.34	93.37	89.39	89.39	93.37	97.34	101.31	105.28	109.26	
										Total = Sum(44)$_{1…12}$ =		1191.9	(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=	162.03	141.71	146.23	127.49	122.33	105.56	97.82	112.25	113.59	132.37	144.5	156.91	
										Total = Sum(45)$_{1…12}$ =		1562.77	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.3	21.26	21.93	19.12	18.35	15.83	14.67	16.84	17.04	19.86	21.67	23.54	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

DER WorkSheet: New dwelling design stage

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

(61)m=	50.96	46.03	50.96	48	47.58	44.08	45.55	47.58	48	50.96	49.32	50.96	(61)

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

(62)m=	212.98	187.74	197.19	175.49	169.91	149.64	143.37	159.82	161.59	183.33	193.81	207.87	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	130.55	118.76	119.02	108.25	54.61	12.92	12.03	13.66	13.81	110.41	119.46	128.96	(63) (G2)

Output from water heater

(64)m=	80.19	66.95	75.93	65.12	113.2	134.78	129.33	144.07	145.67	70.68	72.18	76.67	

Output from water heater (annual)1…12 | 1174.76 | (64)

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

(65)m=	66.61	58.62	61.36	54.39	52.57	46.12	43.91	49.22	49.77	56.75	60.37	64.91	(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=	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.72	21.07	17.13	12.97	9.7	8.19	8.85	11.5	15.43	19.59	22.87	24.38	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	256.78	259.44	252.73	238.43	220.39	203.43	192.1	189.44	196.15	210.45	228.49	245.45	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	(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=	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	(71)
Water heating gains (Table 5)													
(72)m=	89.53	87.24	82.48	75.54	70.66	64.05	59.02	66.15	69.12	76.28	83.85	87.25	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	437.17	434.88	419.47	394.08	367.87	342.8	327.1	334.22	347.84	373.45	402.34	424.21	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	15.34	x	36.79	x	0.63	x	0.7	=	172.49	(77)
Southeast	0.9x	0.77	x	15.34	x	62.67	x	0.63	x	0.7	=	293.82	(77)
Southeast	0.9x	0.77	x	15.34	x	85.75	x	0.63	x	0.7	=	402.02	(77)
Southeast	0.9x	0.77	x	15.34	x	106.25	x	0.63	x	0.7	=	498.12	(77)

Southeast	0.9x	0.77	x	15.34	x	119.01	x	0.63	x	0.7	=	557.93	(77)
Southeast	0.9x	0.77	x	15.34	x	118.15	x	0.63	x	0.7	=	553.9	(77)
Southeast	0.9x	0.77	x	15.34	x	113.91	x	0.63	x	0.7	=	534.02	(77)
Southeast	0.9x	0.77	x	15.34	x	104.39	x	0.63	x	0.7	=	489.39	(77)
Southeast	0.9x	0.77	x	15.34	x	92.85	x	0.63	x	0.7	=	435.3	(77)
Southeast	0.9x	0.77	x	15.34	x	69.27	x	0.63	x	0.7	=	324.73	(77)
Southeast	0.9x	0.77	x	15.34	x	44.07	x	0.63	x	0.7	=	206.61	(77)
Southeast	0.9x	0.77	x	15.34	x	31.49	x	0.63	x	0.7	=	147.62	(77)
Southwest	0.9x	0.77	x	1.28	x	36.79		0.63	x	0.7	=	14.39	(79)
Southwest	0.9x	0.77	x	1.28	x	62.67		0.63	x	0.7	=	24.52	(79)
Southwest	0.9x	0.77	x	1.28	x	85.75		0.63	x	0.7	=	33.55	(79)
Southwest	0.9x	0.77	x	1.28	x	106.25		0.63	x	0.7	=	41.56	(79)
Southwest	0.9x	0.77	x	1.28	x	119.01		0.63	x	0.7	=	46.56	(79)
Southwest	0.9x	0.77	x	1.28	x	118.15		0.63	x	0.7	=	46.22	(79)
Southwest	0.9x	0.77	x	1.28	x	113.91		0.63	x	0.7	=	44.56	(79)
Southwest	0.9x	0.77	x	1.28	x	104.39		0.63	x	0.7	=	40.84	(79)
Southwest	0.9x	0.77	x	1.28	x	92.85		0.63	x	0.7	=	36.32	(79)
Southwest	0.9x	0.77	x	1.28	x	69.27		0.63	x	0.7	=	27.1	(79)
Southwest	0.9x	0.77	x	1.28	x	44.07		0.63	x	0.7	=	17.24	(79)
Southwest	0.9x	0.77	x	1.28	x	31.49		0.63	x	0.7	=	12.32	(79)

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

(83)m=	186.89	318.34	435.56	539.68	604.49	600.12	578.58	530.23	471.62	351.83	223.85	159.94	(83)

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

(84)m=	624.05	753.22	855.03	933.76	972.36	942.92	905.68	864.45	819.46	725.28	626.19	584.15	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.93	0.84	0.68	0.51	0.55	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=	19.77	19.97	20.24	20.55	20.81	20.95	20.99	20.98	20.9	20.55	20.08	19.71	(87)

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

(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

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

(89)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.4	0.44	0.71	0.93	0.99	1	(89)

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

(90)m=	18.38	18.67	19.06	19.5	19.83	19.99	20.02	20.02	19.94	19.51	18.84	18.3	(90)

fLA = Living area ÷ (4) = 0.23 (91)

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

(92)m=	18.7	18.97	19.34	19.74	20.06	20.21	20.25	20.24	20.16	19.75	19.13	18.63	(92)

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

(93)m=	18.55	18.82	19.19	19.59	19.91	20.06	20.1	20.09	20.01	19.6	18.98	18.48	(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	0.6	0.41	0.45	0.71	0.92	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	619	738.93	818.3	840.72	762.26	561.53	371.62	390.8	579.86	668.73	615.46	580.59		(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=	1527.97	1492.29	1359.91	1146.29	880.19	585.63	374.82	395.91	633.95	965.06	1273.53	1531.08		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	676.27	506.26	402.96	220.01	87.74	0	0	0	0	220.47	473.81	707.16		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													3294.69	(98)
Space heating requirement in kWh/m²/year													32.85	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)														
	676.27	506.26	402.96	220.01	87.74	0	0	0	0	220.47	473.81	707.16		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	748.91	560.65	446.25	243.65	97.16	0	0	0	0	244.15	524.71	783.13		
Total (kWh/year) =Sum(211)1...5,10...12=													3648.6	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

Output from water heater (calculated above)														
	80.19	66.95	75.93	65.12	113.2	134.78	129.33	144.07	145.67	70.68	72.18	76.67		
Efficiency of water heater													81	(216)
(217)m=	89.21	89.11	88.69	87.99	84.81	81	81	81	81	87.85	88.95	89.3		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	89.89	75.13	85.61	74.01	133.47	166.4	159.67	177.86	179.83	80.45	81.14	85.86		
Total = Sum(219a)1...12 =													1389.32	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3648.6

DER WorkSheet: New dwelling design stage

Water heating fuel used		1389.32	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	459.24		(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) =		534.24	(231)
Electricity for lighting		418.92	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5991.09	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	788.1	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	300.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1088.19	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	277.27	(267)
Electricity for lighting	(232) x	0.519	=	217.42	(268)
Total CO2, kg/year		sum of (265)…(271) =		1582.88	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		15.78	(273)
EI rating (section 14)				85	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:54

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 52.98m²

Site Reference : 231 Watford Road - LEAN **Plot Reference:** Sample 2

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	17.47 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.62 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	27.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	6.39m²	
Ventilation rate:	6.00	

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.98	(1a) x	2.75	(2a) =	145.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows			6.39	x1/[1/(1.1)+ 0.04]		=	6.73			(27)
Walls Type1	22.17	6.39	15.78	x	0.16	=	2.52	60	946.8	(29)
Walls Type2	17.22	0	17.22	x	0.15	=	2.58	60	1033.2	(29)
Total area of elements, m²			39.39							(31)
Party wall			46.48	x	0	=	0	45	2091.6	(32)
Party floor			52.98					40	2119.2	(32a)
Party ceiling			52.98					30	1589.4	(32b)
Internal wall **			97.63					9	878.67	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 11.84 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8658.87 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.44 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 6.45 (36)

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

Total fabric heat loss (33) + (36) = 18.29 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	(38)

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

(39)m=	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	

Average = $Sum(39)_{1…12}$ /12= 42.33 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Average = Sum(40)1…12 /12= 0.8 (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 — 1.78 (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 — 76.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	84.07	81.01	77.96	74.9	71.84	68.78	68.78	71.84	74.9	77.96	81.01	84.07	
Total = Sum(44)1…12 =												917.12	(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=	124.67	109.04	112.52	98.1	94.13	81.22	75.27	86.37	87.4	101.86	111.18	120.74	
Total = Sum(45)1…12 =												1202.49	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.7	16.36	16.88	14.71	14.12	12.18	11.29	12.96	13.11	15.28	16.68	18.11	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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) × (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 × (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)

DER WorkSheet: New dwelling design stage

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

(61)m=	42.84	37.29	39.73	36.94	36.61	33.92	35.05	36.61	36.94	39.73	39.95	42.84	(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=	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	106.82	78.54	64.44	36.06	20.17	10.02	9.28	10.66	10.79	35.87	73.71	105.11	(63) (G2)

Output from water heater

(64)m=	58.81	66.15	86.05	97.35	108.95	103.64	99.5	110.71	111.92	103.96	75.66	56.59	

Output from water heater (annual)1…12 | 1079.28 | (64)

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

(65)m=	52.16	45.58	47.34	41.85	40.45	35.49	33.79	37.87	38.29	43.8	46.96	50.86	(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=	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	(66)

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

(67)m=	15.32	13.6	11.06	8.38	6.26	5.29	5.71	7.42	9.96	12.65	14.77	15.74	(67)

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

(68)m=	154.97	156.57	152.52	143.9	133.01	122.77	115.93	114.32	118.38	127	137.89	148.13	(68)

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

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(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=	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	(71)

Water heating gains (Table 5)

(72)m=	70.11	67.82	63.63	58.13	54.37	49.29	45.42	50.9	53.19	58.87	65.22	68.35	(72)

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

(73)m=	293.07	290.67	279.89	263.07	246.3	230.01	219.73	225.32	234.2	251.2	270.55	284.9	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	6.39	x	36.79	x	0.63	x	0.7	=	71.85	(77)
Southeast 0.9x	0.77	x	6.39	x	62.67	x	0.63	x	0.7	=	122.39	(77)
Southeast 0.9x	0.77	x	6.39	x	85.75	x	0.63	x	0.7	=	167.46	(77)
Southeast 0.9x	0.77	x	6.39	x	106.25	x	0.63	x	0.7	=	207.5	(77)

DER WorkSheet: New dwelling design stage

Southeast	0.9x	0.77	x	6.39	x	119.01	x	0.63	x	0.7	=	232.41	(77)
Southeast	0.9x	0.77	x	6.39	x	118.15	x	0.63	x	0.7	=	230.73	(77)
Southeast	0.9x	0.77	x	6.39	x	113.91	x	0.63	x	0.7	=	222.45	(77)
Southeast	0.9x	0.77	x	6.39	x	104.39	x	0.63	x	0.7	=	203.86	(77)
Southeast	0.9x	0.77	x	6.39	x	92.85	x	0.63	x	0.7	=	181.33	(77)
Southeast	0.9x	0.77	x	6.39	x	69.27	x	0.63	x	0.7	=	135.27	(77)
Southeast	0.9x	0.77	x	6.39	x	44.07	x	0.63	x	0.7	=	86.06	(77)
Southeast	0.9x	0.77	x	6.39	x	31.49	x	0.63	x	0.7	=	61.49	(77)

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

(83)m=	71.85	122.39	167.46	207.5	232.41	230.73	222.45	203.86	181.33	135.27	86.06	61.49	(83)

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

(84)m=	364.92	413.07	447.35	470.56	478.72	460.74	442.18	429.18	415.53	386.47	356.61	346.39	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.93	0.86	0.74	0.57	0.42	0.45	0.66	0.88	0.96	0.98	(86)

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

(87)m=	20.06	20.24	20.47	20.71	20.89	20.98	21	20.99	20.95	20.73	20.34	20.01	(87)

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

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

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

(89)m=	0.98	0.96	0.92	0.84	0.7	0.51	0.35	0.38	0.6	0.85	0.95	0.98	(89)

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

(90)m=	19	19.25	19.58	19.91	20.14	20.23	20.25	20.25	20.21	19.94	19.41	18.92	(90)

fLA = Living area ÷ (4) = 0.4 (91)

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

(92)m=	19.43	19.65	19.94	20.24	20.44	20.53	20.55	20.55	20.51	20.26	19.78	19.36	(92)

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

(93)m=	19.28	19.5	19.79	20.09	20.29	20.38	20.4	20.4	20.36	20.11	19.63	19.21	(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=	0.97	0.95	0.91	0.83	0.7	0.52	0.36	0.39	0.61	0.84	0.95	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	353.46	391.04	405.71	390.47	334.32	239.13	160.15	168.16	252.96	326.02	337.22	337.5	(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=	634.17	618.1	562.51	473.49	363.81	244.84	160.96	169.36	264.98	402.48	530.59	635.41	(97)

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

(98)m=	208.84	152.59	116.66	59.78	21.93	0	0	0	0	56.89	139.22	221.64

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 977.56 (98)

Space heating requirement in kWh/m²/year 18.45 (99)

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

Space heating:

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

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

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.3 (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)	208.84	152.59	116.66	59.78	21.93	0	0	0	0	56.89	139.22	221.64		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	231.28	168.98	129.19	66.2	24.29	0	0	0	0	63	154.18	245.45		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1082.57	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)	58.81	66.15	86.05	97.35	108.95	103.64	99.5	110.71	111.92	103.96	75.66	56.59		
Efficiency of water heater													81	(216)
(217)m=	88.08	87.27	86.1	84.3	82.42	81	81	81	81	84.06	86.79	88.24		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	66.77	75.79	99.94	115.47	132.19	127.95	122.84	136.67	138.18	123.67	87.18	64.13		
Total = Sum(219a)$_{1...12}$ =													1290.78	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1082.57	
Water heating fuel used			1290.78	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		261.29		(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) =		336.29	(231)
Electricity for lighting			270.51	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2980.14	(338)

DER WorkSheet: New dwelling design stage

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	=	233.83	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	278.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =				512.64	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	174.53	(267)
Electricity for lighting	(232)	x	0.519	=	140.39	(268)
Total CO2, kg/year			sum of (265)…(271) =		827.57	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		15.62	(273)
EI rating (section 14)					89	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:53

Project Information:

Assessed By:	Neil Ingham (STRO010943)	**Building Type:**	Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE		Total Floor Area: 92.44m²	
Site Reference :	231 Watford Road - LEAN	**Plot Reference:**	Sample 3
Address :			

Client Details:

Name:
Address :

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

1a TER and DER

Fuel for main heating system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.96 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.12 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	48.7 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	Fail

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	3.85m²	
Windows facing: North West	5.11m²	
Ventilation rate:	6.00	

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 3

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	92.44	(1a)	x	2.75	(2a)	=	254.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.44	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			254.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			3.85	x1/[1/(1.1)+ 0.04]		=	4.06			(27)
Windows Type 2			5.11	x1/[1/(1.1)+ 0.04]		=	5.38			(27)
Floor			92.44	x	0.14	=	12.9416	75	6933	(28)
Walls Type1	35.28	8.96	26.32	x	0.16	=	4.21	60	1579.2	(29)
Walls Type2	82.44	0	82.44	x	0.15	=	12.34	60	4946.4	(29)
Total area of elements, m²			210.16							(31)
Party wall			15.98	x	0	=	0	45	719.1	(32)
Party ceiling			92.44					30	2773.2	(32b)
Internal wall **			154.44					9	1389.96	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 18340.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 198.41 (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 14.76 (36)

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

Total fabric heat loss (33) + (36) = 53.69 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	(38)

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

(39)m=	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	

Average = Sum(39)$_{1\ldots12}$ /12= 95.64 (39)

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

(40)m=	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03

Average = $Sum(40)_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.32 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	107.05	103.16	99.27	95.37	91.48	87.59	87.59	91.48	95.37	99.27	103.16	107.05

Total = $Sum(44)_{1...12}$ = 1167.84 (44)

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

(45)m=	158.75	138.85	143.28	124.91	119.86	103.43	95.84	109.98	111.29	129.7	141.58	153.75

Total = $Sum(45)_{1...12}$ = 1531.22 (45)

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

(46)m=	23.81	20.83	21.49	18.74	17.98	15.51	14.38	16.5	16.69	19.46	21.24	23.06	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (41)m

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

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

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

(61)m=	50.96	46.03	50.58	47.03	46.62	43.19	44.63	46.62	47.03	50.58	49.32	50.96	(61)

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

(62)m=	209.71	184.87	193.86	171.95	166.47	146.62	140.47	156.6	158.33	180.29	190.89	204.7	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	129.02	118.22	119.35	108.38	89.44	12.68	11.8	13.41	13.56	110.41	118.62	127.16	(63) (G2)

Output from water heater

(64)m=	78.45	64.63	72.29	61.5	74.98	132.04	126.71	141.13	142.7	67.65	70.11	75.3	

Output from water heater (annual)$_{1...12}$ 1107.5 (64)

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

(65)m=	65.53	57.67	60.29	53.29	51.51	45.19	43.03	48.22	48.76	55.77	59.4	63.86	(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=	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	25.23	22.41	18.22	13.8	10.31	8.71	9.41	12.23	16.41	20.84	24.33	25.93	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	243.5	246.02	239.66	226.1	208.99	192.91	182.16	179.64	186	199.56	216.67	232.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(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=	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	(71)
Water heating gains (Table 5)													
(72)m=	88.07	85.82	81.03	74.02	69.23	62.76	57.83	64.82	67.73	74.96	82.51	85.83	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	422.66	420.12	404.77	379.78	354.4	330.24	315.27	322.55	336.01	361.23	389.37	410.38	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.85	x	11.28	x	0.63	x	0.7	=	13.28	(75)
Northeast 0.9x	0.77	x	3.85	x	22.97	x	0.63	x	0.7	=	27.02	(75)
Northeast 0.9x	0.77	x	3.85	x	41.38	x	0.63	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	3.85	x	67.96	x	0.63	x	0.7	=	79.96	(75)

DER WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	3.85	x	91.35	x	0.63	x	0.7	=	107.48	(75)
Northeast	0.9x	0.77	x	3.85	x	97.38	x	0.63	x	0.7	=	114.58	(75)
Northeast	0.9x	0.77	x	3.85	x	91.1	x	0.63	x	0.7	=	107.19	(75)
Northeast	0.9x	0.77	x	3.85	x	72.63	x	0.63	x	0.7	=	85.45	(75)
Northeast	0.9x	0.77	x	3.85	x	50.42	x	0.63	x	0.7	=	59.33	(75)
Northeast	0.9x	0.77	x	3.85	x	28.07	x	0.63	x	0.7	=	33.02	(75)
Northeast	0.9x	0.77	x	3.85	x	14.2	x	0.63	x	0.7	=	16.7	(75)
Northeast	0.9x	0.77	x	3.85	x	9.21	x	0.63	x	0.7	=	10.84	(75)
Northwest	0.9x	0.77	x	5.11	x	11.28	x	0.63	x	0.7	=	17.62	(81)
Northwest	0.9x	0.77	x	5.11	x	22.97	x	0.63	x	0.7	=	35.87	(81)
Northwest	0.9x	0.77	x	5.11	x	41.38	x	0.63	x	0.7	=	64.62	(81)
Northwest	0.9x	0.77	x	5.11	x	67.96	x	0.63	x	0.7	=	106.13	(81)
Northwest	0.9x	0.77	x	5.11	x	91.35	x	0.63	x	0.7	=	142.65	(81)
Northwest	0.9x	0.77	x	5.11	x	97.38	x	0.63	x	0.7	=	152.08	(81)
Northwest	0.9x	0.77	x	5.11	x	91.1	x	0.63	x	0.7	=	142.27	(81)
Northwest	0.9x	0.77	x	5.11	x	72.63	x	0.63	x	0.7	=	113.42	(81)
Northwest	0.9x	0.77	x	5.11	x	50.42	x	0.63	x	0.7	=	78.74	(81)
Northwest	0.9x	0.77	x	5.11	x	28.07	x	0.63	x	0.7	=	43.83	(81)
Northwest	0.9x	0.77	x	5.11	x	14.2	x	0.63	x	0.7	=	22.17	(81)
Northwest	0.9x	0.77	x	5.11	x	9.21	x	0.63	x	0.7	=	14.39	(81)

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

(83)m=	30.9	62.89	113.31	186.08	250.13	266.67	249.46	198.87	138.07	76.86	38.88	25.23	(83)

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

(84)m=	453.56	483.01	518.08	565.86	604.53	596.91	564.73	521.42	474.08	438.08	428.24	435.61	(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	1	0.99	0.98	0.94	0.83	0.68	0.74	0.93	0.99	1	1	(86)

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

(87)m=	19.57	19.68	19.91	20.25	20.6	20.85	20.96	20.94	20.72	20.3	19.88	19.54	(87)

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

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

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

(89)m=	1	1	0.99	0.97	0.91	0.76	0.56	0.63	0.89	0.98	0.99	1	(89)

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

(90)m=	18.13	18.29	18.63	19.11	19.6	19.93	20.03	20.02	19.78	19.19	18.57	18.08	(90)

fLA = Living area ÷ (4) = 0.3 (91)

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

(92)m=	18.56	18.71	19.01	19.45	19.9	20.21	20.31	20.29	20.07	19.52	18.96	18.52	(92)

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

(93)m=	18.41	18.56	18.86	19.3	19.75	20.06	20.16	20.14	19.92	19.37	18.81	18.37	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.9	0.76	0.58	0.64	0.88	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	451.45	479.71	511.2	546.31	546.11	454.25	326.04	334.8	416.54	426.9	424.9	433.92	(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=	1349.89	1306.09	1182.36	995.04	770.13	522.05	340.41	357.91	556.15	838.98	1120.24	1355.16	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	668.44	555.33	499.34	323.09	166.68	0	0	0	0	306.58	500.65	685.4	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3705.51 (98)

Space heating requirement in kWh/m²/year 40.09 (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) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)													
	668.44	555.33	499.34	323.09	166.68	0	0	0	0	306.58	500.65	685.4	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	740.25	614.98	552.98	357.79	184.58	0	0	0	0	339.51	554.43	759.03	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4103.55 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)													
	78.45	64.63	72.29	61.5	74.98	132.04	126.71	141.13	142.7	67.65	70.11	75.3	
Efficiency of water heater												81	(216)
(217)m=	89.22	89.23	89.01	88.67	87.19	81	81	81	81	88.46	89.04	89.29	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	87.93	72.43	81.22	69.36	86	163.01	156.43	174.24	176.17	76.47	78.73	84.34	

Total = Sum(219a)$_{1...12}$ = 1306.32 (219)

Annual totals	kWh/year	kWh/year
Space heating fuel used, main system 1		4103.55

DER WorkSheet: New dwelling design stage

Water heating fuel used			1306.32	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		455.9		(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) =		530.9	(231)
Electricity for lighting			445.58	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6386.35	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	886.37	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	282.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1168.53	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	275.54	(267)
Electricity for lighting	(232) x	0.519	=	231.25	(268)
Total CO2, kg/year		sum of (265)…(271) =		1675.33	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.12	(273)
EI rating (section 14)				84	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:51

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 52.98m²

Site Reference : 231 Watford Road - LEAN **Plot Reference:** Sample 4

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	17.47 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.62 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	27.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	6.39m²	
Ventilation rate:	6.00	

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.98	(1a) x	2.75	(2a) =	145.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows			6.39	x1/[1/(1.1)+ 0.04]		=	6.73			(27)
Walls Type1	22.17	6.39	15.78	x	0.16	=	2.52	60	946.8	(29)
Walls Type2	17.22	0	17.22	x	0.15	=	2.58	60	1033.2	(29)
Total area of elements, m²			39.39							(31)
Party wall			46.48	x	0	=	0	45	2091.6	(32)
Party floor			52.98					40	2119.2	(32a)
Party ceiling			52.98					30	1589.4	(32b)
Internal wall **			97.63					9	878.67	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 11.84 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8658.87 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.44 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 6.45 (36)

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

Total fabric heat loss (33) + (36) = 18.29 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	(38)

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

(39)m=	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	

Average = Sum(39)$_{1…12}$ /12= 42.33 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Average = Sum(40)$_{1…12}$ /12= 0.8 (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 1.78 (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 76.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	84.07	81.01	77.96	74.9	71.84	68.78	68.78	71.84	74.9	77.96	81.01	84.07

Total = Sum(44)$_{1…12}$ = 917.12 (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=	124.67	109.04	112.52	98.1	94.13	81.22	75.27	86.37	87.4	101.86	111.18	120.74

Total = Sum(45)$_{1…12}$ = 1202.49 (45)

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

(46)m=	18.7	16.36	16.88	14.71	14.12	12.18	11.29	12.96	13.11	15.28	16.68	18.11	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

DER WorkSheet: New dwelling design stage

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

(61)m=	42.84	37.29	39.73	36.94	36.61	33.92	35.05	36.61	36.94	39.73	39.95	42.84	(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=	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	106.82	78.54	64.44	36.06	20.17	10.02	9.28	10.66	10.79	35.87	73.71	105.11	(63) (G2)

Output from water heater

(64)m=	58.81	66.15	86.05	97.35	108.95	103.64	99.5	110.71	111.92	103.96	75.66	56.59	

Output from water heater (annual)$_{1...12}$ 1079.28 (64)

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

(65)m=	52.16	45.58	47.34	41.85	40.45	35.49	33.79	37.87	38.29	43.8	46.96	50.86	(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=	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	15.32	13.6	11.06	8.38	6.26	5.29	5.71	7.42	9.96	12.65	14.77	15.74	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	154.97	156.57	152.52	143.9	133.01	122.77	115.93	114.32	118.38	127	137.89	148.13	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(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=	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	(71)
Water heating gains (Table 5)													
(72)m=	70.11	67.82	63.63	58.13	54.37	49.29	45.42	50.9	53.19	58.87	65.22	68.35	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	293.07	290.67	279.89	263.07	246.3	230.01	219.73	225.32	234.2	251.2	270.55	284.9	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	6.39	x	36.79	x	0.63	x	0.7	=	71.85	(77)
Southeast	0.9x	0.77	x	6.39	x	62.67	x	0.63	x	0.7	=	122.39	(77)
Southeast	0.9x	0.77	x	6.39	x	85.75	x	0.63	x	0.7	=	167.46	(77)
Southeast	0.9x	0.77	x	6.39	x	106.25	x	0.63	x	0.7	=	207.5	(77)

Southeast	0.9x	0.77	x	6.39	x	119.01	x	0.63	x	0.7	=	232.41	(77)
Southeast	0.9x	0.77	x	6.39	x	118.15	x	0.63	x	0.7	=	230.73	(77)
Southeast	0.9x	0.77	x	6.39	x	113.91	x	0.63	x	0.7	=	222.45	(77)
Southeast	0.9x	0.77	x	6.39	x	104.39	x	0.63	x	0.7	=	203.86	(77)
Southeast	0.9x	0.77	x	6.39	x	92.85	x	0.63	x	0.7	=	181.33	(77)
Southeast	0.9x	0.77	x	6.39	x	69.27	x	0.63	x	0.7	=	135.27	(77)
Southeast	0.9x	0.77	x	6.39	x	44.07	x	0.63	x	0.7	=	86.06	(77)
Southeast	0.9x	0.77	x	6.39	x	31.49	x	0.63	x	0.7	=	61.49	(77)

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

(83)m=	71.85	122.39	167.46	207.5	232.41	230.73	222.45	203.86	181.33	135.27	86.06	61.49	(83)

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

(84)m=	364.92	413.07	447.35	470.56	478.72	460.74	442.18	429.18	415.53	386.47	356.61	346.39	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.93	0.86	0.74	0.57	0.42	0.45	0.66	0.88	0.96	0.98	(86)

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

(87)m=	20.06	20.24	20.47	20.71	20.89	20.98	21	20.99	20.95	20.73	20.34	20.01	(87)

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

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

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

(89)m=	0.98	0.96	0.92	0.84	0.7	0.51	0.35	0.38	0.6	0.85	0.95	0.98	(89)

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

(90)m=	19	19.25	19.58	19.91	20.14	20.23	20.25	20.25	20.21	19.94	19.41	18.92	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

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

(92)m=	19.43	19.65	19.94	20.24	20.44	20.53	20.55	20.55	20.51	20.26	19.78	19.36	(92)

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

(93)m=	19.28	19.5	19.79	20.09	20.29	20.38	20.4	20.4	20.36	20.11	19.63	19.21	(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=	0.97	0.95	0.91	0.83	0.7	0.52	0.36	0.39	0.61	0.84	0.95	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	353.46	391.04	405.71	390.47	334.32	239.13	160.15	168.16	252.96	326.02	337.22	337.5	(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=	634.17	618.1	562.51	473.49	363.81	244.84	160.96	169.36	264.98	402.48	530.59	635.41	(97)

DER WorkSheet: New dwelling design stage

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

(98)m=	208.84	152.59	116.66	59.78	21.93	0	0	0	0	56.89	139.22	221.64

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 977.56 (98)

Space heating requirement in kWh/m²/year 18.45 (99)

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

Space heating:

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

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

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.3 (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)	208.84	152.59	116.66	59.78	21.93	0	0	0	0	56.89	139.22	221.64	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	231.28	168.98	129.19	66.2	24.29	0	0	0	0	63	154.18	245.45	

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 1082.57 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

58.81	66.15	86.05	97.35	108.95	103.64	99.5	110.71	111.92	103.96	75.66	56.59

Efficiency of water heater 81 (216)

(217)m=	88.08	87.27	86.1	84.3	82.42	81	81	81	81	84.06	86.79	88.24	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	66.77	75.79	99.94	115.47	132.19	127.95	122.84	136.67	138.18	123.67	87.18	64.13

Total = $Sum(219a)_{1...12}$ = 1290.78 (219)

Annual totals	kWh/year	kWh/year	
Space heating fuel used, main system 1		1082.57	
Water heating fuel used		1290.78	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	261.29		(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) =		336.29	(231)
Electricity for lighting		270.51	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2980.14	(338)

DER WorkSheet: New dwelling design stage

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	=	233.83	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	278.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =				512.64	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	174.53	(267)
Electricity for lighting	(232)	x	0.519	=	140.39	(268)
Total CO2, kg/year			sum of (265)…(271) =		827.57	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		15.62	(273)
EI rating (section 14)					89	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:50

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 74.55m²

Site Reference : 231 Watford Road - LEAN **Plot Reference:** Sample 5

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.23 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.53 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	39.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: South East	12.79m²
Windows facing: South	1.28m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.55	(1a) x	2.75	(2a) =	205.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			12.79	x1/[1/(1.1)+ 0.04] =	13.48			(27)
Windows Type 2			1.28	x1/[1/(1.1)+ 0.04] =	1.35			(27)
Walls Type1	41.85	14.07	27.78	x 0.16 =	4.44	60	1666.8	(29)
Walls Type2	24.37	0	24.37	x 0.15 =	3.65	60	1462.2	(29)
Total area of elements, m²			66.22					(31)
Party wall			41.82	x 0 =	0	45	1881.9	(32)
Party floor			74.55			40	2982	(32a)
Party ceiling			74.55			30	2236.5	(32b)
Internal wall **			131.12			9	1180.08	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11409.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 153.04 (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 9.46 (36)

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

Total fabric heat loss (33) + (36) = 32.38 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	(38)

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

(39)m=	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	

Average = Sum(39)$_{1…12}$ /12= 66.21 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89

Average = Sum(40)$_{1…12}$ /12= 0.89 (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 2.35 (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 90.04 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	99.05	95.45	91.85	88.24	84.64	81.04	81.04	84.64	88.24	91.85	95.45	99.05

Total = Sum(44)$_{1…12}$ = 1080.53 (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=	146.89	128.47	132.57	115.58	110.9	95.7	88.68	101.76	102.97	120	130.99	142.25

Total = Sum(45)$_{1…12}$ = 1416.75 (45)

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

(46)m=	22.03	19.27	19.89	17.34	16.63	14.35	13.3	15.26	15.45	18	19.65	21.34	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

DER WorkSheet: New dwelling design stage

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

(61)m=	50.47	43.93	46.8	43.52	43.13	39.96	41.3	43.13	43.52	46.8	47.07	50.47	(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=	197.36	172.4	179.37	159.09	154.03	135.66	129.97	144.89	146.49	166.81	178.06	192.73	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	118.26	108.96	98.96	52.46	27.3	11.79	10.94	12.49	12.63	55.12	109.91	116.74	(63) (G2)

Output from water heater

(64)m=	76.88	61.51	78.35	104.72	124.83	122.12	117.21	130.5	131.95	109.63	66.08	73.77	

Output from water heater (annual)$_{1...12}$ 1197.54 (64)

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

(65)m=	61.46	53.7	55.78	49.31	47.66	41.81	39.81	44.62	45.12	51.6	55.32	59.92	(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=	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	(66)

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

(67)m=	18.78	16.68	13.56	10.27	7.68	6.48	7	9.1	12.22	15.51	18.1	19.3	(67)

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

(68)m=	207.68	209.83	204.4	192.84	178.25	164.53	155.37	153.21	158.64	170.2	184.8	198.51	(68)

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

(69)m=	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	(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=	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	(71)

Water heating gains (Table 5)

(72)m=	82.61	79.91	74.97	68.48	64.05	58.07	53.51	59.97	62.66	69.36	76.84	80.53	(72)

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

(73)m=	370.33	367.69	354.21	332.86	311.25	290.35	277.14	283.55	294.79	316.34	341.01	359.62	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.79	x	36.79	x	0.63	x	0.7	=	143.82	(77)
Southeast 0.9x	0.77	x	12.79	x	62.67	x	0.63	x	0.7	=	244.98	(77)
Southeast 0.9x	0.77	x	12.79	x	85.75	x	0.63	x	0.7	=	335.19	(77)
Southeast 0.9x	0.77	x	12.79	x	106.25	x	0.63	x	0.7	=	415.32	(77)

Southeast	0.9x	0.77	x	12.79	x	119.01	x	0.63	x	0.7	=	465.19	(77)
Southeast	0.9x	0.77	x	12.79	x	118.15	x	0.63	x	0.7	=	461.82	(77)
Southeast	0.9x	0.77	x	12.79	x	113.91	x	0.63	x	0.7	=	445.25	(77)
Southeast	0.9x	0.77	x	12.79	x	104.39	x	0.63	x	0.7	=	408.04	(77)
Southeast	0.9x	0.77	x	12.79	x	92.85	x	0.63	x	0.7	=	362.94	(77)
Southeast	0.9x	0.77	x	12.79	x	69.27	x	0.63	x	0.7	=	270.75	(77)
Southeast	0.9x	0.77	x	12.79	x	44.07	x	0.63	x	0.7	=	172.26	(77)
Southeast	0.9x	0.77	x	12.79	x	31.49	x	0.63	x	0.7	=	123.08	(77)
South	0.9x	0.77	x	1.28	x	46.75	x	0.63	x	0.7	=	18.29	(78)
South	0.9x	0.77	x	1.28	x	76.57	x	0.63	x	0.7	=	29.95	(78)
South	0.9x	0.77	x	1.28	x	97.53	x	0.63	x	0.7	=	38.15	(78)
South	0.9x	0.77	x	1.28	x	110.23	x	0.63	x	0.7	=	43.12	(78)
South	0.9x	0.77	x	1.28	x	114.87	x	0.63	x	0.7	=	44.94	(78)
South	0.9x	0.77	x	1.28	x	110.55	x	0.63	x	0.7	=	43.24	(78)
South	0.9x	0.77	x	1.28	x	108.01	x	0.63	x	0.7	=	42.25	(78)
South	0.9x	0.77	x	1.28	x	104.89	x	0.63	x	0.7	=	41.03	(78)
South	0.9x	0.77	x	1.28	x	101.89	x	0.63	x	0.7	=	39.86	(78)
South	0.9x	0.77	x	1.28	x	82.59	x	0.63	x	0.7	=	32.31	(78)
South	0.9x	0.77	x	1.28	x	55.42	x	0.63	x	0.7	=	21.68	(78)
South	0.9x	0.77	x	1.28	x	40.4	x	0.63	x	0.7	=	15.8	(78)

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

(83)m=	162.11	274.93	373.34	458.44	510.12	505.07	487.5	449.07	402.79	303.06	193.94	138.88	(83)

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

(84)m=	532.44	642.62	727.55	791.3	821.37	795.42	764.64	732.63	697.59	619.4	534.95	498.5	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.95	0.9	0.81	0.68	0.51	0.38	0.41	0.61	0.85	0.95	0.98	(86)

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

(87)m=	19.86	20.11	20.41	20.69	20.88	20.97	20.99	20.99	20.94	20.68	20.2	19.78	(87)

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

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

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

(89)m=	0.97	0.94	0.88	0.78	0.63	0.45	0.31	0.34	0.55	0.82	0.94	0.98	(89)

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

(90)m=	18.65	19.01	19.43	19.82	20.06	20.15	20.17	20.17	20.13	19.81	19.15	18.55	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

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

(92)m=	19.13	19.45	19.82	20.16	20.39	20.48	20.5	20.5	20.45	20.16	19.56	19.04	(92)

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

(93)m=	18.98	19.3	19.67	20.01	20.24	20.33	20.35	20.35	20.3	20.01	19.41	18.89	(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=	0.96	0.93	0.87	0.78	0.64	0.47	0.32	0.35	0.56	0.81	0.93	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	512.21	596.56	634.89	614.75	522.18	370.16	246.71	259.07	390.9	501.43	499.52	483.26	(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=	971.82	953.24	871.67	735.72	565.12	379.26	248.22	261.32	410.44	622.74	815.34	972.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	341.94	239.69	176.17	87.1	31.95	0	0	0	0	90.26	227.39	363.91	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1558.4 (98)

Space heating requirement in kWh/m²/year 20.9 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)													
	341.94	239.69	176.17	87.1	31.95	0	0	0	0	90.26	227.39	363.91	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	378.68	265.44	195.09	96.45	35.38	0	0	0	0	99.96	251.81	403	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1725.81 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)												
	76.88	61.51	78.35	104.72	124.83	122.12	117.21	130.5	131.95	109.63	66.08	73.77

Efficiency of water heater 81 (216)

(217)m=	88.44	88.23	87.22	84.97	82.74	81	81	81	81	84.95	88.02	88.59	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	86.93	69.71	89.83	123.23	150.87	150.76	144.71	161.12	162.9	129.05	75.07	83.27

Total = Sum(219a)$_{1...12}$ = 1427.46 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1725.81

DER WorkSheet: New dwelling design stage

Water heating fuel used			1427.46	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		367.67		(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) =		442.67	(231)
Electricity for lighting			331.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			3927.54	(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	372.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	308.33	(264)
Space and water heating	(261) + (262) + (263) + (264) =			681.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	229.75	(267)
Electricity for lighting	(232) x	0.519	=	172.1	(268)
Total CO2, kg/year		sum of (265)…(271) =		1082.95	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		14.53	(273)
EI rating (section 14)				88	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:49

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 92.44m²

Site Reference : 231 Watford Road - LEAN **Plot Reference:** Sample 6

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.63 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.66 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	37.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	Fail

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	OK

Based on:

Overshading:	Average or unknown
Windows facing: North East	3.85m²
Windows facing: North West	5.11m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.44	(1a) x	2.75	(2a) =	254.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.44	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	254.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			3.85	x1/[1/(1.1)+ 0.04]		=	4.06			(27)
Windows Type 2			5.11	x1/[1/(1.1)+ 0.04]		=	5.38			(27)
Walls Type1	35.28	8.96	26.32	x	0.16	=	4.21	60	1579.2	(29)
Walls Type2	82.44	0	82.44	x	0.15	=	12.34	60	4946.4	(29)
Total area of elements, m²			117.72							(31)
Party wall			15.98	x	0	=	0	45	719.1	(32)
Party floor			92.44					40	3697.6	(32a)
Party ceiling			92.44					30	2773.2	(32b)
Internal wall **			154.44					9	1389.96	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15105.46 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.41 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 10.38 (36)

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

Total fabric heat loss (33) + (36) = 36.38 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	(38)

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

(39)m=	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	

Average = Sum(39)$_{1…12}$ /12= 78.32 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85

Average = Sum(40)$_{1…12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	107.05	103.16	99.27	95.37	91.48	87.59	87.59	91.48	95.37	99.27	103.16	107.05

Total = Sum(44)$_{1…12}$ = 1167.84 (44)

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

(45)m=	158.75	138.85	143.28	124.91	119.86	103.43	95.84	109.98	111.29	129.7	141.58	153.75

Total = Sum(45)$_{1…12}$ = 1531.22 (45)

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

(46)m=	23.81	20.83	21.49	18.74	17.98	15.51	14.38	16.5	16.69	19.46	21.24	23.06	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

DER WorkSheet: New dwelling design stage

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

(61)m=	50.96	46.03	50.58	47.03	46.62	43.19	44.63	46.62	47.03	50.58	49.32	50.96	(61)

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

(62)m=	209.71	184.87	193.86	171.95	166.47	146.62	140.47	156.6	158.33	180.29	190.89	204.7	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	125.84	116.04	117.11	107.07	59.97	12.68	11.8	13.41	13.56	109.16	116.57	124.13	(63) (G2)

Output from water heater

(64)m=	81.64	66.81	74.53	62.81	104.46	132.04	126.71	141.13	142.7	68.9	72.16	78.34	

Output from water heater (annual)$_{1...12}$ | 1152.21 | (64)

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

(65)m=	65.53	57.67	60.29	53.29	51.51	45.19	43.03	48.22	48.76	55.77	59.4	63.86	(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=	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	25.23	22.41	18.22	13.8	10.31	8.71	9.41	12.23	16.41	20.84	24.33	25.93	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	243.5	246.02	239.66	226.1	208.99	192.91	182.16	179.64	186	199.56	216.67	232.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(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=	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	(71)
Water heating gains (Table 5)													
(72)m=	88.07	85.82	81.03	74.02	69.23	62.76	57.83	64.82	67.73	74.96	82.51	85.83	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	422.66	420.12	404.77	379.78	354.4	330.24	315.27	322.55	336.01	361.23	389.37	410.38	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.85	x	11.28	x	0.63	x	0.7	=	13.28	(75)
Northeast 0.9x	0.77	x	3.85	x	22.97	x	0.63	x	0.7	=	27.02	(75)
Northeast 0.9x	0.77	x	3.85	x	41.38	x	0.63	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	3.85	x	67.96	x	0.63	x	0.7	=	79.96	(75)

Northeast 0.9x	0.77	x	3.85	x	91.35	x	0.63	x	0.7	=	107.48	(75)
Northeast 0.9x	0.77	x	3.85	x	97.38	x	0.63	x	0.7	=	114.58	(75)
Northeast 0.9x	0.77	x	3.85	x	91.1	x	0.63	x	0.7	=	107.19	(75)
Northeast 0.9x	0.77	x	3.85	x	72.63	x	0.63	x	0.7	=	85.45	(75)
Northeast 0.9x	0.77	x	3.85	x	50.42	x	0.63	x	0.7	=	59.33	(75)
Northeast 0.9x	0.77	x	3.85	x	28.07	x	0.63	x	0.7	=	33.02	(75)
Northeast 0.9x	0.77	x	3.85	x	14.2	x	0.63	x	0.7	=	16.7	(75)
Northeast 0.9x	0.77	x	3.85	x	9.21	x	0.63	x	0.7	=	10.84	(75)
Northwest 0.9x	0.77	x	5.11	x	11.28	x	0.63	x	0.7	=	17.62	(81)
Northwest 0.9x	0.77	x	5.11	x	22.97	x	0.63	x	0.7	=	35.87	(81)
Northwest 0.9x	0.77	x	5.11	x	41.38	x	0.63	x	0.7	=	64.62	(81)
Northwest 0.9x	0.77	x	5.11	x	67.96	x	0.63	x	0.7	=	106.13	(81)
Northwest 0.9x	0.77	x	5.11	x	91.35	x	0.63	x	0.7	=	142.65	(81)
Northwest 0.9x	0.77	x	5.11	x	97.38	x	0.63	x	0.7	=	152.08	(81)
Northwest 0.9x	0.77	x	5.11	x	91.1	x	0.63	x	0.7	=	142.27	(81)
Northwest 0.9x	0.77	x	5.11	x	72.63	x	0.63	x	0.7	=	113.42	(81)
Northwest 0.9x	0.77	x	5.11	x	50.42	x	0.63	x	0.7	=	78.74	(81)
Northwest 0.9x	0.77	x	5.11	x	28.07	x	0.63	x	0.7	=	43.83	(81)
Northwest 0.9x	0.77	x	5.11	x	14.2	x	0.63	x	0.7	=	22.17	(81)
Northwest 0.9x	0.77	x	5.11	x	9.21	x	0.63	x	0.7	=	14.39	(81)

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

(83)m=	30.9	62.89	113.31	186.08	250.13	266.67	249.46	198.87	138.07	76.86	38.88	25.23	(83)

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

(84)m=	453.56	483.01	518.08	565.86	604.53	596.91	564.73	521.42	474.08	438.08	428.24	435.61	(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=	0.99	0.99	0.98	0.96	0.89	0.74	0.58	0.65	0.87	0.97	0.99	1	(86)

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

(87)m=	19.7	19.82	20.05	20.39	20.71	20.91	20.98	20.96	20.81	20.41	19.99	19.66	(87)

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

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)

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

(89)m=	0.99	0.99	0.98	0.95	0.86	0.68	0.49	0.55	0.82	0.96	0.99	0.99	(89)

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

(90)m=	18.45	18.61	18.96	19.44	19.88	20.14	20.2	20.19	20.02	19.48	18.87	18.39	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

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

(92)m=	18.83	18.98	19.29	19.72	20.13	20.37	20.43	20.42	20.25	19.76	19.21	18.77	(92)

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

(93)m=	18.68	18.83	19.14	19.57	19.98	20.22	20.28	20.27	20.1	19.61	19.06	18.62	(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	0.94	0.85	0.68	0.5	0.56	0.82	0.95	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	449.29	476.44	504.92	531.22	512.75	404.92	281.73	292.07	387.41	417.87	421.67	432.16	(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=	1125.86	1090.63	989.74	835.98	648.68	440.03	288.43	303.27	470.27	705.57	936.79	1129.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	503.37	412.73	360.7	219.43	101.13	0	0	0	0	214.05	370.89	518.99	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2701.3 (98)

Space heating requirement in kWh/m²/year 29.22 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)													
	503.37	412.73	360.7	219.43	101.13	0	0	0	0	214.05	370.89	518.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	557.44	457.07	399.45	243	112	0	0	0	0	237.04	410.73	574.74	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2991.47 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	81.64	66.81	74.53	62.81	104.46	132.04	126.71	141.13	142.7	68.9	72.16	78.34	
Efficiency of water heater												81	(216)
(217)m=	88.88	88.88	88.56	88.05	85.32	81	81	81	81	87.84	88.64	88.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	91.85	75.17	84.15	71.33	122.43	163.01	156.43	174.24	176.17	78.43	81.4	88.06

Total = Sum(219a)$_{1...12}$ = 1362.68 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2991.47

DER WorkSheet: New dwelling design stage

Water heating fuel used		1362.68	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	455.9		(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) =		530.9	(231)
Electricity for lighting		445.58	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5330.62	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	646.16	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	294.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			940.5	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	275.54	(267)
Electricity for lighting	(232) x	0.519	=	231.25	(268)
Total CO2, kg/year		sum of (265)…(271) =		1447.29	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		15.66	(273)
EI rating (section 14)				86	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:48

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 52.98m²

Site Reference : 231 Watford Road - LEAN **Plot Reference:** Sample 7

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.47 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.62 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	27.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	6.39m²	
Ventilation rate:	6.00	

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 7

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.98	(1a) x	2.75	(2a) =	145.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows			6.39	x1/[1/(1.1)+ 0.04]		=	6.73			(27)
Walls Type1	22.17	6.39	15.78	x	0.16	=	2.52	60	946.8	(29)
Walls Type2	17.22	0	17.22	x	0.15	=	2.58	60	1033.2	(29)
Total area of elements, m²			39.39							(31)
Party wall			46.48	x	0	=	0	45	2091.6	(32)
Party floor			52.98					40	2119.2	(32a)
Party ceiling			52.98					30	1589.4	(32b)
Internal wall **			97.63					9	878.67	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 11.84 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8658.87 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.44 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 6.45 (36)

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

Total fabric heat loss (33) + (36) = 18.29 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	(38)

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

(39)m=	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	

Average = Sum(39)$_{1…12}$ /12= 42.33 (39)

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

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Average = Sum(40)$_{1\ldots12}$ /12= 0.8 (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 1.78 (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 76.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	84.07	81.01	77.96	74.9	71.84	68.78	68.78	71.84	74.9	77.96	81.01	84.07

Total = Sum(44)$_{1\ldots12}$ = 917.12 (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=	124.67	109.04	112.52	98.1	94.13	81.22	75.27	86.37	87.4	101.86	111.18	120.74

Total = Sum(45)$_{1\ldots12}$ = 1202.49 (45)

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

(46)m=	18.7	16.36	16.88	14.71	14.12	12.18	11.29	12.96	13.11	15.28	16.68	18.11	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

DER WorkSheet: New dwelling design stage

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

(61)m=	42.84	37.29	39.73	36.94	36.61	33.92	35.05	36.61	36.94	39.73	39.95	42.84	(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=	167.51	146.33	152.24	135.03	130.74	115.14	110.32	122.98	124.34	141.58	151.14	163.58	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	106.82	78.54	64.44	36.06	20.17	10.02	9.28	10.66	10.79	35.87	73.71	105.11	(63) (G2)

Output from water heater

(64)m=	58.81	66.15	86.05	97.35	108.95	103.64	99.5	110.71	111.92	103.96	75.66	56.59	

Output from water heater (annual)$_{1…12}$ 1079.28 (64)

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

(65)m=	52.16	45.58	47.34	41.85	40.45	35.49	33.79	37.87	38.29	43.8	46.96	50.86	(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=	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	15.32	13.6	11.06	8.38	6.26	5.29	5.71	7.42	9.96	12.65	14.77	15.74	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	154.97	156.57	152.52	143.9	133.01	122.77	115.93	114.32	118.38	127	137.89	148.13	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(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=	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	(71)
Water heating gains (Table 5)													
(72)m=	70.11	67.82	63.63	58.13	54.37	49.29	45.42	50.9	53.19	58.87	65.22	68.35	(72)
Total internal gains =					(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m								
(73)m=	293.07	290.67	279.89	263.07	246.3	230.01	219.73	225.32	234.2	251.2	270.55	284.9	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	6.39	x	36.79	x	0.63	x	0.7	=	71.85	(77)
Southeast 0.9x	0.77	x	6.39	x	62.67	x	0.63	x	0.7	=	122.39	(77)
Southeast 0.9x	0.77	x	6.39	x	85.75	x	0.63	x	0.7	=	167.46	(77)
Southeast 0.9x	0.77	x	6.39	x	106.25	x	0.63	x	0.7	=	207.5	(77)

DER WorkSheet: New dwelling design stage

Southeast	0.9x	0.77	x	6.39	x	119.01	x	0.63	x	0.7	=	232.41	(77)
Southeast	0.9x	0.77	x	6.39	x	118.15	x	0.63	x	0.7	=	230.73	(77)
Southeast	0.9x	0.77	x	6.39	x	113.91	x	0.63	x	0.7	=	222.45	(77)
Southeast	0.9x	0.77	x	6.39	x	104.39	x	0.63	x	0.7	=	203.86	(77)
Southeast	0.9x	0.77	x	6.39	x	92.85	x	0.63	x	0.7	=	181.33	(77)
Southeast	0.9x	0.77	x	6.39	x	69.27	x	0.63	x	0.7	=	135.27	(77)
Southeast	0.9x	0.77	x	6.39	x	44.07	x	0.63	x	0.7	=	86.06	(77)
Southeast	0.9x	0.77	x	6.39	x	31.49	x	0.63	x	0.7	=	61.49	(77)

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

(83)m=	71.85	122.39	167.46	207.5	232.41	230.73	222.45	203.86	181.33	135.27	86.06	61.49	(83)

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

(84)m=	364.92	413.07	447.35	470.56	478.72	460.74	442.18	429.18	415.53	386.47	356.61	346.39	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.93	0.86	0.74	0.57	0.42	0.45	0.66	0.88	0.96	0.98	(86)

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

(87)m=	20.06	20.24	20.47	20.71	20.89	20.98	21	20.99	20.95	20.73	20.34	20.01	(87)

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

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

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

(89)m=	0.98	0.96	0.92	0.84	0.7	0.51	0.35	0.38	0.6	0.85	0.95	0.98	(89)

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

(90)m=	19	19.25	19.58	19.91	20.14	20.23	20.25	20.25	20.21	19.94	19.41	18.92	(90)

fLA = Living area ÷ (4) = 0.4 (91)

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

(92)m=	19.43	19.65	19.94	20.24	20.44	20.53	20.55	20.55	20.51	20.26	19.78	19.36	(92)

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

(93)m=	19.28	19.5	19.79	20.09	20.29	20.38	20.4	20.4	20.36	20.11	19.63	19.21	(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=	0.97	0.95	0.91	0.83	0.7	0.52	0.36	0.39	0.61	0.84	0.95	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	353.46	391.04	405.71	390.47	334.32	239.13	160.15	168.16	252.96	326.02	337.22	337.5	(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=	634.17	618.1	562.51	473.49	363.81	244.84	160.96	169.36	264.98	402.48	530.59	635.41	(97)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m=	208.84	152.59	116.66	59.78	21.93	0	0	0	0	56.89	139.22	221.64

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 977.56 (98)

Space heating requirement in kWh/m²/year 18.45 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)	208.84	152.59	116.66	59.78	21.93	0	0	0	0	56.89	139.22	221.64	

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

231.28	168.98	129.19	66.2	24.29	0	0	0	0	63	154.18	245.45

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1082.57 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

58.81	66.15	86.05	97.35	108.95	103.64	99.5	110.71	111.92	103.96	75.66	56.59

Efficiency of water heater 81 (216)

(217)m=	88.08	87.27	86.1	84.3	82.42	81	81	81	81	84.06	86.79	88.24	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	66.77	75.79	99.94	115.47	132.19	127.95	122.84	136.67	138.18	123.67	87.18	64.13

Total = Sum(219a)$_{1...12}$ = 1290.78 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1082.57	
Water heating fuel used			1290.78	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		261.29		(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) =		336.29	(231)
Electricity for lighting			270.51	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2980.14	(338)

DER WorkSheet: New dwelling design stage

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	=	233.83	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	278.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =				512.64	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	174.53	(267)
Electricity for lighting	(232)	x	0.519	=	140.39	(268)
Total CO2, kg/year			sum of (265)…(271) =		827.57	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		15.62	(273)
EI rating (section 14)					89	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:47

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 74.55m²
Site Reference : 231 Watford Road - LEAN **Plot Reference:** Sample 8
Address :

Client Details:

Name:
Address :

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

1a TER and DER

Fuel for main heating system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.23 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.53 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	39.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	Fail

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South East	12.79m²
Windows facing: South	1.28m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 8

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.55	(1a) x	2.75	(2a) =	205.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			12.79	x1/[1/(1.1)+ 0.04]	=	13.48			(27)
Windows Type 2			1.28	x1/[1/(1.1)+ 0.04]	=	1.35			(27)
Walls Type1	41.85	14.07	27.78	x 0.16	=	4.44	60	1666.8	(29)
Walls Type2	24.37	0	24.37	x 0.15	=	3.65	60	1462.2	(29)
Total area of elements, m²			66.22						(31)
Party wall			41.82	x 0	=	0	45	1881.9	(32)
Party floor			74.55				40	2982	(32a)
Party ceiling			74.55				30	2236.5	(32b)
Internal wall **			131.12				9	1180.08	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11409.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 153.04 (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 9.46 (36)

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

Total fabric heat loss (33) + (36) = 32.38 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	(38)

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

(39)m=	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	

Average = $Sum(39)_{1…12}$ /12= 66.21 (39)

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

(40)m=	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89

Average = Sum(40)$_{1…12}$ /12= 0.89 (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 2.35 (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 90.04 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	99.05	95.45	91.85	88.24	84.64	81.04	81.04	84.64	88.24	91.85	95.45	99.05

Total = Sum(44)$_{1…12}$ = 1080.53 (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=	146.89	128.47	132.57	115.58	110.9	95.7	88.68	101.76	102.97	120	130.99	142.25

Total = Sum(45)$_{1…12}$ = 1416.75 (45)

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

(46)m=	22.03	19.27	19.89	17.34	16.63	14.35	13.3	15.26	15.45	18	19.65	21.34	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (41)m

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

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

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

(61)m=	50.47	43.93	46.8	43.52	43.13	39.96	41.3	43.13	43.52	46.8	47.07	50.47	(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=	197.36	172.4	179.37	159.09	154.03	135.66	129.97	144.89	146.49	166.81	178.06	192.73	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	118.26	108.96	98.96	52.46	27.3	11.79	10.94	12.49	12.63	55.12	109.91	116.74	(63) (G2)

Output from water heater

(64)m=	76.88	61.51	78.35	104.72	124.83	122.12	117.21	130.5	131.95	109.63	66.08	73.77	

Output from water heater (annual)1…12 | 1197.54 | (64)

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

(65)m=	61.46	53.7	55.78	49.31	47.66	41.81	39.81	44.62	45.12	51.6	55.32	59.92	(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=	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	(66)

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

(67)m=	18.78	16.68	13.56	10.27	7.68	6.48	7	9.1	12.22	15.51	18.1	19.3	(67)

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

(68)m=	207.68	209.83	204.4	192.84	178.25	164.53	155.37	153.21	158.64	170.2	184.8	198.51	(68)

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

(69)m=	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	(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=	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	(71)

Water heating gains (Table 5)

(72)m=	82.61	79.91	74.97	68.48	64.05	58.07	53.51	59.97	62.66	69.36	76.84	80.53	(72)

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

(73)m=	370.33	367.69	354.21	332.86	311.25	290.35	277.14	283.55	294.79	316.34	341.01	359.62	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	12.79	x	36.79	x	0.63	x	0.7	=	143.82	(77)
Southeast	0.9x	0.77	x	12.79	x	62.67	x	0.63	x	0.7	=	244.98	(77)
Southeast	0.9x	0.77	x	12.79	x	85.75	x	0.63	x	0.7	=	335.19	(77)
Southeast	0.9x	0.77	x	12.79	x	106.25	x	0.63	x	0.7	=	415.32	(77)

Southeast	0.9x	0.77	x	12.79	x	119.01	x	0.63	x	0.7	=	465.19	(77)
Southeast	0.9x	0.77	x	12.79	x	118.15	x	0.63	x	0.7	=	461.82	(77)
Southeast	0.9x	0.77	x	12.79	x	113.91	x	0.63	x	0.7	=	445.25	(77)
Southeast	0.9x	0.77	x	12.79	x	104.39	x	0.63	x	0.7	=	408.04	(77)
Southeast	0.9x	0.77	x	12.79	x	92.85	x	0.63	x	0.7	=	362.94	(77)
Southeast	0.9x	0.77	x	12.79	x	69.27	x	0.63	x	0.7	=	270.75	(77)
Southeast	0.9x	0.77	x	12.79	x	44.07	x	0.63	x	0.7	=	172.26	(77)
Southeast	0.9x	0.77	x	12.79	x	31.49	x	0.63	x	0.7	=	123.08	(77)
South	0.9x	0.77	x	1.28	x	46.75	x	0.63	x	0.7	=	18.29	(78)
South	0.9x	0.77	x	1.28	x	76.57	x	0.63	x	0.7	=	29.95	(78)
South	0.9x	0.77	x	1.28	x	97.53	x	0.63	x	0.7	=	38.15	(78)
South	0.9x	0.77	x	1.28	x	110.23	x	0.63	x	0.7	=	43.12	(78)
South	0.9x	0.77	x	1.28	x	114.87	x	0.63	x	0.7	=	44.94	(78)
South	0.9x	0.77	x	1.28	x	110.55	x	0.63	x	0.7	=	43.24	(78)
South	0.9x	0.77	x	1.28	x	108.01	x	0.63	x	0.7	=	42.25	(78)
South	0.9x	0.77	x	1.28	x	104.89	x	0.63	x	0.7	=	41.03	(78)
South	0.9x	0.77	x	1.28	x	101.89	x	0.63	x	0.7	=	39.86	(78)
South	0.9x	0.77	x	1.28	x	82.59	x	0.63	x	0.7	=	32.31	(78)
South	0.9x	0.77	x	1.28	x	55.42	x	0.63	x	0.7	=	21.68	(78)
South	0.9x	0.77	x	1.28	x	40.4	x	0.63	x	0.7	=	15.8	(78)

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

(83)m=	162.11	274.93	373.34	458.44	510.12	505.07	487.5	449.07	402.79	303.06	193.94	138.88	(83)

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

(84)m=	532.44	642.62	727.55	791.3	821.37	795.42	764.64	732.63	697.59	619.4	534.95	498.5	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.95	0.9	0.81	0.68	0.51	0.38	0.41	0.61	0.85	0.95	0.98	(86)

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

(87)m=	19.86	20.11	20.41	20.69	20.88	20.97	20.99	20.99	20.94	20.68	20.2	19.78	(87)

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

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

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

(89)m=	0.97	0.94	0.88	0.78	0.63	0.45	0.31	0.34	0.55	0.82	0.94	0.98	(89)

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

(90)m=	18.65	19.01	19.43	19.82	20.06	20.15	20.17	20.17	20.13	19.81	19.15	18.55	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

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

(92)m=	19.13	19.45	19.82	20.16	20.39	20.48	20.5	20.5	20.45	20.16	19.56	19.04	(92)

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

DER WorkSheet: New dwelling design stage

(93)m=	18.98	19.3	19.67	20.01	20.24	20.33	20.35	20.35	20.3	20.01	19.41	18.89	(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=	0.96	0.93	0.87	0.78	0.64	0.47	0.32	0.35	0.56	0.81	0.93	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	512.21	596.56	634.89	614.75	522.18	370.16	246.71	259.07	390.9	501.43	499.52	483.26	(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=	971.82	953.24	871.67	735.72	565.12	379.26	248.22	261.32	410.44	622.74	815.34	972.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	341.94	239.69	176.17	87.1	31.95	0	0	0	0	90.26	227.39	363.91	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1558.4 (98)

Space heating requirement in kWh/m²/year 20.9 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)													
	341.94	239.69	176.17	87.1	31.95	0	0	0	0	90.26	227.39	363.91	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	378.68	265.44	195.09	96.45	35.38	0	0	0	0	99.96	251.81	403	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1725.81 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)													
	76.88	61.51	78.35	104.72	124.83	122.12	117.21	130.5	131.95	109.63	66.08	73.77	
Efficiency of water heater												81	(216)
(217)m=	88.44	88.23	87.22	84.97	82.74	81	81	81	81	84.95	88.02	88.59	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	86.93	69.71	89.83	123.23	150.87	150.76	144.71	161.12	162.9	129.05	75.07	83.27	

Total = Sum(219a)$_{1...12}$ = 1427.46 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1725.81

DER WorkSheet: New dwelling design stage

Water heating fuel used		1427.46	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	367.67		(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) =		442.67	(231)
Electricity for lighting		331.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3927.54	(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	372.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	308.33	(264)
Space and water heating	(261) + (262) + (263) + (264) =			681.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	229.75	(267)
Electricity for lighting	(232) x	0.519	=	172.1	(268)
Total CO2, kg/year		sum of (265)…(271) =		1082.95	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		14.53	(273)
EI rating (section 14)				88	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:46

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 48m²

Site Reference : 231 Watford Road - LEAN **Plot Reference:** Sample 9

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	21.48 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.22 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	42.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	Fail

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	7.68m²	
Ventilation rate:	6.00	

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 9

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48	(1a) x	2.75	(2a) =	132	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	48	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	132	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows			7.68	x1/[1/(1.1)+ 0.04]		=	8.09			(27)
Walls Type1	28.95	7.68	21.27	x	0.16	=	3.4	60	1276.2	(29)
Walls Type2	40.29	0	40.29	x	0.15	=	6.03	60	2417.4	(29)
Roof	48	0	48	x	0.12	=	5.76	9	432	(30)
Total area of elements, m²			117.24							(31)
Party wall			22.38	x	0	=	0	45	1007.1	(32)
Party floor			48					40	1920	(32a)
Internal wall **			97.35					9	876.15	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.29 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7928.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.18 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.78 (36)

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

Total fabric heat loss (33) + (36) = 31.06 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	(38)

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

(39)m=	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84	

Average = Sum(39)$_{1…12}$ /12= 52.84 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

Average = Sum(40)$_{1…12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.63 (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 72.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	80.24	77.32	74.4	71.49	68.57	65.65	65.65	68.57	71.49	74.4	77.32	80.24

Total = Sum(44)$_{1…12}$ = 875.35 (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=	118.99	104.07	107.39	93.63	89.84	77.52	71.84	82.44	83.42	97.22	106.12	115.24

Total = Sum(45)$_{1…12}$ = 1147.73 (45)

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

(46)m=	17.85	15.61	16.11	14.04	13.48	11.63	10.78	12.37	12.51	14.58	15.92	17.29	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

DER WorkSheet: New dwelling design stage

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

(61)m=	40.89	35.59	37.92	35.25	34.94	32.38	33.46	34.94	35.25	37.92	38.13	40.89	(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=	159.88	139.66	145.31	128.88	124.78	109.9	105.29	117.38	118.67	135.13	144.25	156.13	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	105.19	96.26	92.9	54.25	30.29	9.55	8.85	10.17	10.29	53.61	97.29	103.39	(63) (G2)

Output from water heater

(64)m=	52.9	41.84	50.75	73.08	92.96	98.92	94.97	105.67	106.83	79.85	45.29	50.94	

Output from water heater (annual)1…12 | 894 | (64)

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

(65)m=	49.79	43.5	45.19	39.95	38.61	33.87	32.25	36.15	36.55	41.8	44.82	48.54	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.21	11.73	9.54	7.22	5.4	4.56	4.93	6.4	8.59	10.91	12.74	13.58	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	142.04	143.52	139.8	131.89	121.91	112.53	106.26	104.79	108.5	116.41	126.39	135.77	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	(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=	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	(71)
Water heating gains (Table 5)													
(72)m=	66.92	64.73	60.74	55.48	51.89	47.04	43.35	48.58	50.76	56.19	62.25	65.24	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	272.64	270.46	260.55	245.07	229.68	214.6	205.01	210.25	218.33	233.98	251.85	265.07	(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 m²		Flux Table 6a	g_ Table 6b		FF Table 6c		Gains (W)	
Southwest	0.9x	0.77	x	7.68	x	36.79	0.63	x	0.7	=	86.36	(79)
Southwest	0.9x	0.77	x	7.68	x	62.67	0.63	x	0.7	=	147.1	(79)
Southwest	0.9x	0.77	x	7.68	x	85.75	0.63	x	0.7	=	201.27	(79)
Southwest	0.9x	0.77	x	7.68	x	106.25	0.63	x	0.7	=	249.38	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	7.68	x	119.01	0.63	x	0.7	=	279.33	(79)
Southwest	0.9x	0.77	x	7.68	x	118.15	0.63	x	0.7	=	277.31	(79)
Southwest	0.9x	0.77	x	7.68	x	113.91	0.63	x	0.7	=	267.36	(79)
Southwest	0.9x	0.77	x	7.68	x	104.39	0.63	x	0.7	=	245.02	(79)
Southwest	0.9x	0.77	x	7.68	x	92.85	0.63	x	0.7	=	217.93	(79)
Southwest	0.9x	0.77	x	7.68	x	69.27	0.63	x	0.7	=	162.58	(79)
Southwest	0.9x	0.77	x	7.68	x	44.07	0.63	x	0.7	=	103.44	(79)
Southwest	0.9x	0.77	x	7.68	x	31.49	0.63	x	0.7	=	73.91	(79)

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

(83)m=	86.36	147.1	201.27	249.38	279.33	277.31	267.36	245.02	217.93	162.58	103.44	73.91	(83)

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

(84)m=	359	417.56	461.82	494.45	509.01	491.92	472.37	455.26	436.27	396.56	355.29	338.97	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.94	0.88	0.78	0.62	0.47	0.51	0.71	0.9	0.97	0.98	(86)

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

(87)m=	19.56	19.79	20.1	20.45	20.74	20.92	20.98	20.97	20.86	20.48	19.94	19.5	(87)

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

(88)m=	20	20	20	20	20	20	20	20	20	20	20	20	(88)

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

(89)m=	0.98	0.96	0.92	0.85	0.73	0.55	0.37	0.41	0.64	0.87	0.96	0.98	(89)

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

(90)m=	18.1	18.42	18.86	19.35	19.73	19.93	19.99	19.98	19.88	19.4	18.65	18.01	(90)

fLA = Living area ÷ (4) = 0.42 (91)

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

(92)m=	18.72	19	19.38	19.81	20.16	20.35	20.41	20.4	20.29	19.85	19.2	18.64	(92)

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

(93)m=	18.57	18.85	19.23	19.66	20.01	20.2	20.26	20.25	20.14	19.7	19.05	18.49	(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=	0.97	0.95	0.91	0.84	0.73	0.56	0.4	0.44	0.65	0.86	0.95	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	347.28	394.93	419.96	416.41	370.94	277.02	189.34	198.06	285.33	340.88	336.37	329.71	(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=	754.12	737.19	672.93	568.72	439.08	295.99	193.3	203.55	319.3	481.14	631.23	755.15	(97)

DER WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m=	302.69	230	188.21	109.66	50.7	0	0	0	0	104.36	212.3	316.53

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1514.44 (98)

Space heating requirement in kWh/m²/year 31.55 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)	302.69	230	188.21	109.66	50.7	0	0	0	0	104.36	212.3	316.53		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	335.21	254.71	208.42	121.44	56.14	0	0	0	0	115.57	235.11	350.53		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1677.12	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	52.9	41.84	50.75	73.08	92.96	98.92	94.97	105.67	106.83	79.85	45.29	50.94		
Efficiency of water heater													81	(216)
(217)m=	88.78	88.73	88.15	86.34	84.05	81	81	81	81	86.02	88.51	88.89		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	59.58	47.15	57.57	84.65	110.59	122.13	117.24	130.46	131.89	92.83	51.17	57.31		
Total = Sum(219a)$_{1...12}$ =													1062.57	(219)

Annual totals

		kWh/year	kWh/year	
Space heating fuel used, main system 1			1677.12	
Water heating fuel used			1062.57	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		236.73		(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) =		311.73	(231)
Electricity for lighting			233.31	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			3284.73	(338)

DER WorkSheet: New dwelling design stage

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	=	362.26	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	229.51	(264)
Space and water heating	(261) + (262) + (263) + (264) =				591.77	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	161.79	(267)
Electricity for lighting	(232)	x	0.519	=	121.09	(268)
Total CO2, kg/year			sum of (265)…(271) =		874.65	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		18.22	(273)
EI rating (section 14)					87	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:57:45

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.38m²

Site Reference : 231 Watford Road - LEAN **Plot Reference:** Sample 10

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	22.37 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.95 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	47.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

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		
Specific fan power:	1.05	
Maximum	0.7	Fail

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: North West	6.39m²	
Windows facing: North East	3.85m²	
Ventilation rate:	6.00	

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 10

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	50.38	(1a)	x	2.75	(2a)	=	138.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.38	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			138.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

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

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			6.39	x1/[1/(1.1)+ 0.04]		=	6.73			(27)
Windows Type 2			3.85	x1/[1/(1.1)+ 0.04]		=	4.06			(27)
Walls Type1	39.98	10.24	29.74	x	0.16	=	4.76	60	1784.4	(29)
Walls Type2	20.07	0	20.07	x	0.15	=	3	60	1204.2	(29)
Roof	50.38	0	50.38	x	0.12	=	6.05	9	453.42	(30)
Total area of elements, m²			110.43							(31)
Party wall			25.9	x	0	=	0	45	1165.5	(32)
Party floor			50.38					40	2015.2	(32a)
Internal wall **			108.68					9	978.12	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.6 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7600.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 150.87 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.15 (36)

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

Total fabric heat loss (33) + (36) = 32.74 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	(38)

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

(39)m=	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	

Average = Sum(39)$_{1…12}$ /12= 55.6 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

Average = $Sum(40)_{1...12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (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 74.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	82.07	79.08	76.1	73.11	70.13	67.15	67.15	70.13	73.11	76.1	79.08	82.07

Total = $Sum(44)_{1...12}$ = 895.27 (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=	121.7	106.44	109.84	95.76	91.88	79.29	73.47	84.31	85.32	99.43	108.53	117.86

Total = $Sum(45)_{1...12}$ = 1173.84 (45)

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

(46)m=	18.26	15.97	16.48	14.36	13.78	11.89	11.02	12.65	12.8	14.91	16.28	17.68	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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) × (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 × (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)

DER WorkSheet: New dwelling design stage

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

(61)m=	41.82	36.4	38.78	36.06	35.74	33.11	34.22	35.74	36.06	38.78	39	41.82	(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=	163.52	142.84	148.62	131.82	127.62	112.4	107.69	120.05	121.37	138.21	147.53	159.68	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	107.13	98.14	99.64	66.02	34.47	9.77	9.05	10.4	10.53	71.54	99.1	105.28	(63) (G2)

Output from water heater

(64)m=	54.55	43.1	47.27	64.21	91.58	101.17	97.13	108.07	109.26	64.96	46.72	52.56	

Output from water heater (annual)1…12 880.57 (64)

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

(65)m=	50.92	44.49	46.22	40.85	39.49	34.64	32.98	36.97	37.38	42.75	45.84	49.64	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	(66)

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

(67)m=	13.29	11.8	9.6	7.27	5.43	4.58	4.95	6.44	8.64	10.97	12.81	13.66	(67)

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

(68)m=	148.22	149.76	145.88	137.63	127.22	117.43	110.89	109.35	113.22	121.48	131.89	141.68	(68)

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

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(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=	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	(71)

Water heating gains (Table 5)

(72)m=	68.44	66.21	62.12	56.74	53.07	48.11	44.33	49.69	51.92	57.47	63.66	66.73	(72)

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

(73)m=	281.47	279.29	269.12	253.16	237.24	221.64	211.69	217	225.31	241.44	259.88	273.58	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.85	x	11.28	x	0.63	x	0.7	=	13.28	(75)
Northeast 0.9x	0.77	x	3.85	x	22.97	x	0.63	x	0.7	=	27.02	(75)
Northeast 0.9x	0.77	x	3.85	x	41.38	x	0.63	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	3.85	x	67.96	x	0.63	x	0.7	=	79.96	(75)

Northeast 0.9x	0.77	x	3.85	x	91.35	x	0.63	x	0.7	=	107.48	(75)
Northeast 0.9x	0.77	x	3.85	x	97.38	x	0.63	x	0.7	=	114.58	(75)
Northeast 0.9x	0.77	x	3.85	x	91.1	x	0.63	x	0.7	=	107.19	(75)
Northeast 0.9x	0.77	x	3.85	x	72.63	x	0.63	x	0.7	=	85.45	(75)
Northeast 0.9x	0.77	x	3.85	x	50.42	x	0.63	x	0.7	=	59.33	(75)
Northeast 0.9x	0.77	x	3.85	x	28.07	x	0.63	x	0.7	=	33.02	(75)
Northeast 0.9x	0.77	x	3.85	x	14.2	x	0.63	x	0.7	=	16.7	(75)
Northeast 0.9x	0.77	x	3.85	x	9.21	x	0.63	x	0.7	=	10.84	(75)
Northwest 0.9x	0.77	x	6.39	x	11.28	x	0.63	x	0.7	=	22.03	(81)
Northwest 0.9x	0.77	x	6.39	x	22.97	x	0.63	x	0.7	=	44.85	(81)
Northwest 0.9x	0.77	x	6.39	x	41.38	x	0.63	x	0.7	=	80.81	(81)
Northwest 0.9x	0.77	x	6.39	x	67.96	x	0.63	x	0.7	=	132.71	(81)
Northwest 0.9x	0.77	x	6.39	x	91.35	x	0.63	x	0.7	=	178.39	(81)
Northwest 0.9x	0.77	x	6.39	x	97.38	x	0.63	x	0.7	=	190.18	(81)
Northwest 0.9x	0.77	x	6.39	x	91.1	x	0.63	x	0.7	=	177.91	(81)
Northwest 0.9x	0.77	x	6.39	x	72.63	x	0.63	x	0.7	=	141.83	(81)
Northwest 0.9x	0.77	x	6.39	x	50.42	x	0.63	x	0.7	=	98.46	(81)
Northwest 0.9x	0.77	x	6.39	x	28.07	x	0.63	x	0.7	=	54.81	(81)
Northwest 0.9x	0.77	x	6.39	x	14.2	x	0.63	x	0.7	=	27.72	(81)
Northwest 0.9x	0.77	x	6.39	x	9.21	x	0.63	x	0.7	=	17.99	(81)

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

(83)m=	35.31	71.87	129.49	212.67	285.87	304.76	285.1	227.28	157.79	87.84	44.43	28.84	(83)

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

(84)m=	316.78	351.16	398.61	465.82	523.1	526.41	496.79	444.28	383.1	329.27	304.31	302.42	(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	0.9	0.77	0.61	0.47	0.54	0.78	0.94	0.98	0.99	(86)

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

(87)m=	19.31	19.48	19.83	20.3	20.69	20.9	20.97	20.95	20.77	20.26	19.69	19.25	(87)

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

(88)m=	20	20	20	20	20	20	20	20	20	20	20	20	(88)

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

(89)m=	0.98	0.97	0.95	0.87	0.73	0.53	0.37	0.44	0.72	0.92	0.97	0.98	(89)

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

(90)m=	17.74	17.99	18.5	19.15	19.67	19.92	19.98	19.97	19.78	19.11	18.3	17.66	(90)

fLA = Living area ÷ (4) = | 0.48 | (91)

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

(92)m=	18.48	18.7	19.13	19.7	20.16	20.39	20.45	20.44	20.25	19.66	18.96	18.42	(92)

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

DER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	18.33	18.55	18.98	19.55	20.01	20.24	20.3	20.29	20.1	19.51	18.81	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		
Utilisation factor for gains, hm:														
(94)m=	0.97	0.96	0.93	0.86	0.73	0.55	0.4	0.47	0.72	0.91	0.96	0.98		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	308.85	338.37	372.56	401.57	381.16	291.07	200.45	207.18	276.85	298.29	292.92	295.86		(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=	780.34	759.16	694.06	592.1	462.03	313.57	205.93	216.26	333.66	495.27	651.35	782.3		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	350.79	282.77	239.19	137.18	60.17	0	0	0	0	146.55	258.07	361.91		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													1836.63	(98)
Space heating requirement in kWh/m²/year													36.46	(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) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)														
	350.79	282.77	239.19	137.18	60.17	0	0	0	0	146.55	258.07	361.91		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	388.47	313.14	264.89	151.92	66.63	0	0	0	0	162.29	285.8	400.79		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2033.92	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	54.55	43.1	47.27	64.21	91.58	101.17	97.13	108.07	109.26	64.96	46.72	52.56		
Efficiency of water heater													81	(216)
(217)m=	88.93	88.95	88.62	87.11	84.45	81	81	81	81	87.22	88.74	89		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	61.34	48.46	53.34	73.71	108.44	124.91	119.91	133.42	134.88	74.47	52.65	59.05		
Total = Sum(219a)$_{1...12}$ =													1044.59	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2033.92

DER WorkSheet: New dwelling design stage

Water heating fuel used			1044.59	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		248.47		(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) =		323.47	(231)
Electricity for lighting			234.63	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			3636.61	(338)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	439.33	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	225.63	(264)
Space and water heating	(261) + (262) + (263) + (264) =				664.96	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	167.88	(267)
Electricity for lighting	(232)	x	0.519	=	121.77	(268)
Total CO2, kg/year			sum of (265)…(271) =		954.61	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		18.95	(273)
EI rating (section 14)					87	(274)

Appendix C

Generating energy on-site:-

Final SAP Outputs & Dwelling Emission Rates

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:48

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 100.28m²

Site Reference : 231 Watford Road - GREEN **Plot Reference:** Sample 1

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	25.2 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.44 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	42.3 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: South East	15.34m²
Windows facing: South West	1.28m²
Ventilation rate:	3.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 1

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	100.28	(1a)	x	2.75	(2a)	=	275.77	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.28	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	275.77	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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			3.5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.18	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			15.34	x1/[1/(1.1)+ 0.04]		=	16.16			(27)
Windows Type 2			1.28	x1/[1/(1.1)+ 0.04]		=	1.35			(27)
Floor			100.28	x	0.14	=	14.0392	110	11030.8	(28)
Walls Type1	68.22	16.62	51.6	x	0.16	=	8.26	60	3096	(29)
Walls Type2	43.24	0	43.24	x	0.15	=	6.47	60	2594.4	(29)
Total area of elements, m²			211.74							(31)
Party wall			15.21	x	0	=	0	45	684.45	(32)
Party ceiling			100.28					30	3008.4	(32b)
Internal wall **			175.18					9	1576.62	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21990.67 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 219.29 (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 15.42 (36)

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

Total fabric heat loss (33) + (36) = 61.7 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	(38)

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

(39)m=	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	

Average = Sum(39)$_{1…12}$ /12= 107.2 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07

Average = Sum(40)$_{1…12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.74 (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 99.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	109.26	105.28	101.31	97.34	93.37	89.39	89.39	93.37	97.34	101.31	105.28	109.26

Total = Sum(44)$_{1…12}$ = 1191.9 (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=	162.03	141.71	146.23	127.49	122.33	105.56	97.82	112.25	113.59	132.37	144.5	156.91

Total = Sum(45)$_{1…12}$ = 1562.77 (45)

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

(46)m=	24.3	21.26	21.93	19.12	18.35	15.83	14.67	16.84	17.04	19.86	21.67	23.54	(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

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

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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)

DER WorkSheet: New dwelling design stage

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	190.15	167.11	174.35	154.7	150.45	132.78	125.94	140.37	140.8	160.5	171.71	185.04	(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=	190.15	167.11	174.35	154.7	150.45	132.78	125.94	140.37	140.8	160.5	171.71	185.04	

Output from water heater (annual)$_{1...12}$ 1893.9 (64)

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

(65)m=	53.87	47.12	48.62	42.39	40.67	35.1	32.52	37.32	37.77	44.01	48.04	52.17	(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=	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	137.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.72	21.07	17.13	12.97	9.7	8.19	8.85	11.5	15.43	19.59	22.87	24.38	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	256.78	259.44	252.73	238.43	220.39	203.43	192.1	189.44	196.15	210.45	228.49	245.45	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	-109.68	(71)

Water heating gains (Table 5)

(72)m=	72.41	70.12	65.35	58.87	54.67	48.75	43.71	50.16	52.45	59.16	66.73	70.13	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.04	414.76	399.35	374.41	348.89	324.5	308.79	315.23	328.17	353.33	382.22	404.09	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	15.34	x	36.79	x	0.63	x	0.7	=	172.49	(77)
Southeast 0.9x	0.77	x	15.34	x	62.67	x	0.63	x	0.7	=	293.82	(77)
Southeast 0.9x	0.77	x	15.34	x	85.75	x	0.63	x	0.7	=	402.02	(77)
Southeast 0.9x	0.77	x	15.34	x	106.25	x	0.63	x	0.7	=	498.12	(77)
Southeast 0.9x	0.77	x	15.34	x	119.01	x	0.63	x	0.7	=	557.93	(77)

DER WorkSheet: New dwelling design stage

Southeast	0.9x	0.77	x	15.34	x	118.15	x	0.63	x	0.7	=	553.9	(77)
Southeast	0.9x	0.77	x	15.34	x	113.91	x	0.63	x	0.7	=	534.02	(77)
Southeast	0.9x	0.77	x	15.34	x	104.39	x	0.63	x	0.7	=	489.39	(77)
Southeast	0.9x	0.77	x	15.34	x	92.85	x	0.63	x	0.7	=	435.3	(77)
Southeast	0.9x	0.77	x	15.34	x	69.27	x	0.63	x	0.7	=	324.73	(77)
Southeast	0.9x	0.77	x	15.34	x	44.07	x	0.63	x	0.7	=	206.61	(77)
Southeast	0.9x	0.77	x	15.34	x	31.49	x	0.63	x	0.7	=	147.62	(77)
Southwest	0.9x	0.77	x	1.28	x	36.79		0.63	x	0.7	=	14.39	(79)
Southwest	0.9x	0.77	x	1.28	x	62.67		0.63	x	0.7	=	24.52	(79)
Southwest	0.9x	0.77	x	1.28	x	85.75		0.63	x	0.7	=	33.55	(79)
Southwest	0.9x	0.77	x	1.28	x	106.25		0.63	x	0.7	=	41.56	(79)
Southwest	0.9x	0.77	x	1.28	x	119.01		0.63	x	0.7	=	46.56	(79)
Southwest	0.9x	0.77	x	1.28	x	118.15		0.63	x	0.7	=	46.22	(79)
Southwest	0.9x	0.77	x	1.28	x	113.91		0.63	x	0.7	=	44.56	(79)
Southwest	0.9x	0.77	x	1.28	x	104.39		0.63	x	0.7	=	40.84	(79)
Southwest	0.9x	0.77	x	1.28	x	92.85		0.63	x	0.7	=	36.32	(79)
Southwest	0.9x	0.77	x	1.28	x	69.27		0.63	x	0.7	=	27.1	(79)
Southwest	0.9x	0.77	x	1.28	x	44.07		0.63	x	0.7	=	17.24	(79)
Southwest	0.9x	0.77	x	1.28	x	31.49		0.63	x	0.7	=	12.32	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	186.89	318.34	435.56	539.68	604.49	600.12	578.58	530.23	471.62	351.83	223.85	159.94	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	603.93	733.1	834.91	914.1	953.38	924.61	887.37	845.46	799.79	705.16	606.07	564.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.69	0.52	0.56	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.92	0.8	0.6	0.41	0.45	0.72	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.92	0.81	0.62	0.44	0.48	0.74	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	601.28	724.63	810.35	842.95	773.18	575.86	387.18	406.08	591.42	665.17	600.01	562.23	(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=	1710.14	1645.82	1474.29	1217	916.83	605.94	391.54	412.98	659.55	1034.76	1409.97	1720.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	825	619.04	493.97	269.32	106.88	0	0	0	0	274.97	583.17	862.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4034.38 (98)

Space heating requirement in kWh/m²/year 40.23 (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		295.34	(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)														
	825	619.04	493.97	269.32	106.88	0	0	0	0	274.97	583.17	862.03		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	279.34	209.6	167.26	91.19	36.19	0	0	0	0	93.1	197.46	291.88		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1366.02	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	190.15	167.11	174.35	154.7	150.45	132.78	125.94	140.37	140.8	160.5	171.71	185.04		
Efficiency of water heater													207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	91.56	80.47	83.96	74.49	72.45	63.94	60.64	67.59	67.8	77.28	82.68	89.1		
Total = Sum(219a)$_{1...12}$ =													911.97	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1366.02

DER WorkSheet: New dwelling design stage

Water heating fuel used			911.97	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		253.46		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		253.46	(231)
Electricity for lighting			418.92	(232)
Electricity generated by PVs			-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2017.66	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	708.96	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	473.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1182.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	131.55	(267)
Electricity for lighting	(232) x	0.519	=	217.42	(268)
Energy saving/generation technologies Item 1		0.519	=	-484.08	(269)
Total CO2, kg/year		sum of (265)…(271) =		1047.17	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		10.44	(273)
EI rating (section 14)				90	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:47

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 52.98m²

Site Reference : 231 Watford Road - GREEN **Plot Reference:** Sample 2

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	25.05 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	7.90 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	27.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder thermostat	
	No cylinder	

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	6.39m²	
Ventilation rate:	6.00	

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.98	(1a) x	2.75	(2a) =	145.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows			6.39	x1/[1/(1.1)+ 0.04]		=	6.73			(27)
Walls Type1	22.17	6.39	15.78	x	0.16	=	2.52	60	946.8	(29)
Walls Type2	17.22	0	17.22	x	0.15	=	2.58	60	1033.2	(29)
Total area of elements, m²			39.39							(31)
Party wall			46.48	x	0	=	0	45	2091.6	(32)
Party floor			52.98					40	2119.2	(32a)
Party ceiling			52.98					30	1589.4	(32b)
Internal wall **			97.63					9	878.67	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 11.84 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8658.87 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.44 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.45 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	

Average = Sum(39)$_{1\ldots12}$ /12= 42.33 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Average = Sum(40)1…12 /12= 0.8 (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 1.78 (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 76.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	84.07	81.01	77.96	74.9	71.84	68.78	68.78	71.84	74.9	77.96	81.01	84.07

Total = Sum(44)1…12 = 917.12 (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=	124.67	109.04	112.52	98.1	94.13	81.22	75.27	86.37	87.4	101.86	111.18	120.74

Total = Sum(45)1…12 = 1202.49 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.7	16.36	16.88	14.71	14.12	12.18	11.29	12.96	13.11	15.28	16.68	18.11

(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12

(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12

(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)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	152.8	134.44	140.64	125.31	122.25	108.44	103.39	114.49	114.62	129.98	138.4	148.86	(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=	152.8	134.44	140.64	125.31	122.25	108.44	103.39	114.49	114.62	129.98	138.4	148.86	

Output from water heater (annual) 1…12 — 1533.62 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	41.45	36.26	37.41	32.62	31.3	27.01	25.03	28.72	29.06	33.87	36.97	40.15	(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=	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	15.32	13.6	11.06	8.38	6.26	5.29	5.71	7.42	9.96	12.65	14.77	15.74	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	154.97	156.57	152.52	143.9	133.01	122.77	115.93	114.32	118.38	127	137.89	148.13	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	(71)
Water heating gains (Table 5)													
(72)m=	55.72	53.95	50.29	45.3	42.07	37.51	33.64	38.6	40.36	45.52	51.35	53.96	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	275.67	273.8	263.54	247.24	231	215.24	204.95	210.02	218.37	234.85	253.68	267.5	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	6.39	x	36.79	x	0.63	x	0.7	=	71.85	(77)
Southeast 0.9x	0.77	x	6.39	x	62.67	x	0.63	x	0.7	=	122.39	(77)
Southeast 0.9x	0.77	x	6.39	x	85.75	x	0.63	x	0.7	=	167.46	(77)
Southeast 0.9x	0.77	x	6.39	x	106.25	x	0.63	x	0.7	=	207.5	(77)
Southeast 0.9x	0.77	x	6.39	x	119.01	x	0.63	x	0.7	=	232.41	(77)

Southeast	0.9x	0.77	x	6.39	x	118.15	x	0.63	x	0.7	=	230.73	(77)
Southeast	0.9x	0.77	x	6.39	x	113.91	x	0.63	x	0.7	=	222.45	(77)
Southeast	0.9x	0.77	x	6.39	x	104.39	x	0.63	x	0.7	=	203.86	(77)
Southeast	0.9x	0.77	x	6.39	x	92.85	x	0.63	x	0.7	=	181.33	(77)
Southeast	0.9x	0.77	x	6.39	x	69.27	x	0.63	x	0.7	=	135.27	(77)
Southeast	0.9x	0.77	x	6.39	x	44.07	x	0.63	x	0.7	=	86.06	(77)
Southeast	0.9x	0.77	x	6.39	x	31.49	x	0.63	x	0.7	=	61.49	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.85	122.39	167.46	207.5	232.41	230.73	222.45	203.86	181.33	135.27	86.06	61.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	347.52	396.19	431	454.74	463.41	445.97	427.4	413.88	399.7	370.12	339.74	328.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.94	0.87	0.75	0.58	0.43	0.46	0.68	0.89	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.96	0.93	0.85	0.71	0.52	0.36	0.39	0.62	0.87	0.96	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	(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	0.86	0.73	0.55	0.39	0.42	0.64	0.88	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	340.86	381.9	400.99	390.69	338.16	244.7	166.3	174.23	257.54	324.31	327.58	324.03	(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=	688.1	662.7	594.97	493.39	374.87	252.11	167.45	175.92	273.28	421.43	569.58	692.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	258.34	188.7	144.32	73.94	27.31	0	0	0	0	72.26	174.24	274.02	

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1213.13	(98)
Space heating requirement in kWh/m²/year	22.9	(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		277.43	(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)	258.34	188.7	144.32	73.94	27.31	0	0	0	0	72.26	174.24	274.02		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	93.12	68.02	52.02	26.65	9.84	0	0	0	0	26.04	62.8	98.77		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													437.27	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	152.8	134.44	140.64	125.31	122.25	108.44	103.39	114.49	114.62	129.98	138.4	148.86		
Efficiency of water heater													207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	73.58	64.74	67.72	60.34	58.87	52.22	49.79	55.13	55.19	62.59	66.64	71.68		
Total = Sum(219a)$_{1...12}$ =													738.49	(219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			437.27	
Water heating fuel used			738.49	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		292.61		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		292.61	(231)
Electricity for lighting			270.51	(232)
Electricity generated by PVs			-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			806.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.519	=	226.94	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	383.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			610.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	151.86	(267)
Electricity for lighting	(232) x	0.519	=	140.39	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-484.08	(269)
Total CO2, kg/year	sum of (265)…(271) =			418.4	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			7.9	(273)
EI rating (section 14)				94	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:45

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 92.44m²

Site Reference : 231 Watford Road - GREEN **Plot Reference:** Sample 3

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	28.63 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.58 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	48.7 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services		**OK**
Hot water controls:	No cylinder thermostat		
	No cylinder		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	3.85m²
Windows facing: North West	5.11m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 3

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	92.44	(1a)	x	2.75	(2a)	=	254.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.44	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			254.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			3.85	x1/[1/(1.1)+ 0.04]		=	4.06			(27)
Windows Type 2			5.11	x1/[1/(1.1)+ 0.04]		=	5.38			(27)
Floor			92.44	x	0.14	=	12.9416	75	6933	(28)
Walls Type1	35.28	8.96	26.32	x	0.16	=	4.21	60	1579.2	(29)
Walls Type2	82.44	0	82.44	x	0.15	=	12.34	60	4946.4	(29)
Total area of elements, m²			210.16							(31)
Party wall			15.98	x	0	=	0	45	719.1	(32)
Party ceiling			92.44					30	2773.2	(32b)
Internal wall **			154.44					9	1389.96	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 18340.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 198.41 (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 14.76 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 53.69 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	95.64	

Average = Sum(39)$_{1…12}$ /12= 95.64 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	107.05	103.16	99.27	95.37	91.48	87.59	87.59	91.48	95.37	99.27	103.16	107.05

Total = Sum(44)$_{1...12}$ = 1167.84 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.75	138.85	143.28	124.91	119.86	103.43	95.84	109.98	111.29	129.7	141.58	153.75

Total = Sum(45)$_{1...12}$ = 1531.22 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.81	20.83	21.49	18.74	17.98	15.51	14.38	16.5	16.69	19.46	21.24	23.06	(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.88	164.25	171.4	152.13	147.98	130.64	123.96	138.1	138.51	157.82	168.79	181.87	(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=	186.88	164.25	171.4	152.13	147.98	130.64	123.96	138.1	138.51	157.82	168.79	181.87	

Output from water heater (annual)$_{1...12}$ 1862.34 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	52.79	46.17	47.64	41.53	39.85	34.39	31.87	36.57	37	43.13	47.07	51.12	(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=	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.23	22.41	18.22	13.8	10.31	8.71	9.41	12.23	16.41	20.84	24.33	25.93	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	243.5	246.02	239.66	226.1	208.99	192.91	182.16	179.64	186	199.56	216.67	232.75	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	(71)

Water heating gains (Table 5)

(72)m=	70.95	68.7	64.03	57.69	53.57	47.76	42.83	49.15	51.4	57.96	65.38	68.71	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.54	400	384.78	360.45	335.73	312.24	297.27	303.88	316.68	341.23	369.24	390.26	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	3.85	x	11.28	x	0.63	x	0.7	=	13.28	(75)
Northeast	0.9x	0.77	x	3.85	x	22.97	x	0.63	x	0.7	=	27.02	(75)
Northeast	0.9x	0.77	x	3.85	x	41.38	x	0.63	x	0.7	=	48.69	(75)
Northeast	0.9x	0.77	x	3.85	x	67.96	x	0.63	x	0.7	=	79.96	(75)
Northeast	0.9x	0.77	x	3.85	x	91.35	x	0.63	x	0.7	=	107.48	(75)

Northeast 0.9x	0.77	x	3.85	x	97.38	x	0.63	x	0.7	=	114.58	(75)
Northeast 0.9x	0.77	x	3.85	x	91.1	x	0.63	x	0.7	=	107.19	(75)
Northeast 0.9x	0.77	x	3.85	x	72.63	x	0.63	x	0.7	=	85.45	(75)
Northeast 0.9x	0.77	x	3.85	x	50.42	x	0.63	x	0.7	=	59.33	(75)
Northeast 0.9x	0.77	x	3.85	x	28.07	x	0.63	x	0.7	=	33.02	(75)
Northeast 0.9x	0.77	x	3.85	x	14.2	x	0.63	x	0.7	=	16.7	(75)
Northeast 0.9x	0.77	x	3.85	x	9.21	x	0.63	x	0.7	=	10.84	(75)
Northwest 0.9x	0.77	x	5.11	x	11.28	x	0.63	x	0.7	=	17.62	(81)
Northwest 0.9x	0.77	x	5.11	x	22.97	x	0.63	x	0.7	=	35.87	(81)
Northwest 0.9x	0.77	x	5.11	x	41.38	x	0.63	x	0.7	=	64.62	(81)
Northwest 0.9x	0.77	x	5.11	x	67.96	x	0.63	x	0.7	=	106.13	(81)
Northwest 0.9x	0.77	x	5.11	x	91.35	x	0.63	x	0.7	=	142.65	(81)
Northwest 0.9x	0.77	x	5.11	x	97.38	x	0.63	x	0.7	=	152.08	(81)
Northwest 0.9x	0.77	x	5.11	x	91.1	x	0.63	x	0.7	=	142.27	(81)
Northwest 0.9x	0.77	x	5.11	x	72.63	x	0.63	x	0.7	=	113.42	(81)
Northwest 0.9x	0.77	x	5.11	x	50.42	x	0.63	x	0.7	=	78.74	(81)
Northwest 0.9x	0.77	x	5.11	x	28.07	x	0.63	x	0.7	=	43.83	(81)
Northwest 0.9x	0.77	x	5.11	x	14.2	x	0.63	x	0.7	=	22.17	(81)
Northwest 0.9x	0.77	x	5.11	x	9.21	x	0.63	x	0.7	=	14.39	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.9	62.89	113.31	186.08	250.13	266.67	249.46	198.87	138.07	76.86	38.88	25.23	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	433.44	462.89	498.08	546.53	585.86	578.91	546.73	502.76	454.75	418.09	408.12	415.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.94	0.84	0.7	0.76	0.93	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.92	0.77	0.58	0.65	0.9	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.93	0.8	0.62	0.69	0.91	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	432.45	461.27	494.43	534.66	544	461.57	337.77	344.89	414.39	412	406.51	414.72	(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=	1533.89	1476.5	1323.48	1093.95	826.17	548.82	357.54	376.67	596.64	931.37	1266.1	1543.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	819.47	682.24	616.81	402.69	209.93	0	0	0	0	386.41	618.9	839.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4576.24 (98)

Space heating requirement in kWh/m²/year 49.5 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		292.62	(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)													
	819.47	682.24	616.81	402.69	209.93	0	0	0	0	386.41	618.9	839.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	280.05	233.15	210.79	137.62	71.74	0	0	0	0	132.05	211.5	286.99	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1563.88 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	186.88	164.25	171.4	152.13	147.98	130.64	123.96	138.1	138.51	157.82	168.79	181.87	
Efficiency of water heater												207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	89.99	79.09	82.54	73.26	71.26	62.91	59.69	66.5	66.7	76	81.28	87.58	

Total = Sum(219a)$_{1...12}$ = 896.78 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1563.88

DER WorkSheet: New dwelling design stage

Water heating fuel used			896.78	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		266.28		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		266.28	(231)
Electricity for lighting			445.58	(232)
Electricity generated by PVs			-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2239.81	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	811.66	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	465.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1277.08	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	138.2	(267)
Electricity for lighting	(232) x	0.519	=	231.25	(268)
Energy saving/generation technologies Item 1		0.519	=	-484.08	(269)
Total CO2, kg/year		sum of (265)…(271) =		1162.46	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		12.58	(273)
EI rating (section 14)				89	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:43

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 52.98m²

Site Reference : 231 Watford Road - GREEN **Plot Reference:** Sample 4

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	25.05 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	7.90 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	27.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services		OK
Hot water controls:	No cylinder thermostat		
	No cylinder		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	Fail

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South East	6.39m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.98	(1a) x	2.75	(2a) =	145.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	145.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows			6.39	x1/[1/(1.1)+ 0.04]		=	6.73			(27)
Walls Type1	22.17	6.39	15.78	x	0.16	=	2.52	60	946.8	(29)
Walls Type2	17.22	0	17.22	x	0.15	=	2.58	60	1033.2	(29)
Total area of elements, m²			39.39							(31)
Party wall			46.48	x	0	=	0	45	2091.6	(32)
Party floor			52.98					40	2119.2	(32a)
Party ceiling			52.98					30	1589.4	(32b)
Internal wall **			97.63					9	878.67	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 11.84 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8658.87 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.44 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.45 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	

Average = Sum(39)$_{1…12}$ /12= 42.33 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Average = Sum(40)1…12 /12= 0.8 (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 1.78 (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 76.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	84.07	81.01	77.96	74.9	71.84	68.78	68.78	71.84	74.9	77.96	81.01	84.07	
										Total = Sum(44)1…12 =		917.12	(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=	124.67	109.04	112.52	98.1	94.13	81.22	75.27	86.37	87.4	101.86	111.18	120.74	
										Total = Sum(45)1…12 =		1202.49	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.7	16.36	16.88	14.71	14.12	12.18	11.29	12.96	13.11	15.28	16.68	18.11	(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	152.8	134.44	140.64	125.31	122.25	108.44	103.39	114.49	114.62	129.98	138.4	148.86	(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=	152.8	134.44	140.64	125.31	122.25	108.44	103.39	114.49	114.62	129.98	138.4	148.86	

Output from water heater (annual)$_{1...12}$ 1533.62 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	41.45	36.26	37.41	32.62	31.3	27.01	25.03	28.72	29.06	33.87	36.97	40.15	(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=	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.32	13.6	11.06	8.38	6.26	5.29	5.71	7.42	9.96	12.65	14.77	15.74	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	154.97	156.57	152.52	143.9	133.01	122.77	115.93	114.32	118.38	127	137.89	148.13	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	(71)

Water heating gains (Table 5)

(72)m=	55.72	53.95	50.29	45.3	42.07	37.51	33.64	38.6	40.36	45.52	51.35	53.96	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	275.67	273.8	263.54	247.24	231	215.24	204.95	210.02	218.37	234.85	253.68	267.5	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	6.39	x	36.79	x	0.63	x	0.7	=	71.85	(77)
Southeast	0.9x	0.77	x	6.39	x	62.67	x	0.63	x	0.7	=	122.39	(77)
Southeast	0.9x	0.77	x	6.39	x	85.75	x	0.63	x	0.7	=	167.46	(77)
Southeast	0.9x	0.77	x	6.39	x	106.25	x	0.63	x	0.7	=	207.5	(77)
Southeast	0.9x	0.77	x	6.39	x	119.01	x	0.63	x	0.7	=	232.41	(77)

Southeast	0.9x	0.77	x	6.39	x	118.15	x	0.63	x	0.7	=	230.73	(77)
Southeast	0.9x	0.77	x	6.39	x	113.91	x	0.63	x	0.7	=	222.45	(77)
Southeast	0.9x	0.77	x	6.39	x	104.39	x	0.63	x	0.7	=	203.86	(77)
Southeast	0.9x	0.77	x	6.39	x	92.85	x	0.63	x	0.7	=	181.33	(77)
Southeast	0.9x	0.77	x	6.39	x	69.27	x	0.63	x	0.7	=	135.27	(77)
Southeast	0.9x	0.77	x	6.39	x	44.07	x	0.63	x	0.7	=	86.06	(77)
Southeast	0.9x	0.77	x	6.39	x	31.49	x	0.63	x	0.7	=	61.49	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.85	122.39	167.46	207.5	232.41	230.73	222.45	203.86	181.33	135.27	86.06	61.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	347.52	396.19	431	454.74	463.41	445.97	427.4	413.88	399.7	370.12	339.74	328.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.94	0.87	0.75	0.58	0.43	0.46	0.68	0.89	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.96	0.93	0.85	0.71	0.52	0.36	0.39	0.62	0.87	0.96	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	(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	0.86	0.73	0.55	0.39	0.42	0.64	0.88	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	340.86	381.9	400.99	390.69	338.16	244.7	166.3	174.23	257.54	324.31	327.58	324.03	(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=	688.1	662.7	594.97	493.39	374.87	252.11	167.45	175.92	273.28	421.43	569.58	692.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	258.34	188.7	144.32	73.94	27.31	0	0	0	0	72.26	174.24	274.02	

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1213.13 (98)

Space heating requirement in kWh/m²/year 22.9 (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 1 277.43 (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)	258.34	188.7	144.32	73.94	27.31	0	0	0	0	72.26	174.24	274.02		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	93.12	68.02	52.02	26.65	9.84	0	0	0	0	26.04	62.8	98.77		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													437.27	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	152.8	134.44	140.64	125.31	122.25	108.44	103.39	114.49	114.62	129.98	138.4	148.86		
Efficiency of water heater													207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	73.58	64.74	67.72	60.34	58.87	52.22	49.79	55.13	55.19	62.59	66.64	71.68		
Total = Sum(219a)$_{1...12}$ =													738.49	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		437.27	
Water heating fuel used		738.49	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	292.61		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		292.61	(231)
Electricity for lighting		270.51	(232)
Electricity generated by PVs		-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		806.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.519	=	226.94	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	383.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			610.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	151.86	(267)
Electricity for lighting	(232) x	0.519	=	140.39	(268)
Energy saving/generation technologies Item 1		0.519	=	-484.08	(269)
Total CO2, kg/year		sum of (265)…(271) =		418.4	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		7.9	(273)
EI rating (section 14)				94	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:42

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 74.55m²

Site Reference : 231 Watford Road - GREEN **Plot Reference:** Sample 5

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.1 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	8.08 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	39.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	No cylinder thermostat	
	No cylinder	

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	Fail

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South East	12.79m²
Windows facing: South	1.28m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.55	(1a) x	2.75	(2a) =	205.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			12.79	x1/[1/(1.1)+ 0.04] =	13.48			(27)
Windows Type 2			1.28	x1/[1/(1.1)+ 0.04] =	1.35			(27)
Walls Type1	41.85	14.07	27.78	x 0.16 =	4.44	60	1666.8	(29)
Walls Type2	24.37	0	24.37	x 0.15 =	3.65	60	1462.2	(29)
Total area of elements, m²			66.22					(31)
Party wall			41.82	x 0 =	0	45	1881.9	(32)
Party floor			74.55			40	2982	(32a)
Party ceiling			74.55			30	2236.5	(32b)
Internal wall **			131.12			9	1180.08	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11409.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 153.04 (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 9.46 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.38 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	

Average = Sum(39)$_{1…12}$ /12= 66.21 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89

Average = Sum(40)$_{1…12}$ /12= 0.89 (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 2.35 (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 90.04 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	99.05	95.45	91.85	88.24	84.64	81.04	81.04	84.64	88.24	91.85	95.45	99.05

Total = Sum(44)$_{1…12}$ = 1080.53 (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=	146.89	128.47	132.57	115.58	110.9	95.7	88.68	101.76	102.97	120	130.99	142.25

Total = Sum(45)$_{1…12}$ = 1416.75 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.27	19.89	17.34	16.63	14.35	13.3	15.26	15.45	18	19.65	21.34	(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	175.01	153.87	160.69	142.79	139.02	122.91	116.8	129.88	130.19	148.13	158.21	170.37	(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=	175.01	153.87	160.69	142.79	139.02	122.91	116.8	129.88	130.19	148.13	158.21	170.37	

Output from water heater (annual)$_{1...12}$ 1747.88 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.84	42.72	44.08	38.43	36.87	31.82	29.48	33.83	34.24	39.9	43.56	47.3	(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=	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.78	16.68	13.56	10.27	7.68	6.48	7	9.1	12.22	15.51	18.1	19.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.68	209.83	204.4	192.84	178.25	164.53	155.37	153.21	158.64	170.2	184.8	198.51	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	(71)

Water heating gains (Table 5)

(72)m=	65.64	63.56	59.25	53.37	49.56	44.19	39.63	45.48	47.55	53.63	60.49	63.57	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	350.37	348.34	335.48	314.75	293.75	273.47	260.27	266.06	276.68	297.61	321.66	339.65	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.79	x	36.79	x	0.63	x	0.7	=	143.82	(77)
Southeast 0.9x	0.77	x	12.79	x	62.67	x	0.63	x	0.7	=	244.98	(77)
Southeast 0.9x	0.77	x	12.79	x	85.75	x	0.63	x	0.7	=	335.19	(77)
Southeast 0.9x	0.77	x	12.79	x	106.25	x	0.63	x	0.7	=	415.32	(77)
Southeast 0.9x	0.77	x	12.79	x	119.01	x	0.63	x	0.7	=	465.19	(77)

Southeast	0.9x	0.77	x	12.79	x	118.15	x	0.63	x	0.7	=	461.82	(77)
Southeast	0.9x	0.77	x	12.79	x	113.91	x	0.63	x	0.7	=	445.25	(77)
Southeast	0.9x	0.77	x	12.79	x	104.39	x	0.63	x	0.7	=	408.04	(77)
Southeast	0.9x	0.77	x	12.79	x	92.85	x	0.63	x	0.7	=	362.94	(77)
Southeast	0.9x	0.77	x	12.79	x	69.27	x	0.63	x	0.7	=	270.75	(77)
Southeast	0.9x	0.77	x	12.79	x	44.07	x	0.63	x	0.7	=	172.26	(77)
Southeast	0.9x	0.77	x	12.79	x	31.49	x	0.63	x	0.7	=	123.08	(77)
South	0.9x	0.77	x	1.28	x	46.75	x	0.63	x	0.7	=	18.29	(78)
South	0.9x	0.77	x	1.28	x	76.57	x	0.63	x	0.7	=	29.95	(78)
South	0.9x	0.77	x	1.28	x	97.53	x	0.63	x	0.7	=	38.15	(78)
South	0.9x	0.77	x	1.28	x	110.23	x	0.63	x	0.7	=	43.12	(78)
South	0.9x	0.77	x	1.28	x	114.87	x	0.63	x	0.7	=	44.94	(78)
South	0.9x	0.77	x	1.28	x	110.55	x	0.63	x	0.7	=	43.24	(78)
South	0.9x	0.77	x	1.28	x	108.01	x	0.63	x	0.7	=	42.25	(78)
South	0.9x	0.77	x	1.28	x	104.89	x	0.63	x	0.7	=	41.03	(78)
South	0.9x	0.77	x	1.28	x	101.89	x	0.63	x	0.7	=	39.86	(78)
South	0.9x	0.77	x	1.28	x	82.59	x	0.63	x	0.7	=	32.31	(78)
South	0.9x	0.77	x	1.28	x	55.42	x	0.63	x	0.7	=	21.68	(78)
South	0.9x	0.77	x	1.28	x	40.4	x	0.63	x	0.7	=	15.8	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	162.11	274.93	373.34	458.44	510.12	505.07	487.5	449.07	402.79	303.06	193.94	138.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	512.48	623.27	708.82	773.19	803.88	778.54	747.77	715.13	679.48	600.67	515.6	478.54	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.95	0.91	0.82	0.69	0.52	0.38	0.42	0.62	0.86	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.89	0.79	0.64	0.46	0.32	0.35	0.56	0.83	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5		(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	0.95	0.9	0.8	0.66	0.49	0.34	0.38	0.59	0.84	0.95	0.98		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	500.11	591.21	636.78	622.24	531.55	379.71	256.47	268.75	399.8	505.17	492.01	469.6		(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=	1072.8	1033.08	927.15	768.25	582.87	390.86	258.45	271.69	423.97	655.7	887.42	1079.43		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	426.09	296.94	216.03	105.13	38.18	0	0	0	0	111.99	284.7	453.71		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													1932.77	(98)
Space heating requirement in kWh/m²/year													25.93	(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		296.31	(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)														
	426.09	296.94	216.03	105.13	38.18	0	0	0	0	111.99	284.7	453.71		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	143.8	100.21	72.91	35.48	12.89	0	0	0	0	37.79	96.08	153.12		
Total (kWh/year) =Sum(211)1...5,10...12=													652.27	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	175.01	153.87	160.69	142.79	139.02	122.91	116.8	129.88	130.19	148.13	158.21	170.37		
Efficiency of water heater													207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	84.27	74.09	77.38	68.76	66.94	59.19	56.24	62.54	62.69	71.33	76.18	82.04		
Total = Sum(219a)1...12 =													841.66	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		652.27

DER WorkSheet: New dwelling design stage

Water heating fuel used		841.66	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	267.37		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		267.37	(231)
Electricity for lighting		331.6	(232)
Electricity generated by PVs		-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1160.2	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	338.53	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	436.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =			775.35	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	138.77	(267)
Electricity for lighting	(232) x	0.519	=	172.1	(268)
Energy saving/generation technologies Item 1		0.519	=	-484.08	(269)
Total CO2, kg/year		sum of (265)…(271) =		602.14	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		8.08	(273)
EI rating (section 14)				93	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:41

Project Information:

Assessed By: Neil Ingham (STRO010943)   **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE   Total Floor Area: 92.44m²

Site Reference : 231 Watford Road - GREEN   **Plot Reference:** Sample 6

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	25.04 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.47 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	37.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services		**OK**
Hot water controls:	No cylinder thermostat		
	No cylinder		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	3.85m²
Windows facing: North West	5.11m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.44	(1a) x	2.75	(2a) =	254.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.44	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	254.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			3.85	x1/[1/(1.1)+ 0.04]		=	4.06			(27)
Windows Type 2			5.11	x1/[1/(1.1)+ 0.04]		=	5.38			(27)
Walls Type1	35.28	8.96	26.32	x	0.16	=	4.21	60	1579.2	(29)
Walls Type2	82.44	0	82.44	x	0.15	=	12.34	60	4946.4	(29)
Total area of elements, m²			117.72							(31)
Party wall			15.98	x	0	=	0	45	719.1	(32)
Party floor			92.44					40	3697.6	(32a)
Party ceiling			92.44					30	2773.2	(32b)
Internal wall **			154.44					9	1389.96	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15105.46 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.41 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.38 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.38 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	41.94	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	78.32	

Average = $Sum(39)_{1…12}$ /12= 78.32 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85

Average = Sum(40)$_{1…12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	107.05	103.16	99.27	95.37	91.48	87.59	87.59	91.48	95.37	99.27	103.16	107.05

Total = Sum(44)$_{1…12}$ = 1167.84 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.75	138.85	143.28	124.91	119.86	103.43	95.84	109.98	111.29	129.7	141.58	153.75

Total = Sum(45)$_{1…12}$ = 1531.22 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.81	20.83	21.49	18.74	17.98	15.51	14.38	16.5	16.69	19.46	21.24	23.06	(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.88	164.25	171.4	152.13	147.98	130.64	123.96	138.1	138.51	157.82	168.79	181.87	(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=	186.88	164.25	171.4	152.13	147.98	130.64	123.96	138.1	138.51	157.82	168.79	181.87	

Output from water heater (annual)1…12 1862.34 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	52.79	46.17	47.64	41.53	39.85	34.39	31.87	36.57	37	43.13	47.07	51.12	(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=	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	132.88	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.23	22.41	18.22	13.8	10.31	8.71	9.41	12.23	16.41	20.84	24.33	25.93	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	243.5	246.02	239.66	226.1	208.99	192.91	182.16	179.64	186	199.56	216.67	232.75	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	-106.31	(71)

Water heating gains (Table 5)

(72)m=	70.95	68.7	64.03	57.69	53.57	47.76	42.83	49.15	51.4	57.96	65.38	68.71	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.54	400	384.78	360.45	335.73	312.24	297.27	303.88	316.68	341.23	369.24	390.26	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.85	x	11.28	x	0.63	x	0.7	=	13.28	(75)
Northeast 0.9x	0.77	x	3.85	x	22.97	x	0.63	x	0.7	=	27.02	(75)
Northeast 0.9x	0.77	x	3.85	x	41.38	x	0.63	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	3.85	x	67.96	x	0.63	x	0.7	=	79.96	(75)
Northeast 0.9x	0.77	x	3.85	x	91.35	x	0.63	x	0.7	=	107.48	(75)

Northeast	0.9x	0.77	x	3.85	x	97.38	x	0.63	x	0.7	=	114.58	(75)
Northeast	0.9x	0.77	x	3.85	x	91.1	x	0.63	x	0.7	=	107.19	(75)
Northeast	0.9x	0.77	x	3.85	x	72.63	x	0.63	x	0.7	=	85.45	(75)
Northeast	0.9x	0.77	x	3.85	x	50.42	x	0.63	x	0.7	=	59.33	(75)
Northeast	0.9x	0.77	x	3.85	x	28.07	x	0.63	x	0.7	=	33.02	(75)
Northeast	0.9x	0.77	x	3.85	x	14.2	x	0.63	x	0.7	=	16.7	(75)
Northeast	0.9x	0.77	x	3.85	x	9.21	x	0.63	x	0.7	=	10.84	(75)
Northwest	0.9x	0.77	x	5.11	x	11.28	x	0.63	x	0.7	=	17.62	(81)
Northwest	0.9x	0.77	x	5.11	x	22.97	x	0.63	x	0.7	=	35.87	(81)
Northwest	0.9x	0.77	x	5.11	x	41.38	x	0.63	x	0.7	=	64.62	(81)
Northwest	0.9x	0.77	x	5.11	x	67.96	x	0.63	x	0.7	=	106.13	(81)
Northwest	0.9x	0.77	x	5.11	x	91.35	x	0.63	x	0.7	=	142.65	(81)
Northwest	0.9x	0.77	x	5.11	x	97.38	x	0.63	x	0.7	=	152.08	(81)
Northwest	0.9x	0.77	x	5.11	x	91.1	x	0.63	x	0.7	=	142.27	(81)
Northwest	0.9x	0.77	x	5.11	x	72.63	x	0.63	x	0.7	=	113.42	(81)
Northwest	0.9x	0.77	x	5.11	x	50.42	x	0.63	x	0.7	=	78.74	(81)
Northwest	0.9x	0.77	x	5.11	x	28.07	x	0.63	x	0.7	=	43.83	(81)
Northwest	0.9x	0.77	x	5.11	x	14.2	x	0.63	x	0.7	=	22.17	(81)
Northwest	0.9x	0.77	x	5.11	x	9.21	x	0.63	x	0.7	=	14.39	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.9	62.89	113.31	186.08	250.13	266.67	249.46	198.87	138.07	76.86	38.88	25.23	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	433.44	462.89	498.08	546.53	585.86	578.91	546.73	502.76	454.75	418.09	408.12	415.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.9	0.76	0.6	0.66	0.88	0.98	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.95	0.87	0.69	0.5	0.57	0.84	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=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	20.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.96	0.88	0.71	0.53	0.6	0.86	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	431.3	459.43	490.52	523.53	514.57	413.09	292.23	301.69	388.87	406.05	404.73	413.81	(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=	1264.8	1217.8	1092.49	904.52	685.23	458.1	301.46	317.12	497.26	771.38	1045.5	1272.63	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	620.12	509.63	447.87	274.32	126.97	0	0	0	0	271.81	461.36	638.96	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3351.03 (98)

Space heating requirement in kWh/m²/year 36.25 (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		287.39	(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)													
	620.12	509.63	447.87	274.32	126.97	0	0	0	0	271.81	461.36	638.96	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	215.77	177.33	155.84	95.45	44.18	0	0	0	0	94.58	160.53	222.33	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1166.01 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	186.88	164.25	171.4	152.13	147.98	130.64	123.96	138.1	138.51	157.82	168.79	181.87	
Efficiency of water heater												207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	89.99	79.09	82.54	73.26	71.26	62.91	59.69	66.5	66.7	76	81.28	87.58	

Total = Sum(219a)$_{1...12}$ = 896.78 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1166.01

DER WorkSheet: New dwelling design stage

Water heating fuel used			896.78	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		288.44		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		288.44	(231)
Electricity for lighting			445.58	(232)
Electricity generated by PVs			-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			1864.1	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	605.16	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	465.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1070.59	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	149.7	(267)
Electricity for lighting	(232)	x	0.519	=	231.25	(268)
Energy saving/generation technologies						
Item 1			0.519	=	-484.08	(269)
Total CO2, kg/year			sum of (265)…(271) =		967.47	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		10.47	(273)
EI rating (section 14)					91	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:40

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 52.98m²

Site Reference : 231 Watford Road - GREEN **Plot Reference:** Sample 7

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	25.05 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	7.90 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	27.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder thermostat No cylinder	

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	6.39m²	
Ventilation rate:	6.00	

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 7

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.98	(1a) x	2.75	(2a) =	145.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	145.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows			6.39	x1/[1/(1.1)+ 0.04]		=	6.73			(27)
Walls Type1	22.17	6.39	15.78	x	0.16	=	2.52	60	946.8	(29)
Walls Type2	17.22	0	17.22	x	0.15	=	2.58	60	1033.2	(29)
Total area of elements, m²			39.39							(31)
Party wall			46.48	x	0	=	0	45	2091.6	(32)
Party floor			52.98					40	2119.2	(32a)
Party ceiling			52.98					30	1589.4	(32b)
Internal wall **			97.63					9	878.67	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 11.84 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8658.87 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.44 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.45 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	42.33	

Average = Sum(39)$_{1…12}$ /12= 42.33 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	

Average = Sum(40)$_{1…12}$ /12= 0.8 (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 1.78 (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 76.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.07	81.01	77.96	74.9	71.84	68.78	68.78	71.84	74.9	77.96	81.01	84.07	

Total = Sum(44)$_{1…12}$ = 917.12 (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=	124.67	109.04	112.52	98.1	94.13	81.22	75.27	86.37	87.4	101.86	111.18	120.74	

Total = Sum(45)$_{1…12}$ = 1202.49 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.7	16.36	16.88	14.71	14.12	12.18	11.29	12.96	13.11	15.28	16.68	18.11	(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	152.8	134.44	140.64	125.31	122.25	108.44	103.39	114.49	114.62	129.98	138.4	148.86	(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=	152.8	134.44	140.64	125.31	122.25	108.44	103.39	114.49	114.62	129.98	138.4	148.86	

Output from water heater (annual)$_{1...12}$ 1533.62 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	41.45	36.26	37.41	32.62	31.3	27.01	25.03	28.72	29.06	33.87	36.97	40.15	(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=	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.32	13.6	11.06	8.38	6.26	5.29	5.71	7.42	9.96	12.65	14.77	15.74	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	154.97	156.57	152.52	143.9	133.01	122.77	115.93	114.32	118.38	127	137.89	148.13	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	-71.12	(71)

Water heating gains (Table 5)

(72)m=	55.72	53.95	50.29	45.3	42.07	37.51	33.64	38.6	40.36	45.52	51.35	53.96	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	275.67	273.8	263.54	247.24	231	215.24	204.95	210.02	218.37	234.85	253.68	267.5	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	6.39	x	36.79	x	0.63	x	0.7	=	71.85	(77)
Southeast 0.9x	0.77	x	6.39	x	62.67	x	0.63	x	0.7	=	122.39	(77)
Southeast 0.9x	0.77	x	6.39	x	85.75	x	0.63	x	0.7	=	167.46	(77)
Southeast 0.9x	0.77	x	6.39	x	106.25	x	0.63	x	0.7	=	207.5	(77)
Southeast 0.9x	0.77	x	6.39	x	119.01	x	0.63	x	0.7	=	232.41	(77)

Southeast	0.9x	0.77	x	6.39	x	118.15	x	0.63	x	0.7	=	230.73	(77)
Southeast	0.9x	0.77	x	6.39	x	113.91	x	0.63	x	0.7	=	222.45	(77)
Southeast	0.9x	0.77	x	6.39	x	104.39	x	0.63	x	0.7	=	203.86	(77)
Southeast	0.9x	0.77	x	6.39	x	92.85	x	0.63	x	0.7	=	181.33	(77)
Southeast	0.9x	0.77	x	6.39	x	69.27	x	0.63	x	0.7	=	135.27	(77)
Southeast	0.9x	0.77	x	6.39	x	44.07	x	0.63	x	0.7	=	86.06	(77)
Southeast	0.9x	0.77	x	6.39	x	31.49	x	0.63	x	0.7	=	61.49	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.85	122.39	167.46	207.5	232.41	230.73	222.45	203.86	181.33	135.27	86.06	61.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	347.52	396.19	431	454.74	463.41	445.97	427.4	413.88	399.7	370.12	339.74	328.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.94	0.87	0.75	0.58	0.43	0.46	0.68	0.89	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.96	0.93	0.85	0.71	0.52	0.36	0.39	0.62	0.87	0.96	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	(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	0.86	0.73	0.55	0.39	0.42	0.64	0.88	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	340.86	381.9	400.99	390.69	338.16	244.7	166.3	174.23	257.54	324.31	327.58	324.03	(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=	688.1	662.7	594.97	493.39	374.87	252.11	167.45	175.92	273.28	421.43	569.58	692.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	258.34	188.7	144.32	73.94	27.31	0	0	0	0	72.26	174.24	274.02	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)1...5,9...12 =	1213.13	(98)
Space heating requirement in kWh/m²/year		22.9	(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		277.43	(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)	258.34	188.7	144.32	73.94	27.31	0	0	0	0	72.26	174.24	274.02		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	93.12	68.02	52.02	26.65	9.84	0	0	0	0	26.04	62.8	98.77		(211)
Total (kWh/year) =Sum(211)1...5,10....12=													437.27	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10....12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	152.8	134.44	140.64	125.31	122.25	108.44	103.39	114.49	114.62	129.98	138.4	148.86		
Efficiency of water heater													207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	73.58	64.74	67.72	60.34	58.87	52.22	49.79	55.13	55.19	62.59	66.64	71.68		
Total = Sum(219a)1...12 =													738.49	(219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			437.27	
Water heating fuel used			738.49	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		292.61		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		292.61	(231)
Electricity for lighting			270.51	(232)
Electricity generated by PVs			-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			806.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.519	=	226.94	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	383.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			610.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	151.86	(267)
Electricity for lighting	(232) x	0.519	=	140.39	(268)
Energy saving/generation technologies Item 1		0.519	=	-484.08	(269)
Total CO2, kg/year	sum of (265)…(271) =			418.4	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			7.9	(273)
EI rating (section 14)				94	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:39

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 74.55m²

Site Reference : 231 Watford Road - GREEN **Plot Reference:** Sample 8

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity		
Fuel factor: 1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	23.1 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	8.08 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	39.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services		OK
Hot water controls:	No cylinder thermostat		
	No cylinder		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	Fail

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	12.79m²	
Windows facing: South	1.28m²	
Ventilation rate:	6.00	

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 8

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.55	(1a) x	2.75	(2a) =	205.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.55	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		205.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			12.79		x1/[1/(1.1)+ 0.04]	=	13.48			(27)
Windows Type 2			1.28		x1/[1/(1.1)+ 0.04]	=	1.35			(27)
Walls Type1	41.85	14.07	27.78	x	0.16	=	4.44	60	1666.8	(29)
Walls Type2	24.37	0	24.37	x	0.15	=	3.65	60	1462.2	(29)
Total area of elements, m²			66.22							(31)
Party wall			41.82	x	0	=	0	45	1881.9	(32)
Party floor			74.55					40	2982	(32a)
Party ceiling			74.55					30	2236.5	(32b)
Internal wall **			131.12					9	1180.08	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11409.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 153.04 (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 9.46 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.38 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	66.21	

Average = Sum(39)1…12 /12= 66.21 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89

Average = Sum(40)$_{1...12}$ /12= 0.89 (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 2.35 (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 90.04 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	99.05	95.45	91.85	88.24	84.64	81.04	81.04	84.64	88.24	91.85	95.45	99.05

Total = Sum(44)$_{1...12}$ = 1080.53 (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=	146.89	128.47	132.57	115.58	110.9	95.7	88.68	101.76	102.97	120	130.99	142.25

Total = Sum(45)$_{1...12}$ = 1416.75 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.27	19.89	17.34	16.63	14.35	13.3	15.26	15.45	18	19.65	21.34	(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	175.01	153.87	160.69	142.79	139.02	122.91	116.8	129.88	130.19	148.13	158.21	170.37	(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=	175.01	153.87	160.69	142.79	139.02	122.91	116.8	129.88	130.19	148.13	158.21	170.37

Output from water heater (annual)$_{1...12}$ | 1747.88 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.84	42.72	44.08	38.43	36.87	31.82	29.48	33.83	34.24	39.9	43.56	47.3	(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=	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	117.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.78	16.68	13.56	10.27	7.68	6.48	7	9.1	12.22	15.51	18.1	19.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.68	209.83	204.4	192.84	178.25	164.53	155.37	153.21	158.64	170.2	184.8	198.51	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	34.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	-94.05	(71)

Water heating gains (Table 5)

(72)m=	65.64	63.56	59.25	53.37	49.56	44.19	39.63	45.48	47.55	53.63	60.49	63.57	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	350.37	348.34	335.48	314.75	293.75	273.47	260.27	266.06	276.68	297.61	321.66	339.65	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.79	x	36.79	x	0.63	x	0.7	=	143.82	(77)
Southeast 0.9x	0.77	x	12.79	x	62.67	x	0.63	x	0.7	=	244.98	(77)
Southeast 0.9x	0.77	x	12.79	x	85.75	x	0.63	x	0.7	=	335.19	(77)
Southeast 0.9x	0.77	x	12.79	x	106.25	x	0.63	x	0.7	=	415.32	(77)
Southeast 0.9x	0.77	x	12.79	x	119.01	x	0.63	x	0.7	=	465.19	(77)

Southeast	0.9x	0.77	x	12.79	x	118.15	x	0.63	x	0.7	=	461.82	(77)
Southeast	0.9x	0.77	x	12.79	x	113.91	x	0.63	x	0.7	=	445.25	(77)
Southeast	0.9x	0.77	x	12.79	x	104.39	x	0.63	x	0.7	=	408.04	(77)
Southeast	0.9x	0.77	x	12.79	x	92.85	x	0.63	x	0.7	=	362.94	(77)
Southeast	0.9x	0.77	x	12.79	x	69.27	x	0.63	x	0.7	=	270.75	(77)
Southeast	0.9x	0.77	x	12.79	x	44.07	x	0.63	x	0.7	=	172.26	(77)
Southeast	0.9x	0.77	x	12.79	x	31.49	x	0.63	x	0.7	=	123.08	(77)
South	0.9x	0.77	x	1.28	x	46.75	x	0.63	x	0.7	=	18.29	(78)
South	0.9x	0.77	x	1.28	x	76.57	x	0.63	x	0.7	=	29.95	(78)
South	0.9x	0.77	x	1.28	x	97.53	x	0.63	x	0.7	=	38.15	(78)
South	0.9x	0.77	x	1.28	x	110.23	x	0.63	x	0.7	=	43.12	(78)
South	0.9x	0.77	x	1.28	x	114.87	x	0.63	x	0.7	=	44.94	(78)
South	0.9x	0.77	x	1.28	x	110.55	x	0.63	x	0.7	=	43.24	(78)
South	0.9x	0.77	x	1.28	x	108.01	x	0.63	x	0.7	=	42.25	(78)
South	0.9x	0.77	x	1.28	x	104.89	x	0.63	x	0.7	=	41.03	(78)
South	0.9x	0.77	x	1.28	x	101.89	x	0.63	x	0.7	=	39.86	(78)
South	0.9x	0.77	x	1.28	x	82.59	x	0.63	x	0.7	=	32.31	(78)
South	0.9x	0.77	x	1.28	x	55.42	x	0.63	x	0.7	=	21.68	(78)
South	0.9x	0.77	x	1.28	x	40.4	x	0.63	x	0.7	=	15.8	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	162.11	274.93	373.34	458.44	510.12	505.07	487.5	449.07	402.79	303.06	193.94	138.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	512.48	623.27	708.82	773.19	803.88	778.54	747.77	715.13	679.48	600.67	515.6	478.54	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.95	0.91	0.82	0.69	0.52	0.38	0.42	0.62	0.86	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.89	0.79	0.64	0.46	0.32	0.35	0.56	0.83	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	(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	0.95	0.9	0.8	0.66	0.49	0.34	0.38	0.59	0.84	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	500.11	591.21	636.78	622.24	531.55	379.71	256.47	268.75	399.8	505.17	492.01	469.6	(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=	1072.8	1033.08	927.15	768.25	582.87	390.86	258.45	271.69	423.97	655.7	887.42	1079.43	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	426.09	296.94	216.03	105.13	38.18	0	0	0	0	111.99	284.7	453.71	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1932.77 (98)

Space heating requirement in kWh/m²/year 25.93 (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		296.31	(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)														
	426.09	296.94	216.03	105.13	38.18	0	0	0	0	111.99	284.7	453.71		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	143.8	100.21	72.91	35.48	12.89	0	0	0	0	37.79	96.08	153.12		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													652.27	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	175.01	153.87	160.69	142.79	139.02	122.91	116.8	129.88	130.19	148.13	158.21	170.37		
Efficiency of water heater													207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	84.27	74.09	77.38	68.76	66.94	59.19	56.24	62.54	62.69	71.33	76.18	82.04		
Total = Sum(219a)$_{1...12}$ =													841.66	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		652.27

DER WorkSheet: New dwelling design stage

Water heating fuel used		841.66	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	267.37		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		267.37	(231)
Electricity for lighting		331.6	(232)
Electricity generated by PVs		-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1160.2	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	338.53	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	436.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =			775.35	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	138.77	(267)
Electricity for lighting	(232) x	0.519	=	172.1	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-484.08	(269)
Total CO2, kg/year		sum of (265)…(271) =		602.14	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		8.08	(273)
EI rating (section 14)				93	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:38

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 48m²

Site Reference : 231 Watford Road - GREEN **Plot Reference:** Sample 9

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity		
Fuel factor: 1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	31.37 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.40 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	42.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services		**OK**
Hot water controls:	No cylinder thermostat		
	No cylinder		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	7.68m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 9

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48	(1a) x	2.75	(2a) =	132	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	48	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	132	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows			7.68	x1/[1/(1.1)+ 0.04]		=	8.09			(27)
Walls Type1	28.95	7.68	21.27	x	0.16	=	3.4	60	1276.2	(29)
Walls Type2	40.29	0	40.29	x	0.15	=	6.03	60	2417.4	(29)
Roof	48	0	48	x	0.12	=	5.76	9	432	(30)
Total area of elements, m²			117.24							(31)
Party wall			22.38	x	0	=	0	45	1007.1	(32)
Party floor			48					40	1920	(32a)
Internal wall **			97.35					9	876.15	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.29 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7928.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.18 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.78 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 31.06 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	21.78	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84	52.84

Average = Sum(39)$_{1…12}$ /12= 52.84 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

Average = Sum(40)1…12 /12= 1.1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.63 (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 72.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	80.24	77.32	74.4	71.49	68.57	65.65	65.65	68.57	71.49	74.4	77.32	80.24	
										Total = Sum(44)1…12 =		875.35	(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=	118.99	104.07	107.39	93.63	89.84	77.52	71.84	82.44	83.42	97.22	106.12	115.24	
										Total = Sum(45)1…12 =		1147.73	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	17.85	15.61	16.11	14.04	13.48	11.63	10.78	12.37	12.51	14.58	15.92	17.29	(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	147.12	129.48	135.52	120.85	117.96	104.74	99.96	110.56	110.64	125.34	133.34	143.36	(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=	147.12	129.48	135.52	120.85	117.96	104.74	99.96	110.56	110.64	125.34	133.34	143.36	

Output from water heater (annual)$_{1...12}$ 1478.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	39.57	34.6	35.71	31.13	29.87	25.78	23.89	27.41	27.74	32.32	35.29	38.32	(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=	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	81.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.21	11.73	9.54	7.22	5.4	4.56	4.93	6.4	8.59	10.91	12.74	13.58	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	142.04	143.52	139.8	131.89	121.91	112.53	106.26	104.79	108.5	116.41	126.39	135.77	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	-65.26	(71)

Water heating gains (Table 5)

(72)m=	53.18	51.49	48	43.24	40.15	35.8	32.1	36.84	38.52	43.45	49.01	51.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	255.9	254.22	244.81	229.83	214.93	200.36	190.77	195.51	203.09	218.24	235.61	248.33	(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 m²		Flux Table 6a	g_ Table 6b		FF Table 6c		Gains (W)	
Southwest 0.9x	0.77	x	7.68	x	36.79	0.63	x	0.7	=	86.36	(79)
Southwest 0.9x	0.77	x	7.68	x	62.67	0.63	x	0.7	=	147.1	(79)
Southwest 0.9x	0.77	x	7.68	x	85.75	0.63	x	0.7	=	201.27	(79)
Southwest 0.9x	0.77	x	7.68	x	106.25	0.63	x	0.7	=	249.38	(79)
Southwest 0.9x	0.77	x	7.68	x	119.01	0.63	x	0.7	=	279.33	(79)

Southwest	0.9x	0.77	x	7.68	x	118.15	0.63	x	0.7	=	277.31 (79)
Southwest	0.9x	0.77	x	7.68	x	113.91	0.63	x	0.7	=	267.36 (79)
Southwest	0.9x	0.77	x	7.68	x	104.39	0.63	x	0.7	=	245.02 (79)
Southwest	0.9x	0.77	x	7.68	x	92.85	0.63	x	0.7	=	217.93 (79)
Southwest	0.9x	0.77	x	7.68	x	69.27	0.63	x	0.7	=	162.58 (79)
Southwest	0.9x	0.77	x	7.68	x	44.07	0.63	x	0.7	=	103.44 (79)
Southwest	0.9x	0.77	x	7.68	x	31.49	0.63	x	0.7	=	73.91 (79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.36	147.1	201.27	249.38	279.33	277.31	267.36	245.02	217.93	162.58	103.44	73.91	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	342.26	401.32	446.08	479.21	494.26	477.67	458.12	440.52	421.03	380.82	339.05	322.23	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.94	0.89	0.79	0.64	0.49	0.52	0.73	0.91	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20	20	20	20	20	20	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.96	0.93	0.86	0.74	0.56	0.39	0.42	0.66	0.88	0.96	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20	20	20	20	20	20	20	20	20	20	20	20	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	(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	0.76	0.59	0.43	0.47	0.69	0.89	0.97	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	335.65	387.1	416.91	418.66	376.81	284.08	196.86	205.42	291.11	340.09	327.59	317.2	(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=	852.08	820.37	735.82	608.99	461.03	307.78	202.09	212.66	334.2	519.16	704.11	857.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	384.22	291.16	237.27	137.04	62.66	0	0	0	0	133.23	271.1	401.88	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1918.57	(98)
Space heating requirement in kWh/m²/year		39.97	(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		287.51	(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)	384.22	291.16	237.27	137.04	62.66	0	0	0	0	133.23	271.1	401.88		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	133.64	101.27	82.53	47.66	21.79	0	0	0	0	46.34	94.29	139.78		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													667.3	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	147.12	129.48	135.52	120.85	117.96	104.74	99.96	110.56	110.64	125.34	133.34	143.36		
Efficiency of water heater													207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	70.84	62.35	65.26	58.19	56.8	50.44	48.13	53.24	53.27	60.36	64.21	69.03		
Total = Sum(219a)$_{1...12}$ =													712.12	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			667.3	
Water heating fuel used			712.12	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		281.9		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		281.9	(231)
Electricity for lighting			233.31	(232)
Electricity generated by PVs			-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			961.92	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.519	=	346.33	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	369.59	(264)
Space and water heating	(261) + (262) + (263) + (264) =			715.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	146.31	(267)
Electricity for lighting	(232) x	0.519	=	121.09	(268)
Energy saving/generation technologies Item 1		0.519	=	-484.08	(269)
Total CO2, kg/year	sum of (265)…(271) =			499.24	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			10.4	(273)
EI rating (section 14)				93	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41
Printed on 12 July 2021 at 10:59:37

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.38m²

Site Reference : 231 Watford Road - GREEN **Plot Reference:** Sample 10

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	32.68 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.51 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	47.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
NIBE Fighter 360

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No Separate Cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services		**OK**
Hot water controls:	No cylinder thermostat		
	No cylinder		

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous extract system		
Specific fan power:	1.05	
Maximum	0.7	**Fail**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	6.39m²
Windows facing: North East	3.85m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.5 m³/m²h
Windows U-value	1.1 W/m²K
Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Sample 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.38	(1a) x	2.75	(2a) =	138.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.38	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		138.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ 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)

Air changes per hour

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		3.5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.18	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.18	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.22	0.21	0.19	0.19	0.17	0.17	0.16	0.18	0.19	0.2	0.21

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	
Windows Type 1			6.39	x1/[1/(1.1)+ 0.04]		=	6.73			(27)
Windows Type 2			3.85	x1/[1/(1.1)+ 0.04]		=	4.06			(27)
Walls Type1	39.98	10.24	29.74	x	0.16	=	4.76	60	1784.4	(29)
Walls Type2	20.07	0	20.07	x	0.15	=	3	60	1204.2	(29)
Roof	50.38	0	50.38	x	0.12	=	6.05	9	453.42	(30)
Total area of elements, m²			110.43							(31)
Party wall			25.9	x	0	=	0	45	1165.5	(32)
Party floor			50.38					40	2015.2	(32a)
Internal wall **			108.68					9	978.12	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.6 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7600.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 150.87 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.15 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.74 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	22.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6

Average = Sum(39)$_{1…12}$ /12= 55.6 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

Average = Sum(40)$_{1…12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (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 74.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.07	79.08	76.1	73.11	70.13	67.15	67.15	70.13	73.11	76.1	79.08	82.07

Total = Sum(44)$_{1…12}$ = 895.27 (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=	121.7	106.44	109.84	95.76	91.88	79.29	73.47	84.31	85.32	99.43	108.53	117.86

Total = Sum(45)$_{1…12}$ = 1173.84 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.26	15.97	16.48	14.36	13.78	11.89	11.02	12.65	12.8	14.91	16.28	17.68	(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): 0.54 (48)

Temperature factor from Table 2b 0.9072 (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) 0.91 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	149.83	131.84	137.96	122.98	120.01	106.5	101.6	112.43	112.53	127.55	135.75	145.99	(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=	149.83	131.84	137.96	122.98	120.01	106.5	101.6	112.43	112.53	127.55	135.75	145.99	

Output from water heater (annual)$_{1...12}$ 1504.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	40.47	35.39	36.52	31.84	30.55	26.36	24.43	28.03	28.37	33.06	36.09	39.19	(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=	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	85.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.29	11.8	9.6	7.27	5.43	4.58	4.95	6.44	8.64	10.97	12.81	13.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.22	149.76	145.88	137.63	127.22	117.43	110.89	109.35	113.22	121.48	131.89	141.68	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	-68.05	(71)

Water heating gains (Table 5)

(72)m=	54.39	52.67	49.09	44.22	41.06	36.62	32.84	37.68	39.4	44.44	50.12	52.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	264.42	262.74	253.09	237.64	222.23	207.15	197.2	201.99	209.79	225.41	243.34	256.53	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.85	x	11.28	x	0.63	x	0.7	=	13.28	(75)
Northeast 0.9x	0.77	x	3.85	x	22.97	x	0.63	x	0.7	=	27.02	(75)
Northeast 0.9x	0.77	x	3.85	x	41.38	x	0.63	x	0.7	=	48.69	(75)
Northeast 0.9x	0.77	x	3.85	x	67.96	x	0.63	x	0.7	=	79.96	(75)
Northeast 0.9x	0.77	x	3.85	x	91.35	x	0.63	x	0.7	=	107.48	(75)

Northeast	0.9x	0.77	x	3.85	x	97.38	x	0.63	x	0.7	=	114.58	(75)
Northeast	0.9x	0.77	x	3.85	x	91.1	x	0.63	x	0.7	=	107.19	(75)
Northeast	0.9x	0.77	x	3.85	x	72.63	x	0.63	x	0.7	=	85.45	(75)
Northeast	0.9x	0.77	x	3.85	x	50.42	x	0.63	x	0.7	=	59.33	(75)
Northeast	0.9x	0.77	x	3.85	x	28.07	x	0.63	x	0.7	=	33.02	(75)
Northeast	0.9x	0.77	x	3.85	x	14.2	x	0.63	x	0.7	=	16.7	(75)
Northeast	0.9x	0.77	x	3.85	x	9.21	x	0.63	x	0.7	=	10.84	(75)
Northwest	0.9x	0.77	x	6.39	x	11.28	x	0.63	x	0.7	=	22.03	(81)
Northwest	0.9x	0.77	x	6.39	x	22.97	x	0.63	x	0.7	=	44.85	(81)
Northwest	0.9x	0.77	x	6.39	x	41.38	x	0.63	x	0.7	=	80.81	(81)
Northwest	0.9x	0.77	x	6.39	x	67.96	x	0.63	x	0.7	=	132.71	(81)
Northwest	0.9x	0.77	x	6.39	x	91.35	x	0.63	x	0.7	=	178.39	(81)
Northwest	0.9x	0.77	x	6.39	x	97.38	x	0.63	x	0.7	=	190.18	(81)
Northwest	0.9x	0.77	x	6.39	x	91.1	x	0.63	x	0.7	=	177.91	(81)
Northwest	0.9x	0.77	x	6.39	x	72.63	x	0.63	x	0.7	=	141.83	(81)
Northwest	0.9x	0.77	x	6.39	x	50.42	x	0.63	x	0.7	=	98.46	(81)
Northwest	0.9x	0.77	x	6.39	x	28.07	x	0.63	x	0.7	=	54.81	(81)
Northwest	0.9x	0.77	x	6.39	x	14.2	x	0.63	x	0.7	=	27.72	(81)
Northwest	0.9x	0.77	x	6.39	x	9.21	x	0.63	x	0.7	=	17.99	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	35.31	71.87	129.49	212.67	285.87	304.76	285.1	227.28	157.79	87.84	44.43	28.84	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	299.73	334.62	382.58	450.3	508.09	511.91	482.29	429.27	367.58	313.24	287.77	285.36	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.62	0.48	0.55	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=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20	20	20	20	20	20	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.98	0.95	0.88	0.74	0.55	0.38	0.45	0.73	0.93	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20	20	20	20	20	20	20	20	20	20	20	20	(90)

fLA = Living area ÷ (4) = | 0.48 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.89	0.76	0.58	0.43	0.5	0.76	0.94	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	295.57	327.38	366.01	402.53	387.83	298.86	208.38	214.75	281.2	293.13	281.52	282.03	(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=	899.41	866.05	777.09	643.64	487.95	326.7	215.5	226.62	354.5	549.11	743.72	904.97	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	449.26	361.99	305.84	173.6	74.49	0	0	0	0	190.46	332.79	463.47	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2351.9 (98)

Space heating requirement in kWh/m²/year 46.68 (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		289.63	(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)													
	449.26	361.99	305.84	173.6	74.49	0	0	0	0	190.46	332.79	463.47	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	155.12	124.98	105.6	59.94	25.72	0	0	0	0	65.76	114.9	160.02	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 812.04 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	149.83	131.84	137.96	122.98	120.01	106.5	101.6	112.43	112.53	127.55	135.75	145.99	
Efficiency of water heater												207.67	(216)
(217)m=	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	207.67	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	72.15	63.49	66.43	59.22	57.79	51.29	48.92	54.14	54.19	61.42	65.37	70.3	

Total = Sum(219a)$_{1...12}$ = 724.69 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		812.04

DER WorkSheet: New dwelling design stage

Water heating fuel used		724.69	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	278.35		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		278.35	(231)
Electricity for lighting		234.63	(232)
Electricity generated by PVs		-932.71	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1117	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	421.45	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	376.11	(264)
Space and water heating	(261) + (262) + (263) + (264) =			797.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	144.46	(267)
Electricity for lighting	(232) x	0.519	=	121.77	(268)
Energy saving/generation technologies Item 1		0.519	=	-484.08	(269)
Total CO2, kg/year	sum of (265)…(271) =			579.72	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			11.51	(273)
EI rating (section 14)				92	(274)

Appendix D

SAP 10 Emissions

GLA Emissions Calculation Spreadsheet

The applicant should complete all the light blue cells including information on the modelled units, the area per unit, the number of units, the baseline energy consumption figures, the TER and the TFEE.

DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK: Calculated TER 2012 (kgCO2 / m2)	VALIDATION CHECK: TER Worksheet TER 2012 (kgCO2 / m2)	REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - TER WORKSHEET: Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Lighting	Auxiliary	Cooling
	TER Worksheet (Row 4)				TER Worksheet (Row 273)	TER Worksheet (Row 211)		TER Worksheet (Row 219)		TER Worksheet (Row 232)	TER Worksheet (Row 231)	N / A
Sample 1	*100.28*	*1*	*100.28*	17.5	17.6	*4439.13*	*Natural Gas*	*2520.11*	*Natural Gas*	*418.92*	*75*	
Sample 2	*52.98*	*1*	*52.98*	17.5	17.5	*1469.1*	*Natural Gas*	*1985.93*	*Natural Gas*	*270.51*	*75*	
Sample 3	*92.44*	*1*	*92.44*	20.0	20.0	*4821.95*	*Natural Gas*	*2467.64*	*Natural Gas*	*445.58*	*75*	
Sample 4	*52.98*	*1*	*52.98*	17.5	17.5	*1469.1*	*Natural Gas*	*1985.93*	*Natural Gas*	*270.51*	*75*	
Sample 5	*74.55*	*1*	*74.55*	16.2	16.2	*2296.39*	*Natural Gas*	*2328.79*	*Natural Gas*	*331.6*	*75*	
Sample 6	*92.44*	*1*	*92.44*	17.6	17.6	*3817.01*	*Natural Gas*	*2478.59*	*Natural Gas*	*445.58*	*75*	
Sample 7	*52.98*	*1*	*52.98*	17.5	17.5	*1469.1*	*Natural Gas*	*1985.93*	*Natural Gas*	*270.51*	*75*	
Sample 8	*74.55*	*1*	*74.55*	16.2	16.2	*2296.39*	*Natural Gas*	*2328.79*	*Natural Gas*	*331.6*	*75*	
Sample 9	*48*	*1*	*48*	21.5	21.5	*2153.51*	*Natural Gas*	*1877.93*	*Natural Gas*	*233.31*	*75*	
Sample 10	*50.38*	*1*	*50.38*	22.4	22.4	*2558.13*	*Natural Gas*	*1915.01*	*Natural Gas*	*234.63*	*75*	
Sum	692	10	692	18.2	-	26,790	N/A	21,875	N/A	3,253	750	0

Unit identifier	SAP 2012 CO2 PERFORMANCE — REGULATED CO2 EMISSIONS PER UNIT (kgCO2 p.a.): Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	2012 CO2 emissions (kgCO2 p.a.)	SAP10 CO2 PERFORMANCE — REGULATED CO2 EMISSIONS PER UNIT: Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated TER SAP10 (kgCO2 / m2)	DEMAND — Fabric Energy Efficiency (FEE): Target Fabric Energy Efficiency (TFEE) (kWh/m²)
Sample 1	959	544	217	39		1,760	932	529	98	17		1,577	15.7	
Sample 2	317	429	140	39		926	309	417	63	17		806	15.2	
Sample 3	1,042	533	231	39		1,845	1,013	518	104	17		1,652	17.9	
Sample 4	317	429	140	39		926	309	417	63	17		806	15.2	
Sample 5	496	503	172	39		1,210	482	489	77	17		1,066	14.3	
Sample 6	824	535	231	39		1,630	802	521	104	17		1,443	15.6	
Sample 7	317	429	140	39		926	309	417	63	17		806	15.2	
Sample 8	496	503	172	39		1,210	482	489	77	17		1,066	14.3	
Sample 9	465	406	121	39		1,031	452	394	54	17		918	19.1	
Sample 10	553	414	122	39		1,127	537	402	55	17		1,012	20.1	
Sum	5,787	4,725	1,688	389	0	*12,589*	5,626	4,594	758	175	0	*11,152*	16.1	0.00

NON-DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

Building Use	Area per unit (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK: Calculated TER 2012 (kgCO2 / m2)	VALIDATION CHECK: BRUKL TER 2012 (kgCO2 / m2)	REGULATED ENERGY CONSUMPTION BY END USE (kWh/m² p.a.) TER - SOURCE: BRUKL OUTPUT: Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Lighting	Auxiliary	Cooling

Building Use	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) TER - SOURCE: BRUKL.INP or *SIM.CSV FILE: Natural Gas	Grid Electricity	2012 CO2 emissions (kgCO2 p.a.)	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) - TER BRUKL: Natural Gas	Grid Electricity	REGULATED CO2 EMISSIONS: SAP10 CO2 emissions (kgCO2 p.a.)	BRUKL TER SAP10 (kgCO2 / m2)
	##############	##############		##############	##############		

The applicant should complete all the light blue cells including information on the 'be lean' energy consumption figures, the 'be lean' DER, the DFEE and the regulated energy demand of the 'be lean' scenario.

DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK: Calculated DER 2012 (kgCO2 / m2)	VALIDATION CHECK: DER Worksheet DER 2012 (kgCO2 / m2)	REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE LEAN' SAP DER WORKSHEET: Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Lighting	Auxiliary	Cooling
					DER Sheet (Row 384)	DER Sheet [(Row 307a) ÷ (Row 367a x 0.01)]	Select fuel type	DER Sheet [(Row 310a) ÷ (Row 367a x 0.01)]	Select fuel type	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315
Sample 1	100.28	1	100.28	15.8	15.8	3648.6	Natural Gas	1389.32	Natural Gas	418.92	534.24	0
Sample 2	52.98	1	52.98	15.6	15.6	1082.57	Natural Gas	1290.78	Natural Gas	270.51	336.29	0
Sample 3	92.44	1	92.44	18.1	18.1	4103.55	Natural Gas	1306.32	Natural Gas	445.58	530.9	0
Sample 4	52.98	1	52.98	15.6	15.6	1082.57	Natural Gas	1290.78	Natural Gas	270.51	336.29	0
Sample 5	74.55	1	74.55	14.5	14.5	1725.81	Natural Gas	1427.46	Natural Gas	331.6	442.67	0
Sample 6	92.44	1	92.44	15.7	15.7	2991.47	Natural Gas	1362.68	Natural Gas	445.58	530.9	0
Sample 7	52.98	1	52.98	15.6	15.6	1082.57	Natural Gas	1290.78	Natural Gas	270.51	336.29	0
Sample 8	74.55	1	74.55	14.5	14.5	1725.81	Natural Gas	1427.46	Natural Gas	331.6	442.67	0
Sample 9	48	1	48	18.2	18.2	1677.12	Natural Gas	1062.57	Natural Gas	233.31	311.73	0
Sample 10	50.38	1	50.38	18.9	19.0	2033.92	Natural Gas	1044.59	Natural Gas	234.63	323.47	
Sum	692	10	692	16.2	-	21,154	N/A	12,893	N/A	3,253	4,125	0

SAP 2012 CO2 PERFORMANCE / **SAP10 CO2 PERFORMANCE** / **DOMESTIC ENERGY DEMAND DATA**

Unit identifier	SAP 2012 – REGULATED CO2 EMISSIONS PER UNIT (kgCO2 p.a.): Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	2012 CO2 emissions (kgCO2 p.a.)	SAP10 – REGULATED CO2 EMISSIONS PER UNIT: Space Heating CO2 emissions (kgCO2 p.a.)	Domestic Hot Water CO2 emissions (kgCO2 p.a.)	Lighting CO2 emissions (kgCO2 p.a.)	Auxiliary CO2 emissions (kgCO2 p.a.)	Cooling CO2 emissions (kgCO2 p.a.)	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated DER SAP10 (kgCO2 / m2)	Fabric Energy Efficiency (FEE): Dwelling Fabric Energy Efficiency (DFEE) (kWh/m²)	REGULATED ENERGY DEMAND PER UNIT PER ANNUM (kWh p.a.): Space Heating (kWh p.a.)	Domestic Hot Water (kWh p.a.)	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)
Sample 1	788	300	217	277	0	1,583	766	292	98	124	0	1,280	12.8						
Sample 2	234	279	140	175	0	828	227	271	63	78	0	640	12.1						
Sample 3	886	282	231	276	0	1,675	862	274	104	124	0	1,364	14.8						
Sample 4	234	279	140	175	0	828	227	271	63	78	0	640	12.1						
Sample 5	373	308	172	230	0	1,083	362	300	77	103	0	843	11.3						
Sample 6	646	294	231	276	0	1,447	628	286	104	124	0	1,142	12.4						
Sample 7	234	279	140	175	0	828	227	271	63	78	0	640	12.1						
Sample 8	373	308	172	230	0	1,083	362	300	77	103	0	843	11.3						
Sample 9	362	230	121	162	0	875	352	223	54	73	0	702	14.6						
Sample 10	439	226	122	168		955	427	219	55	75		777	15.4						
Sum	4,569	2,785	1,688	2,141	0	11,183	4,442	2,707	758	961	0	8,869	12.8	0.00	0	0	0	0	0

NON-DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

Building Use	Area per unit (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK: Calculated BER 2012 (kgCO2 / m2)	VALIDATION CHECK: BRUKL BER 2012 (kgCO2 / m2)	REGULATED ENERGY CONSUMPTION BY END USE (kWh/m² p.a.) 'BE LEAN' BER - SOURCE: BRUKL OUTPUT: Space Heating (kWh/m² p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water	Lighting (kWh/m² p.a.)	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)
Sum	0	0	0	#DIV/0!	-	0	N/A	0	N/A	0	0	0

	LATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) 'BE LEAN' BER - SOURCE: BRUKL.INP or *SIM.CS: Natural Gas	Grid Electricity				2012 CO2 emissions (kgCO2 p.a.)	REGULATED CO2 EMISSIONS PER UNIT: Natural Gas	Grid Electricity	SAP10 CO2 emissions (kgCO2 p.a.)	BRUKL BER SAP10 (kgCO2 / m2)		NON-DOMESTIC ENERGY DEMAND – REGULATED ENERGY DEMAND PER UNIT PER ANNUM (kWh p.a.): Space Heating (kWh p.a.)	Domestic Hot Water (kWh p.a.)	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)
	##############	##############					##############	##############			N/A					
Sum	0	0	N/A	N/A	N/A	0	0	0	0	#DIV/0!		0	0	0	0	0

SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS

Use	Total Area (m²)	Calculated BER 2012 (kgCO2 / m2)	-	REGULATED ENERGY CONSUMPTION: Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)	REGULATED CO2 EMISSIONS: 2012 CO2 emissions (kgCO2 p.a.)	REGULATED CO2 EMISSIONS: SAP10 CO2 emissions (kgCO2 p.a.)	Calculated BER SAP10 (kgCO2 / m2)	N/A	REGULATED ENERGY DEMAND PER UNIT PER ANNUM (kWh p.a.): Space Heating (kWh p.a.)	Domestic Hot Water (kWh p.a.)	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)
Sum	692	16.2	-	21,154		12,893		3,253	4,125	0	11,183	8,869	12.8		0	0	0	0	0

The applicant should complete all the light blue cells including information on the 'be green' energy consumption figures and the 'be green' DER.

DOMESTIC ENERGY CONSUMPTION AND CO 2 ANALYSIS

Regulated energy consumption per unit (kWh p.a.) – 'BE GREEN' SAP DER WORKSHEET

Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK: Calculated DER 2012 (kgCO2 / m2)	VALIDATION CHECK: DER Worksheet DER 2012 (kgCO2 / m2)	Space Heating (Heat Source 1)	Fuel type Space Heating	Domestic Hot Water (Heat Source 1)	Fuel type Domestic Hot Water	Space Heating (Heat source 2) if applicable	Fuel type Space Heating	Domestic Hot Water (Heat source 2) if applicable	Fuel type Domestic Hot Water	Space and Domestic Hot Water from CHP if applicable	Fuel type CHP if applicable	Total Electricity generated by CHP (-) if applicable	Electricity generated by renewable (-) if applicable	Lighting	Auxiliary	Cooling
					DER Sheet (Row 384)	DER Sheet [Row 307b ÷ (Row 367b x 0.01)]	Select fuel type	DER Sheet [Row 310b ÷ (Row 367b x 0.01)]	Select fuel type	DER Sheet [Row 307c ÷ (Row 367c x 0.01)]	Select fuel type	DER Sheet [Row 310c ÷ (Row 367c x 0.01)]	Select fuel type	DER Sheet [(Row 307a + 310a) ÷ (Row 362 x 0.01)]	Select fuel type	DER Sheet [(Row 307a + 310a) × (Row 361 ÷ 362)]	DER Sheet Row 380	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315
Sample 1	100.28	1	100.28	10.4	10.4	1366.02	Grid Electricity	911.97	Grid Electricity		Grid Electricity		Grid Electricity				-932.71	418.92	253.46	
Sample 2	52.98	1	52.98	7.9	7.9	437.27	Grid Electricity	738.49	Grid Electricity		Grid Electricity		Grid Electricity				-932.71	270.51	292.61	
Sample 3	92.44	1	92.44	12.6	12.6	1563.88	Grid Electricity	896.78	Grid Electricity		Grid Electricity		Grid Electricity				-932.71	445.58	266.28	
Sample 4	52.98	1	52.98	7.9	7.9	437.27	Grid Electricity	738.49	Grid Electricity		Grid Electricity		Grid Electricity				-932.71	270.51	292.61	
Sample 5	74.55	1	74.55	8.1	8.1	652.27	Grid Electricity	841.66	Grid Electricity		Grid Electricity		Grid Electricity				-932.71	331.6	267.37	
Sample 6	92.44	1	92.44	10.5	10.5	1166.01	Grid Electricity	896.78	Grid Electricity		Grid Electricity		Grid Electricity				-932.71	445.58	288.44	
Sample 7	52.98	1	52.98	7.9	7.9	437.27	Grid Electricity	738.49	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-932.71	270.51	292.61	
Sample 8	74.55	1	74.55	8.1	8.1	652.27	Grid Electricity	841.66	Grid Electricity		Grid Electricity		Grid Electricity				-932.71	331.6	267.37	
Sample 9	48	1	48	10.4	10.4	667.3	Grid Electricity	712.12	Grid Electricity		Grid Electricity		Grid Electricity				-932.71	233.31	281.9	
Sample 10	50.38	1	50.38	11.5	11.5	812.04	Grid Electricity	724.69	Grid Electricity		Grid Electricity		Grid Electricity				-932.71	234.63	278.35	
Sum	692	10	692	9.7	-	8,192	N/A	8,041	N/A	0	N/A	0	N/A	0	N/A	0	-9,327	3,253	2,781	0

SAP 2012 CO2 PERFORMANCE – Regulated CO2 emissions per unit (kgCO2 p.a.) / **SAP10 CO2 PERFORMANCE – Regulated CO2 emissions per unit**

Unit identifier	Space Heating	Domestic Hot Water	Space Heating and DHW from CHP if applicable	Electricity generated by CHP if applicable	Electricity generated by renewable if applicable	Lighting	Auxiliary	Cooling	2012 CO2 emissions (kgCO2 p.a.)	SAP10 Space Heating	SAP10 Domestic Hot Water	SAP10 Space Heating and DHW from CHP if applicable	SAP10 Electricity generated by CHP if applicable	SAP10 Electricity generated by renewable if applicable	SAP10 Lighting	SAP10 Auxiliary	SAP10 Cooling	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated DER SAP10 (kgCO2 / m2)
Sample 1	709	473			-484	217	132		1,047	318	212			-217	98	59		470	4.7
Sample 2	227	383			-484	140	152		418	102	172			-217	63	68		188	3.5
Sample 3	812	465			-484	231	138		1,162	364	209			-217	104	62		522	5.6
Sample 4	227	383			-484	140	152		418	102	172			-217	63	68		188	3.5
Sample 5	339	437			-484	172	139		602	152	196			-217	77	62		270	3.6
Sample 6	605	465			-484	231	150		967	272	209			-217	104	67		434	4.7
Sample 7	227	383	0		-484	140	152		418	102	172	0		-217	63	68		188	3.5
Sample 8	339	437			-484	172	139		602	152	196			-217	77	62		270	3.6
Sample 9	346	370			-484	121	146		499	155	166			-217	54	66		224	4.7
Sample 10	421	376			-484	122	144		580	189	169			-217	55	65		260	5.2
Sum	4,251	4,173	0	0	-4,841	1,688	1,443	0	6,716	1,909	1,874	0	0	-2,173	758	648	0	3,015	4.4

NON-DOMESTIC ENERGY CONSUMPTION AND CO 2 ANALYSIS

Regulated energy consumption by end use (kWh/m² p.a.) 'BE GREEN' BER - SOURCE: BRUKL OUTPUT

Use	Area per unit (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK: Calculated BER 2012 (kgCO2 / m2)	VALIDATION CHECK: BRUKL BER 2012 (kgCO2 / m2)	Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water							Electricity generated by CHP (-) if applicable	Electricity generated by renewable technology (-) if applicable	Lighting	Auxiliary	Cooling
										N/A	N/A	N/A	N/A	N/A	N/A					
Sum	0	0	0	#DIV/0!	-	0	N/A	0	N/A							0	0	0	0	0

Regulated energy consumption by fuel type (kWh/m² p.a.) 'BE GREEN' BER - SOURCE: BRUKL.INP or *SIM.CSV FILE / **Regulated CO2 emissions per unit**

Use	Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-) if applicable	Electricity generated by renewable technology (-) if applicable	Waste Heat From Power Station	Enter Carbon Factor 2	Enter Carbon Factor 3	2012 CO2 emissions (kgCO2 p.a.)	SAP10 Natural Gas	SAP10 Grid Electricity	SAP10 Bespoke DH Factor	SAP10 Electricity generated by CHP (-) if applicable	SAP10 Electricity generated by renewable technology (-) if applicable	SAP10 Waste Heat From Power Station	SAP10 Enter Carbon Factor 2	SAP10 Enter Carbon Factor 3	SAP10 CO2 emissions	BRUKL BER SAP10 (kgCO2 / m2)
	##############	##############	##############	##############	##############	##############	##############	##############		##############	##############	##############	##############	##############	##############	##############	##############		
Sum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	#DIV/0!

SITE-WIDE ENERGY CONSUMPTION AND CO 2 ANALYSIS

Regulated CO2 emissions

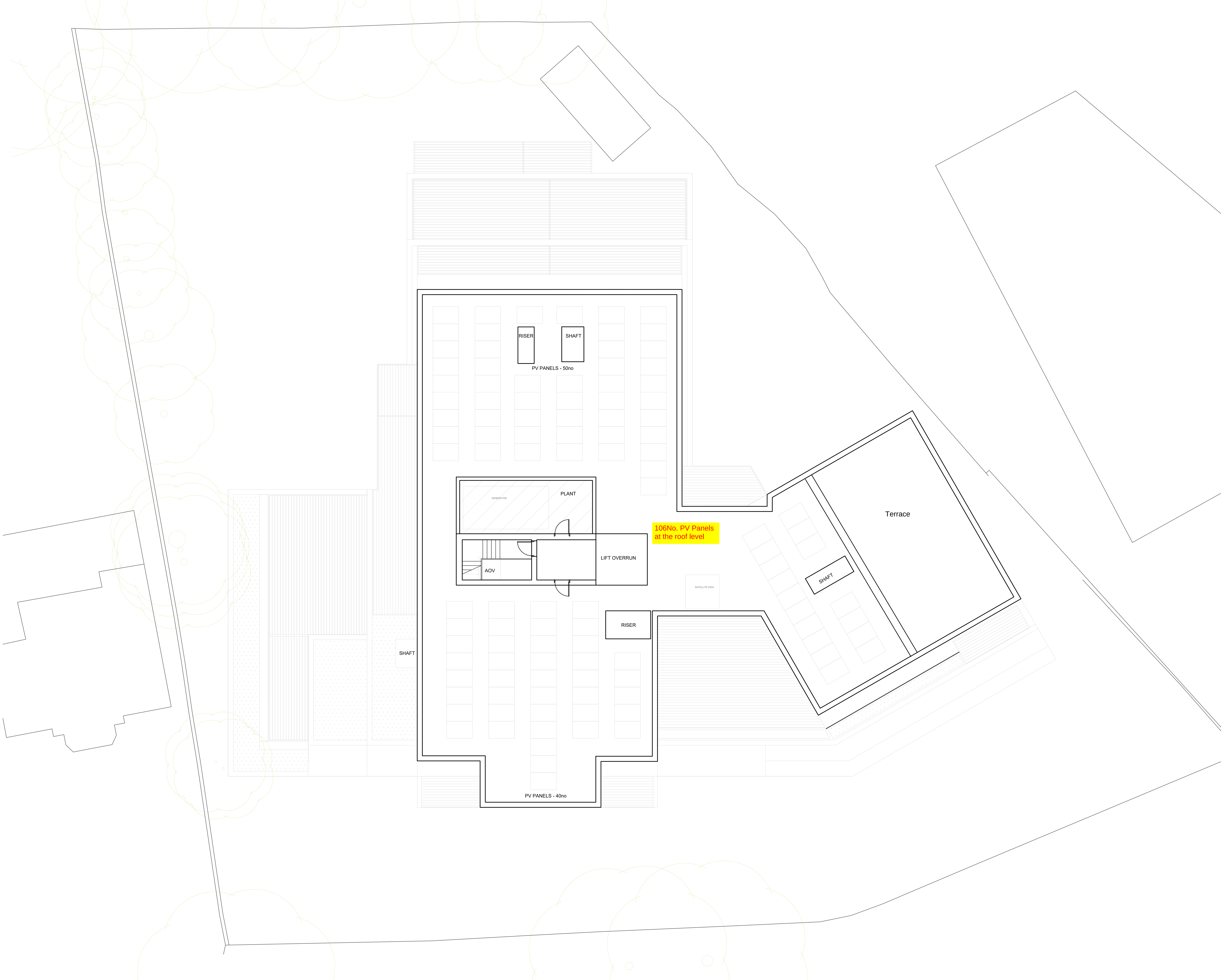
Use	Total Area (m²)	Calculated BER 2012 (kgCO2 / m2)	-	Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Space and Domestic Hot Water from CHP (kWh p.a.)	N/A	Electricity generated by CHP (kWh p.a.) if applicable	Electricity generated by renewable (kWh p.a.) if applicable	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)
Sum	692	0.0	-	8,192		8,041		0		0		0		0	-9,327	3,253	2,781	0

Regulated CO2 emissions / **Regulated CO2 emissions per unit**

Use	Space Heating CO2 emissions	Domestic Hot Water CO2 emissions	Space Heating and DHW from CHP CO2 emissions if applicable	Electricity generated by CHP CO2 savings if applicable	Electricity generated by renewable CO2 savings if applicable	Lighting CO2 emissions	Auxiliary CO2 emissions	Cooling CO2 emissions	2012 CO2 emissions	SAP10 Space Heating CO2 emissions	SAP10 Domestic Hot Water CO2 emissions	SAP10 Space Heating and DHW from CHP CO2 emissions if applicable	SAP10 Electricity generated by CHP CO2 savings if applicable	SAP10 Electricity generated by renewable CO2 savings if applicable	SAP10 Lighting CO2 emissions	SAP10 Auxiliary CO2 emissions	SAP10 Cooling CO2 emissions	SAP10 CO2 emissions	Calculated BER SAP10 (kgCO2 / m2)
Sum	4,251	4,173	0	0	-4,841	1,688	1,443	0	6,716	1,909	1,874	0	0	-2,173	758	648	0	3,015	4.4

Appendix E

Roof Layout indicating PVs



BARR GAZETAS

Note:

1. -
2. -
3. -

Rev.	Description.	By	Date

Client
Fruition Properties

Project
231 Watford Road

Title
Proposed Roof Plan

Status	Purpose of issue	RIBA stage
S2	For Information	03

Project No.	Drawn	Checked	Scale	Rev.
2111	SS	GV	1:100 @ A1 1:200 @ A3	

Drawing No.
2111-BG-ZZ-05-DR-A-20.206

A 19 Heddon Street, London, W1B 4BG
T 0207 636 5581
W www.barrgazetas.com