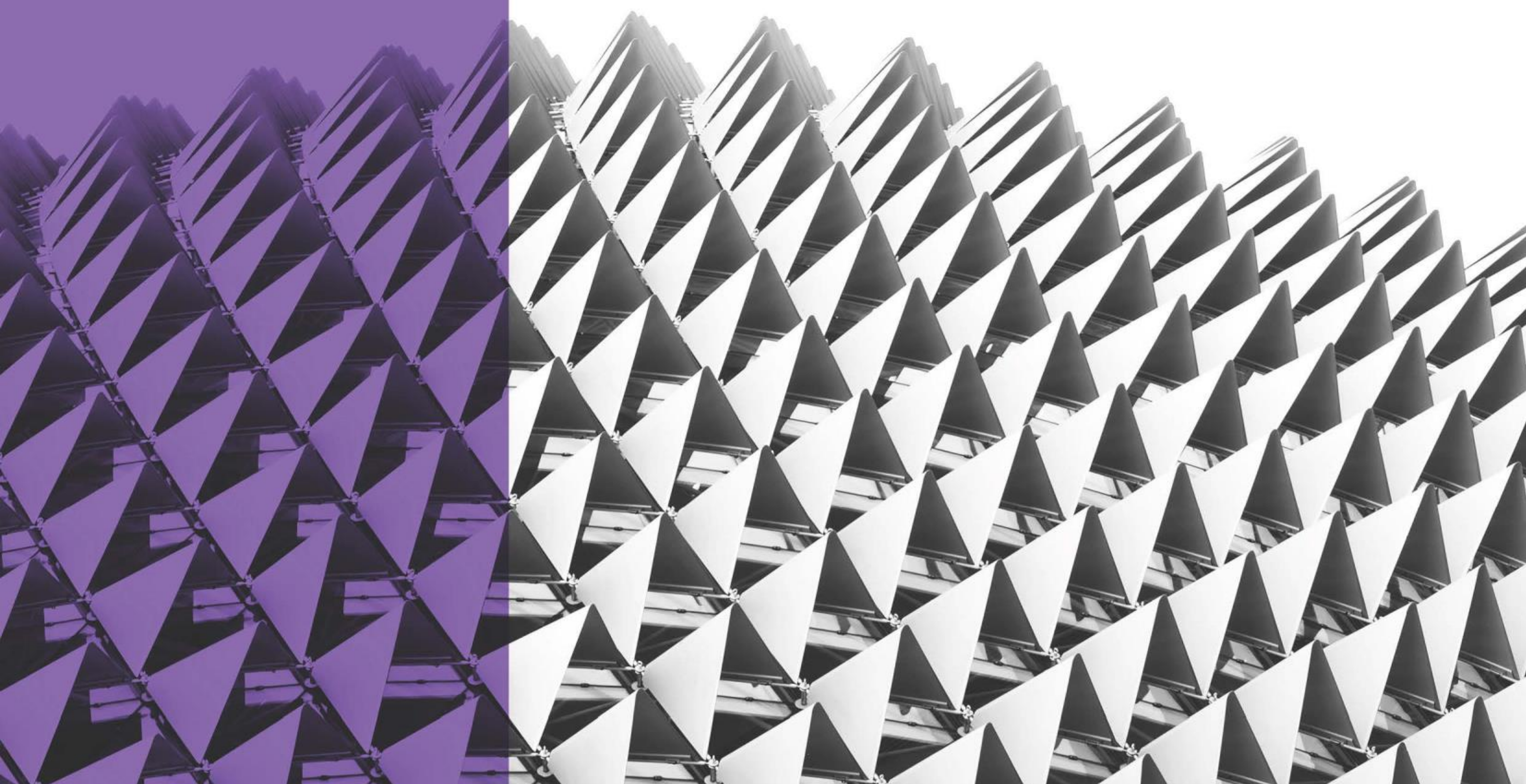
Energy Statement
Tottenham Mews

14-19 Tottenham Mews, London, W1T 4AA



Title	**Energy Statement Tottenham Mews**
Address	14-19 Tottenham Mews, London, W1T 4AA
Client	Central London Commercial Estates Limited
Date	23 November 2020
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Report Preface

IDENTIFICATION PHOTOGRAPH: Proposed CGI of 14-19 Tottenham Mews (Piercy & Co.)

Issue/Revision	**01**	**Date of issue**	**06 November 2020**
Produced by	Vitaliy Troyan		
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Executive Summary

This energy strategy has been prepared on behalf of Central London Commercial Estates Limited, in support of a planning application for Tottenham Mews (hereafter referred to as the “Proposed Development”), located within the Charlotte Street Conservation Area of London.

The statement relates to the final proposals and accompanies full planning application for the development. It follows the London Plan energy hierarchy and approach to energy statements as detailed in the “GLA Guidance on preparing energy assessments” (October 2018 and draft document dated April 2020).

Energy and climate change planning policy within the London Borough of Camden currently follows the London Plan and additional energy planning guidance, with the requirement for the development to meet carbon reduction targets (e.g. 35% reduction in CO_2 emissions and 20% carbon reduction from renewables). This report also considers and addresses the emerging draft policies on energy and carbon with the aim to achieve net zero carbon in operation.

The London Plan requires that the development follows an energy hierarchy when considering reducing CO_2 emissions. The energy hierarchy must consider the incorporation of energy efficiency measures including passive design, supplying energy efficiently (with particular emphasis on decentralised energy generation including CHP) and using renewable energy technologies. The following summarises the key technical solutions that are proposed for the development:

- Utilising building materials with good thermal performance and airtightness to reduce energy demand for heating and cooling (where applicable).
- Passive solar control measures are balanced through specification of high-performance solar control glass to limit solar gains in summer and to allow useful solar gains during heating period.
- High-efficiency Heating, Ventilation and Air Conditioning (HVAC) including heat pump system to provide renewable heating and domestic hot water (DHW), cooling (B1 use only) and balanced mechanical ventilation with heat recovery.
- High performance LED lighting is adopted throughout the development with improved controls such as occupancy sensing and daylight dimming in high density areas and where appropriate.
- 53no high efficiency solar PV panels are proposed to be located on the building’s roof, further contributing to carbon emissions reduction associated with the renewable technologies.

Under the Draft London Plan, it is now required that major residential and non-residential developments adhere to a zero-carbon target. To meet the zero-carbon target, new developments are required to incorporate a minimum of 35% on-site reduction of carbon beyond the ‘baseline’ Part L of the current Building Regulations.

Please note that the modelling inputs and results listed in this report are reflective of the design at the time of issue, the strategy is likely to be further refined as the detailed design develops.

Table 1 and Figure 1 below show estimated regulated CO_2 emissions and savings achieved at each stage of the energy hierarchy for the Proposed Development using revised carbon emission factors for fuels listed in SAP 10 Table 12.

Table 1: Estimated regulated CO_2 emissions and savings after each stage of the hierarchy

Energy Hierarchy	CO_2 Emissions (Residential)		CO_2 Emissions (Non-residential))	
	Regulated emissions (tCO_2/yr)	Unregulated emissions (tCO_2/yr)	Regulated emissions (tCO_2/yr)	Unregulated emissions (tCO_2/yr)
Baseline	25.0	13.4	4.5	2.5
Be Lean	23.7	13.4	3.6	2.5
Be Clean	23.7	13.4	3.6	2.5
Be Green	8.1	13.4	3.4	2.5

Regulated CO_2 emissions savings	Residential		Non-residential	
	Tonnes CO_2 per annum	%	Tonnes CO_2 per annum	%
Be lean: Savings from energy demand reduction	1.3	5%	0.8	18.9%
Be clean: Savings from heat network	-	-	0.0	-
Be green: Savings from renewable energy	15.6	63%	0.3	6.1%
Total cumulative savings	**16.9**	**68%**	**1.1**	**25.1%**
Annual savings from off-set payment	8.1	-	3.4	-
Shortfall in Regulated CO_2 savings	**Tonnes CO_2**		**Tonnes CO_2**	
Cumulative savings for off-set payment (over 30 years)	242	-	101	
Cash-in-lieu contribution (based on £95/tonne)	£22,973	**-**	£9,572	

Table 2: Combined regulated CO_2 emissions and savings

	Total regulated emissions (tCO_2 / year)	CO_2 savings (tCO_2 / year)	Percentage savings (%)
Baseline	29.4	-	-
Be Lean	27.3	2.1	7.3%
Be Clean	27.3	-	-
Be Green	11.4	15.9	54%
Total savings	**-**	**18**	**61.2%**
Offset (tCO_2)	-	345	-

Figure 1: Estimated combined regulated CO_2 emission savings after each stage of the hierarchy

In summary, the energy strategy has enabled the Proposed Development to achieve a total of **61.2%** in regulated carbon emissions when assessed using SAP 10 carbon factors. Contribution of heat pump system, as a form of renewable heat source topped by roof-mounted PV is **54%** of the total CO_2 savings achieved for the development.

1.0 Introduction

Acting on behalf of Central London Commercial Estates Limited, we have prepared this energy statement to support the planning application for the redevelopment of Tottenham Mews.

The Proposed Development is situated within the London Borough of Camden. The site comprises a temporary prefabricated building dating from the 1970s, which is located on the western side of Tottenham Mews. The building is currently vacant and is soon to be demolished by the Applicant to allow the site to be utilised to facilitate the construction of the approved scheme at Middlesex Hospital Annex.

The total GIA of the Proposed Development is approximately 2,003m^2 and according to the GLA guidance, the Proposed Development falls within the criteria for a major development (over 10 dwellings).

To better reflect the need to mitigate the Proposed Development's impact on climate change, and to reduce its carbon dioxide (CO_2) emissions, this report will not only follow the principles set out in the current London Plan (March 2016), and Camden Local Plan (2017), it will also refer to the emerging Draft London Plan (Intention to publish, December 2019) where possible.

The report will take into account Part L1A 2013 of the UK Building Regulations, as well as identify how the design of the Proposed Development can provide energy efficiency measures that result in a minimum 35% residual carbon reduction through the consideration of renewable and low carbon energy installations.

1.1 Client

This report is for the benefit of Central London Commercial Estates Limited only; TFT cannot accept any liability to any third party for the whole or any part of its contents. Our appointment specifically excludes the provisions set out in the Contracts (Rights of Third Parties) Act 1999.

Tuffin Ferraby Taylor LLP (TFT) is a limited liability partnership registered in England and Wales. Registration number: OC306766. Registered office: 18 Holborn, London, EC1N 2LE.

2.0 Description of the Proposed Development

The proposal consists of erection of a ground plus five storey building (plus one basement level) to provide office (e class) at part ground and basement level and residential dwellings (C3) at ground and floors one to five, and associated landscaping, cycling parking and all necessary enabling works.

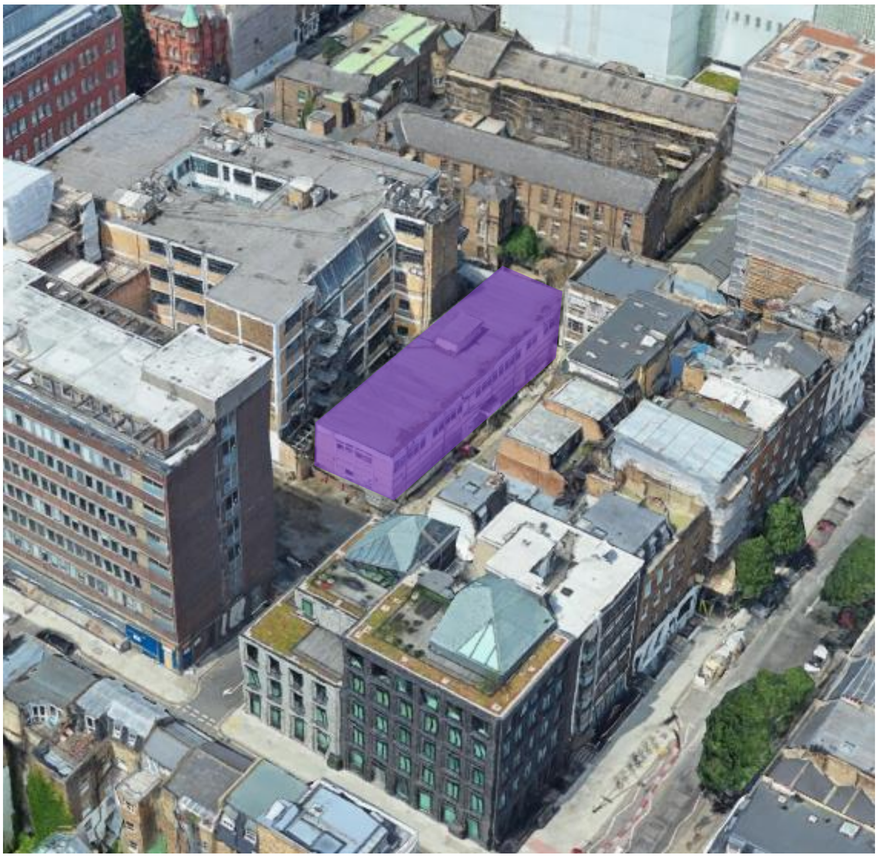


Figure 2: Tottenham Mews, Google Earth view

3.0 Planning Policy and Building Regulations Context

This assessment was carried out in line with local, regional and national planning requirements which encourage that passive design, energy efficiency measures, low carbon and renewable energy technologies are incorporated into the building design. Policies and regulations relevant to the Proposed Development include the following.

3.1 Building Regulations

The approved part L documents give guidance for compliance for building work carried out in England. It deals with the energy efficiency requirements in buildings and sets five different criteria to achieve compliance.

The proposals shall comply with Part L1Aand Part L2A of the UK Building Regulations 2013 (amended in 2016).

3.2 Relevant Planning Policy

GLA Planning Policy

The Greater London Authority (GLA) has set out guidance relating to sustainable design within the London Plan (Spatial Development Strategy for Greater London). The current adopted plan is dated March 2016, with alterations since 2011.

The Greater London Authority (GLA) has set out new guidance relating to sustainable design within the Draft London Plan 'Spatial Development Strategy for Greater London' (intention to publish, December 2019). In preparation for the adoption of the London Plan and to better reflect the need to mitigate the Proposed Development's impact on climate change, this report will also refer to the emerging Draft London Plan policies.

THE LONDON PLAN (MARCH 2016)

Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction are to be met within the framework of the energy hierarchy.

As a minimum, energy assessments should include the following details:

- a calculation of the energy demand and carbon dioxide emissions covered by Building Regulations and,
- separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy

Proposals to reduce carbon dioxide emissions through the energy-efficient design of the site, buildings and services.

Proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP).

Proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring-fenced to secure the delivery of carbon dioxide savings elsewhere.

POLICY 5.2 MINIMISING CARBON DIOXIDE EMISSIONS

Development proposal should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- Be lean: use less energy.
- Be clean: supply energy efficiently.
- Be green: use renewable energy.

The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero-carbon non-domestic buildings from 2019.

Table 3: Year Improvement on 2010 Building Regulations

Year	Year Improvement on 2010 Building Regulations
2011 – 2013	25 per cent
2014 – 2016	40 per cent
2017 – 2019	As per building regulations requirements
2020 – 2031	Zero Carbon

POLICY 5.6 DECENTRALISED ENERGY IN DEVELOPMENT PROPOSALS

Development proposal should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

Major development proposals should select energy systems in accordance with the following hierarchy:

- Connection to existing heating or cooling networks;
- Site wide CHP network;
- Communal heating and cooling;

Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

POLICY 5.7 RENEWABLE ENERGY

Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets, and to avoid any adverse impacts on air quality.

POLICY 5.9 OVERHEATING AND COOLING

Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

- Minimise internal heat generation through energy-efficient design

- Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
- Manage the heat within the building through exposed internal thermal mass and high ceilings
- Passive ventilation
- Mechanical ventilation
- Active cooling systems (ensuring they are the lowest carbon options).

Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy-intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

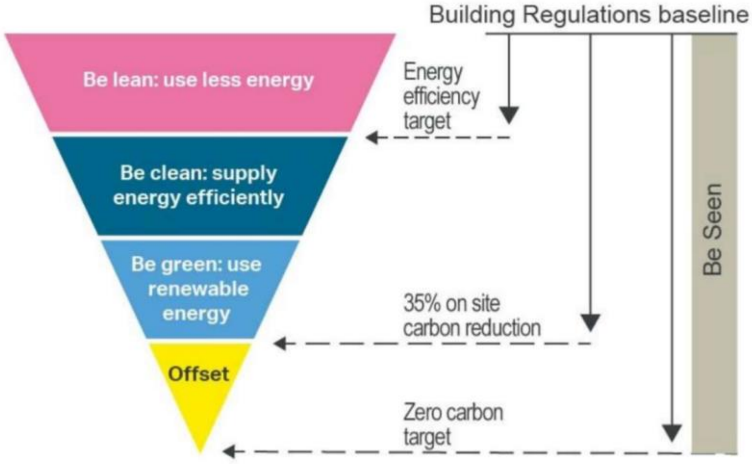
The emerging Draft London Plan

This report will reference the following policies considered relevant to the Proposed Development:

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:

- Be lean: use less energy and manage demand during construction and operation.
- 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.
- 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.
- Be seen: monitor, verify and report on energy performance.



B) Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

C) In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations 117 is expected. 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.

D) Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver greenhouse gas reductions. The operation of offset funds should be monitored and reported on annually.

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.

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

2) minimise internal heat generation through energy-efficient design

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

Camden Local Plan

The Camden Council Local Plan (adopted 2017) is a document that details both strategic and more detailed policies to deliver Camden's future sustainable development. The key sustainable development policy in relation to energy is summarised below.

POLICY CC1 – CLIMATE CHANGE MITIGATION

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. The Council will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;

c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;

d. support and encourage sensitive energy efficiency improvements to existing buildings;

e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and

f. expect all developments to optimise resource efficiency.

For decentralised energy networks, the Council will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;

h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and

i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

As the Proposed Development is GLA-referable development project, the principles and policies summarised within this chapter were adhered to during design and associated energy strategy approach for the scheme.

4.0 Baseline Energy Demands and CO_2 Emissions

4.1 Proposed approach

The recommendations within this Energy Statement embrace the themes outlined in the Mayor's energy hierarchy defined in the London Plan:

1. **Be Lean:** use less energy
2. **Be Clean:** supply energy efficiently
3. **Be Green:** use renewable energy

This approach consists of reducing the energy demand and CO_2 emissions by first improving the energy efficiency of the building envelope and the mechanical and electrical services. Once the energy demand of the building has been reduced from energy efficiency improvements, Low and Zero Carbon (LZC) technologies can then be considered. It is widely accepted that the most effective way to reduce energy consumption (and therefore carbon emissions) is to follow the energy hierarchy shown below.

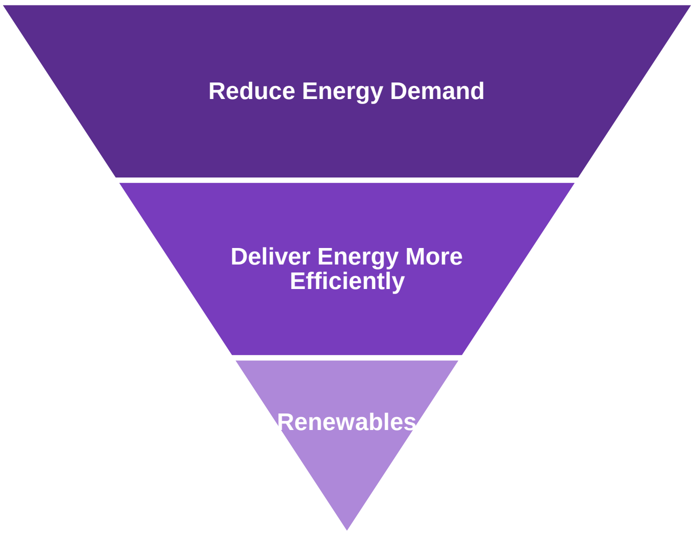


Figure 3: London Plan Energy hierarchy

4.2 Baseline assessment

In order to assess the potential CO_2 emissions reductions achievable at the site through the implementation of passive design, energy efficiency measures and on-site LZC technologies, the baseline CO_2 emissions of the Proposed Development must be estimated.

As a new build construction, the Proposed Development will need to meet the minimum criteria set out in Part L1A and L2A of the Building Regulations and Building Services Compliance Guide 2013.

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5.0 Be Lean – Passive Design & Energy Efficiency Appraisal

A key component of this energy strategy is to demonstrate how energy efficiency can be maximised within the Proposed Development, through passive design and efficient servicing. The measures included within the design are described in greater detail below.

5.1 Building fabric improvements

The proposed building fabric will be designed to exceed the requirements set out in Part L 2013. Please note that these requirements will need to be confirmed by building control and adapted in case of a change in Building Regulations in the future.

The table below summarises the U-Values for the opaque elements of the scheme:

Table 4: Proposed building fabric performance

Element	Proposed U-value (W/m^2K)	Part L1A 2013 recommended U-value (W/m^2K)
External Walls	0.20	0.30
Exposed Floor	0.12	0.25
Main Roof	0.14	0.20
Windows (including frame)	1.1	2.0
Windows g-value	0.44	N/A
Air permeability	$3m^3/m^2/h$	$10^3/m^2/h$

5.2 Proposed building services

High-efficiency services will be provided throughout the building and the target design criteria assumed in the thermal modelling exercise are summarised in the table below:

Table 5: Proposed building services performance

Efficient lighting	The following measures will be introduced to reduce energy consumption associated with lighting: • Energy-efficient LED lamps across office floor plates with high efficacy. • Daylight dimming and occupancy sensing in communal areas and B1 spaces.

Heating & Cooling

- High efficiency air source heat pumps to provide heating to the building's occupied areas.
- Heating COP: 2.5

Ventilation

- Local MVHR units with low SFP of 0.48-0.61W/l/s
- High heat recovery efficiency up to 80%.

DHW

- High efficiency heat pump for DHW provision with SCOP of 2.5.
- Thermally insulated heat interface units within the apartments.

5.3 Cooling hierarchy

In line with Policy 5.2 of the London Plan (March 2016) and Policy SI4 of the emerging Draft London Plan the Proposed Development will be designed to be adaptable to the changing climate, with emphasis given on incorporating features to mitigate overheating, whilst reducing reliance on air conditioning systems.

The following table illustrates how the Proposed Development follows the cooling hierarchy to ensure energy use associated with cooling is minimised.

Table 6: Cooling hierarchy measures

Hierarchy Steps	Measures applied
1. Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.	Selective solar control glazing (high light transmittance with low g-values) has been specified to prevent the excessive solar gains in summer. Fabric insulation and airtightness levels have been improved above Building Regulations requirements to reduce heat gains in the summer.
2. Minimise internal heat generation through energy efficient design	Internal heat gains have been minimised where possible through energy efficient lighting design with automatic daylight and occupancy controls where applicable. Heat losses from distribution pipework and HIUs have also been significantly reduced through specification of high-performance pipe insulation.

3. Manage the heat within the building through exposed internal thermal mass and high ceilings	The thermal mass of the occupied areas will absorb heat gains during the day through the use of concrete slab, internal masonry walls and structural columns. Ceiling height is maintained at 2.4m minimum to improve air circulation and reduce overheating risks.
4. Provide passive ventilation	Although there are certain limitations associated with urban constraints (noise/pollution), the design includes manually openable windows. These will be supplemented by efficient mechanical ventilation system for fresh air provision.
5. Provide mechanical ventilation	Mechanical ventilation with high efficiency heat recovery system has been specified. Ventilation plant has been designed to avoid excessively long duct runs and increased fan power. The system will circulate fresh air in the occupied zones and remove hot stale air from wet rooms. Boost mode operation of MVHR and summer bypass would also be available to increase fresh air supply during hot summer months.
6. Provide active cooling systems	No active cooling is specified for the residential element of the Proposed Development. High efficiency air source heat pump is specified for B1 office unit offering active cooling solution at the Proposed Development. High cooling efficiency (SEER=4.0) and previous steps of the cooling hierarchy have enabled to reduce energy demand for cooling by 40% against the Notional Building target, as can be seen in Table 7 below.

Table 7: Cooling demand

	Area-weighted non-domestic cooling demand (MJ/m^2)	Total non-domestic cooling demand (MJ/year)
Actual	42.1	11,375
Notional	70.7	19,103

5.4 Overheating assessment

A detailed overheating assessment following CIBSE TM59 methodology has been undertaken for the Proposed Development and it indicates no risk of overheating based on the proposed design parameters using recommended DSY1 2020 weather file.

In line with the GLA's 'Energy Assessment Guidance 2018' (section 9.4, table 11) a full dynamic thermal model has been used to demonstrate that summer operative temperature ranges in occupied zones are in accordance with the criteria set out in CIBSE TM59 and TM49.

The simulation has been undertaken on the basis of current climatic data as well as predicted future climatic data in order to investigate the resilience of the design with regards to climate change.

A selection of apartments (highlighted in green below) within the Proposed Development have been assessed to understand whether there is a potential risk of overheating under varying climate scenarios.

Figure 4: Apartments tested

This analysis has been undertaken to test a thermal model of the proposed development using CIBSE 'Design Summer Years' (DSY) weather files for the London Weather Centre location '**London_LWC_DSY**'.

The following weather files were simulated for this analysis as per requirements outlined within the Energy Assessment Guidance:

- **CIBSE LWC DSY1 (**Moderately warm summer): **2020** high emissions, 50% scenario
- **CIBSE LWC DSY2** (Short, intense warm spell): **2020** high emissions, 50% scenario
- **CIBSE LWC DSY3 (**Long, less intense warm spell): **2020** high emissions, 50% scenario

In addition, the following future projected weather files have been analysed:

- **CIBSE LWC DSY1 (**Moderately warm summer): **2050** medium emissions, 50% scenario
- **CIBSE LWC DSY1 (**Moderately warm summer): **2080** medium emissions, 50% scenario

CIBSE TM59 outlines the following compliance criteria for predominantly naturally ventilated homes. Both must be achieved for all relevant rooms.

- **Criterion A – Living rooms, kitchens and bedrooms**

The number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).

- **Criterion B – Bedrooms only**

  To guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

The developments where communal heating system is present it is recommended to undertake the overheating test for corridors. It should be based on the number of annual hours for which an operative temperature of 28 °C is not exceeded for more than 3% of the total hours.

Table 8 below provides a simplified summary breakdown of data input into the thermal model based on TM59 requirements. It includes internal gains (occupancy density, occupancy gains, lighting and equipment), infiltration and ventilation rates as well as pipework and heat interface unit's (HIU) losses (as provided by the MEP consultants).

Table 8: Summary of TM59 modelling inputs

Design Criteria	Living	Kitchen	Bedroom	Communal Corridors
Occupancy	2 People (2 Bed) 1 Person (1 Bed)	2 People (2 Bed) 1 Person (1 Bed)	2 People (2 Bed) 1 Person (1 Bed)	-
Profile	9:00 – 22:00	9:00 – 22:00	24/7	24/7
	Gains			
Lighting	2 W/m^2 (18:00-23:00)	2 W/m^2 (18:00-23:00)	2 W/m^2 (18:00-23:00)	2 W/m^2
Equipment	150W (peak load) 35W (base load)	300W (peak load) 50W (base load)	80W (peak load) 10W (base load)	-
Occupants (sensible)	75 W/person	75 W/person	75 W/person	-
Occupants (latent)	55 W/person	55 W/person	55 W/person	-
	Air changes			
Infiltration	0.15 ACH	0.15 ACH	0.15 ACH	0.15 ACH
Ventilation supply rate	7.5 l/s/person	-	6 l/s/person	-
	Heat losses			
Pipework losses	7.5W/m			
HIU losses	2.5W (based on 0.06kWh/day)			

The following table demonstrates that none of the areas assessed are predicted to exceed the CIBSE TM59 overheating criteria during non-heating-season using the "LWC DSY1 2020 high emissions, 50% scenario" weather file.

Table 9: TM59 results using DSY1 2020 weather file

Apartment/Room	Criterion A Percentage of hours	Achieved?	Criterion B Number of hours above 26°C	Achieved?
4F - 4.01 - Bed 1	0.1	Yes	29	Yes
4F - 4.01 - Bed 2	0.3	Yes	26	Yes
4F - 4.01 - Kitchen	0.4	Yes	N/A	N/A
4F - 4.01 - Living	0.3	Yes	N/A	N/A
4F - 4.02 - Bed	0.1	Yes	18	Yes
4F - 4.02 - Living/Kitchen	0	Yes	N/A	N/A
4F - 4.05 - Bed 1	0	Yes	20	Yes
4F - 4.05 - Bed 2	0	Yes	13	Yes
4F - 4.05 - Living/Kitchen	0	Yes	N/A	N/A
5F - 5.01 - Bed	0.1	Yes	24	Yes
5F - 5.01 - Kitchen	0.1	Yes	N/A	N/A
5F - 5.01 - Living/Dining	0.2	Yes	N/A	N/A
5F - 5.03 - Bed 1	0.1	Yes	30	Yes
5F - 5.03 - Bed 2	0	Yes	19	Yes
5F - 5.03 - Living/Kitchen	0	Yes	N/A	N/A

Zone	Percentage of annual hours above 28°C	Achieved?
4F - Communal corridor	2	Yes
5F - Communal corridor	2.2	Yes

In addition, DSY2 and DSY3 and several future weather files have been assessed for the development, all achieving similar results. Only Criterion A of TM59 has been met with other criteria failing compliance as illustrated be seen in the following tables.

The results of these assessments will be further investigated during the next RIBA stages to inform the design development process and to mitigate any potential overheating risks where possible.

Table 10: TM59 results using DSY2 2020 weather file

Apartment/Room	Criterion A Percentage of hours	Achieved?	Criterion B Number of hours above 26°C	Achieved?
4F - 4.01 - Bed 1	0.7	Yes	68	No
4F - 4.01 - Bed 2	1.2	Yes	58	No
4F - 4.01 - Kitchen	1.7	Yes	N/A	N/A
4F - 4.01 - Living	1.6	Yes	N/A	N/A
4F - 4.02 - Bed	0.9	Yes	46	No
4F - 4.02 - Living/Kitchen	0.8	Yes	N/A	N/A
4F - 4.05 - Bed 1	0.1	Yes	60	No
4F - 4.05 - Bed 2	0	Yes	50	No
4F - 4.05 - Living/Kitchen	0.1	Yes	N/A	N/A

5F - 5.01 - Bed	0.7	Yes	61	No
5F - 5.01 - Kitchen	0.7	Yes	N/A	N/A
5F - 5.01 - Living/Dining	0.9	Yes	N/A	N/A
5F - 5.03 - Bed 1	0.9	Yes	69	No
5F - 5.03 - Bed 2	0.8	Yes	54	No
5F - 5.03 - Living/Kitchen	1.1	Yes	N/A	N/A

Zone	Percentage of annual hours Top>28	Achieved?
4F - Communal corridor	3.3	No
5F - Communal corridor	3.2	No

Table 11: TM59 results using DSY3 2020 weather file

Apartment/Room	Criterion A Percentage of hours	Achieved?	Criterion B Number of hours above 26°C	Achieved?
4F - 4.01 - Bed 1	1.1	Yes	73	No
4F - 4.01 - Bed 2	1.6	Yes	57	No
4F - 4.01 - Kitchen	2.1	Yes	N/A	N/A
4F - 4.01 - Living	2.1	Yes	N/A	N/A
4F - 4.02 - Bed	1.1	Yes	45	No
4F - 4.02 - Living/Kitchen	1.3	Yes	N/A	N/A
4F - 4.05 - Bed 1	0	Yes	62	No
4F - 4.05 - Bed 2	0	Yes	40	No
4F - 4.05 - Living/Kitchen	0	Yes	N/A	N/A
5F - 5.01 - Bed	1.1	Yes	66	No
5F - 5.01 - Kitchen	1.1	Yes	N/A	N/A
5F - 5.01 - Living/Dining	1.5	Yes	N/A	N/A
5F - 5.03 - Bed 1	1.2	Yes	69	No
5F - 5.03 - Bed 2	1.1	Yes	56	No
5F - 5.03 - Living/Kitchen	2	Yes	N/A	N/A

Zone	Percentage of annual hours Top>28	Achieved?
4F - Communal corridor	4.9	No
5F - Communal corridor	5.4	No

5.5 Proposed "Be Lean" stage

The regulated energy consumption and associated CO_2 emissions of the Proposed Development have been estimated using SAP 2012 for residential and Dynamic Simulation Modelling (DSM) software IES Virtual Environment (VE) 2019 following the National Calculation Method (NCM) for non-domestic element of the development.

The resulting CO_2 savings for the energy efficient "Be Lean" stage of the hierarchy are detailed in the table below:

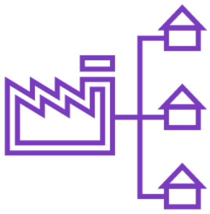
Table 12: Estimated site-wide regulated CO_2 emissions and energy savings after Be Lean stage

"BE LEAN"	CO_2 Emissions	
	Regulated emissions (tCO_2/yr)	Unregulated emissions (tCO_2/yr)
Baseline	29.4	15.9
Be Lean	27.3	15.9
Regulated CO_2 emissions savings	**Tonnes CO_2 per annum**	**%**
Be Lean: Savings from energy demand reduction	2.1	7.3%

The above table demonstrates that a site-wide **7.3%** reduction in regulated CO_2 emissions can be achieved for the development, with 5.2% and 18.9% achieved respectively for domestic and non-domestic elements.

6.0 Be Clean – Low Carbon Technology Appraisal

6.1 Introduction to technologies



This section considers the potential for connection to any existing or proposed DH network in the proximity of the site, and the feasibility of incorporating a CHP/Combined Cooling Heat and Power (CCHP) plant on-site.

CHP technology effectively uses waste heat from the electricity generation process to provide useful heat for space and water heating; the advantage of this system is that it leads to higher system efficiencies when compared to a typical supply arrangement of grid-imported electricity and conventional gas boilers. CHP is considered a low carbon technology when fired by natural gas to generate electricity and provide heating and hot water.

Whilst CHP technologies simultaneously produce heat and power (electricity), tri-generation (i.e. CCHP) implies the simultaneous production of power, heat and cooling from a single fuel.

A District Heating network (DH Network) is a system for distributing heat generated in a centralised location. The energy centre serving the area often includes a CHP plant. A DH network with CHP is considered a cost-effective way of cutting CO_2 emissions, and currently has one of the lowest CO_2 footprints of all fossil fuel generation plants. DH networks are prioritised by some regional and local planning authorities.

6.2 Applicability to the Proposed Development

The London Heat Map has been consulted in order to identify existing and potential future district energy network connection opportunities within a 1 km radius of the site.

Figure 5: London Heat Map

As depicted in Figure 5 above, the map indicates there is currently no existing network within immediate reach of the site. Future heat network has been identified within more than 500m from the Proposed Development, which does not offer a connection opportunity when it becomes available.

Due to the lack of existing district heating network in the vicinity, and the likelihood that any new system would take several years before it becomes available for connection, we believe it would be unreasonable to suggest the allowances for future connection to a heat network.

Responding to decarbonisation of the UK electrical grid with the aim to reduce environmental impact the Proposed Development has been designed to be 100% electrically powered. At present, the proposal is to use a communal high-efficiency air source heat pump system to meet heating and DHW needs of the Proposed Development.

On-Site CHP Opportunities

A CHP requires predictable and relatively constant loads for the best performance, as well as an adequate plant area for the associated equipment. Due to building's intended commercial use it is considered to present a sufficient baseline heating load for a CHP to operate effectively. Several other limitations have been identified which make an on-site CHP option not appropriate for Tottenham Mews development:

- A gas-fired CHP in the running 24/7 would generate significant emissions on site which could potentially have an adverse impact on air quality; and
- The National Grid in the UK is decarbonising rapidly and electrification becomes the most effective solution for carbon reduction strategies, while CHP cease to be a carbon-saving option for many projects.

Combined Cooling, Heat & Power Technology

A Combined Cooling, Heat & Power (CCHP) system is a CHP system with the inclusion of absorption chillers (i.e. chillers driven by heat) to provide space cooling from the CHP waste heat recovery system. This can allow the CHP system to function effectively through the summer period when space heating requirements are low. In addition to considerations listed above, absorption chillers require extensive heat rejection and can significantly increase capital and operational costs compared to a CHP system.

Requirements under the emerging Draft New London Plan (Policy SI3)

Adhering to the requirements within the emerging Draft New London Plan (Policy SI3), as a Major Development within a Heat Network Priority Area, it is required that the following technologies stated in the heating hierarchy are considered:

a) connect to local existing or planned heat networks – as identified above there is no existing or proposed heat networks in close vicinity of the site.

b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required) – no locally available secondary het sources were identified for the site. High efficiency central heating plant (heat pump) is proposed for the development offering opportunities to further reduce carbon emissions through decarbonisation of the grid.

c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network) – as identified above the CHP option is not considered to be feasible for the development. Due to continuing decarbonisation of the electrical grid communal heat pump solution offers greater carbon savings for the development.

d) use ultra-low NOx gas boilers – all heating and hot water for the building is supplied by electrically powered non-combustion system, as such it is assumed there will be no NOx emissions associated with heating at the Proposed Development.

6.3 Proposed 'Be Clean' stage

Based on the feasibility analysis described previously none of the 'Be Clean' opportunities were found to be feasible or viable for the Proposed Development.

Table 13: Estimated regulated CO_2 emissions and savings after each stage of the energy hierarchy

"BE CLEAN"	CO_2 Emissions	
	Regulated emissions (tCO_2/yr)	Unregulated emissions (tCO_2/yr)
Baseline	29.4	15.9
Be Lean	27.3	15.9
Be Clean	27.3	15.9
Regulated CO_2 emissions savings	**Tonnes CO_2 per annum**	**%**
Be Lean: Savings from energy demand reduction	2.1	7.3%
Be Clean: Savings from heat network	-	-

7.0 Be Green – Renewable Energy Technologies

In line with the planning policies, consideration has been given to the inclusion of renewable energy technologies within the Proposed Development.

The renewable energy technologies, which have been found feasible for the Proposed Development and site-specific analysis for those technologies not considered feasible, are included in the following section.

In summary, the main site constraints are as follows:

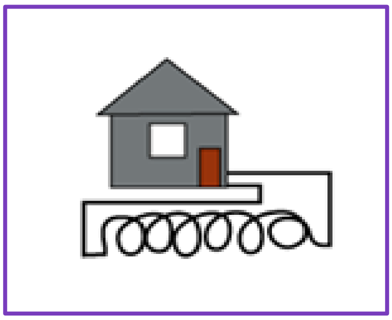
- Location of the site in a dense urban environment with low average wind speed is constraining the opportunity for wind turbine installation.
- Location of the site in an urban area is limiting the possibilities of utilisation of biomass technologies.

In line with the objectives and the methodology outlined in the London Plan, a feasibility study of renewable energy technologies has been carried out for the Proposed Development. Overall, there are a number of constraints associated with the application site when considering the renewable technology provision. Please refer to Table 14 below.

The following table presents a summary of the technologies considered unsuitable for the site. The technologies have been considered as:

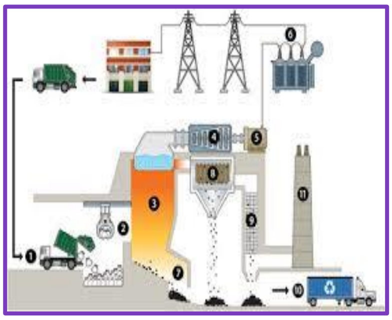
- **H – High feasibility:** Technology is technically and economically feasible with few barriers to implementation.
- **M – Medium feasibility:** Technology is technically and economically feasible, but there are barriers to implementation; and
- **L – Low feasibility:** Technology is technically or economically unfeasible and has been discounted.

Table 14: Renewable technology feasibility

Technology	Feasibility			Comments
	H	M	L	
1. Ground Source Heat Pump (GSHP) 			✓	GSHP technology exploits seasonal temperature differences between ground and air temperatures to provide heating in the winter and air conditioning in the summer. GSHP systems use some electricity to run the heat pump, but as most of the energy for heating is taken from the ground, they produce less greenhouse gas than conventional heating systems. Pipe work is placed either horizontally or vertically in the ground. Fluid pumped through the pipes takes up heat which is then extracted by the heat pump and released at a higher temperature to drive a space heating system. A detailed geological survey, including test boreholes, would be required to verify the suitability of ground conditions and accurately estimate the potential capacity of the GSHP scheme. Due to the nature of the project (building in a dense urban environment) there is no available ground space for incorporation of GSHP boreholes. In addition, the fact that the study would potentially have to be extended beneath the main road and adjacent buildings, significantly increasing the risk, cost and the complexity of the scheme, makes GSHP technology not suitable for this site.
2. Solar Hot Water (SHW) Systems 			✓	Active solar hot water technology uses the Sun's energy to heat fluid passing through a collector in an active process. All available roof space has been allocated for 53no PV panels. An alternative renewable solution in the form of dedicated high efficiency heat pump is proposed for DHW provision.

Technology	Feasibility			Comments
	H	M	L	
3. Wind Power 			✓	Micro wind turbines can be fitted to the roof of any selected building (given appropriate structural measures). Mast-mounted wind turbines can be located in an open area away from obstructions such as buildings and tall trees. A report by BRE[1] highlighted inherent problems and the poor performance to date of urban micro wind installations. Both technologies are considered marginally viable in-built environments by the majority of small wind turbine manufacturers due to the relatively low (and turbulent) wind speed prevailing in an urban environment. The RenSMART windspeed database estimates a predicted wind speed of around 5.6 m/s @ 25m above ground level at the location. Hence, due to the configuration of the site, the character of the location, the lack of space and the relatively low wind speed in this built environment, the use of these technologies is not considered to be feasible.
4. Biomass Heating 			✓	Biomass boilers work on the principle that the combustion of wood chip or pellets can create heat for space heating and hot water loads. There are several factors that strongly disadvantage this technology, namely: • On-site fuel storage space requirements. • The impact on local air quality (concerns exist over the level of NO_2 and particulate matter PM10 from biomass boiler installations, particularly in air quality management areas). • Fuel sourcing and the cost of fuel. • Traffic movement and access arrangements for regular fuel deliveries; and • Regular ash removal and maintenance requirements. Biomass boilers are therefore not further considered for the Proposed Development.

[1] Micro wind turbine in urban environments, Richard Phillips, Paul Blackmore, Jane Anderson, Michael Clift, Antonio Aguiló-Rullán and Steve Pester, BRE 2007 ISBN 978-1-84806-021-0.

Technology	Feasibility			Comments
	H	M	L	
5. Energy from Waste 			✓	Methane gas from sewage or waste can be captured and used for firing boilers. The Proposed Development will not generate sufficient waste to make this option worthwhile. Moreover, plant space requirements and emissions (air quality and odour) would be an issue. This option is therefore not considered feasible.

7.1 Preferred renewable technology – air source heat pumps

Heat pump systems have been improved in their efficiency over recent years - via the use of smart integrated controls, variable speed drives and potentially heat recovery - and now coefficient of performance (COP) in heating mode is realistic.

Air source heat pump system is considered a feasible technology for the Proposed Development to provide space heating and DHW to all occupied areas. Only heat pump system in heating mode is considered a renewable technology (The European Parliament and the Council of the European Union, 2009)[2].

Therefore, for the purposes of this report, only space heating and DHW energy associated with heat pumps will be included under the ‘be green’ stage, whilst any benefits associated with cooling mode have been included under the ‘energy demand reduction or ‘be lean’ stage.

Advantages:

- High efficiency.
- Flexible operation and ease of installation (i.e. no requirement for gas supply, ventilation and flue arrangements and therefore the installation is straightforward).
- Lower associated carbon emissions due to the decarbonisation of the grid; and
- Low maintenance requirements.

Disadvantages:

- Capital cost for the system tends to be high; and
- Potential for refrigerant leaks.

Considerations:

The system can generate increased noise levels. An acoustic assessment may be necessary, particularly in dense urban areas.

[2] National Renewable Energy Action Plan for the United Kingdom - Article 4 of the Renewable Energy Directive 2009/28/EC.

7.2 Preferred renewable technology – photovoltaic panels (PV)

Photovoltaic Cells (PV) generate electricity from sunlight using semiconductor cells linked together to form a module. Electricity can still be generated in cloudy and overcast conditions, although more can be generated in direct sunlight.

The conditions that provide optimal generation in the UK are with South facing panels with a 30°elevation and no overshadowing.

The installation of a photovoltaic system is considered to be a viable option for this development as illustrated in Figure 6 below. The building has a significant roof area available for solar technologies which has been fully utilised by the proposed PV array. It consists of 53no 300Wp PV panels tilted at 30° and facing Southeast. The array is projected to generate around 13,093kWh annually.

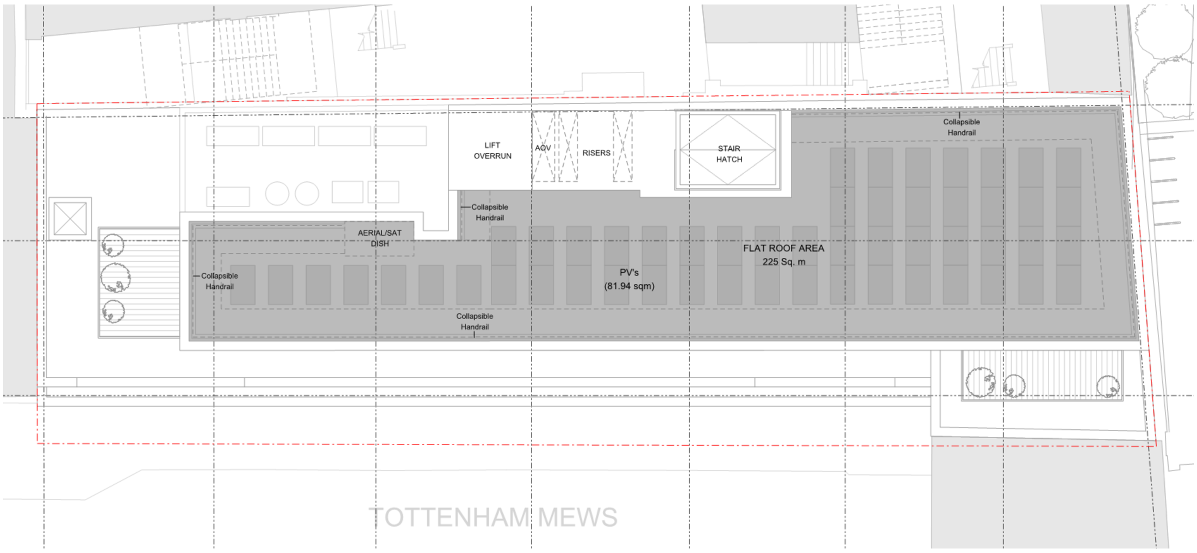


Figure 6: Indicative PV layout

Advantages:

- Maintenance requirement is low as panels are usually cleaned by rainwater, easily accessible and many products come with long guarantees.
- The technology has been in existence for a long time and is well understood.
- Easier and quicker to install compared to other LZC technologies.
- The technology is directly reducing electricity demand from the National Grid.

Disadvantages

- Any shading of panels can seriously impact the amount of electricity generated. Careful consideration should be given to the current and future levels of shading (e.g. account for services flue, adjacent buildings etc.).
- There may be spatial conflicts with other roof mounted equipment.

7.3 Proposed 'Be Green' stage

The 'Be Green' stage of the hierarchy includes the incorporation of heat pump and PV technologies.

The site-wide CO_2 emissions savings achievable through implementation of renewable energy technologies is **15.9** tonnes per annum, which corresponds to a **54%** reduction over the 'Be Lean' scheme, as illustrated in Table 15 below.

Table 15: Estimated regulated CO_2 emissions and savings after each stage of the energy hierarchy

"BE GREEN"	CO_2 Emissions	
	Regulated emissions (tCO_2/yr)	Unregulated emissions (tCO_2/yr)
Be Green	11.4	15.9

Regulated CO_2 emissions savings	Tonnes CO_2 per annum	%
Be Green: Savings from renewable energy	15.9	54%

8.0 Be Seen – Energy Monitoring

The emerging London Plan includes a new energy monitoring requirement referred to as "Be seen" in the Mayor's energy hierarchy to enable a better understanding of the actual operational energy performance of buildings and work towards bridging the 'performance gap' between their design and actual energy use.

This requires all major developments to monitor and report the actual operational energy performance of buildings for at least five years post construction using the reporting template and online portal.

The design team is committed to fulfil the 'Be seen' energy monitoring requirements for the Proposed Development during each stage outlined below.

Planning stage (no later than 4 weeks after planning consent)

- The necessary contextual and performance data will be uploaded to the 'Be seen' portal.
- The target dates for all subsequent 'Be seen' reporting stages will be confirmed.
- Confirmation of metering strategy and details that will enable the in-use energy performance reporting.

As-build stage (**upon commencement of RIBA Stage 6)**

- The contextual data will be updated accounting for any design changes and energy performance predictions for each reportable unit uploaded onto the 'be seen' portal.
- Confirmation that the metering installation is complete and correctly calibrated will be submitted.

Annual in-use reporting (for at least 5 years)

- Annual energy performance data to be submitted on annual basis in line with the GLA's requirements.
- Any deviations from estimated energy performance will be identified, quantified and potential mitigation measures will be proposed to improve the performance where possible.

8.1 Proposed metering strategy

To enable energy usage metering throughout the building meters will be installed on all main incoming feeds (electricity and water). Energy and water consumption for the development will be metered in accordance with statutory requirements, HQM requirements and industry best practices available on a centralised energy management system (EMS).

In summary the following metering strategy is adopted for the Proposed Development:

- 3 no. metered LV services from a new UKPN substation on Ground Floor split to feed residential, office and Landlord areas. Metering shall be centralised within the lower ground floor with all the residential meters in one room. Residential meters shall be Pay as you go smart meters with linked energy display units displaying energy usage information within each apartment. The office meter shall also be in the communal metering room.
- A new incoming main water service will be provided from Tottenham Mews to serve the building. A bulk water meter will be provided near the pipe entry point. Thames Water submeters, located together in a meter cupboard, along with provision for sprinkler riser and dry riser pipework.
- Electric consumer units within each apartment dwelling, with metering as required to meet the Registered Providers' Employer's Requirements. A dedicated distribution board with associated metering to be provided for the B1 office space.
- The building will circulate Low Temperature Hot Water (LTHW) throughout. Each apartment shall have a Heat Interface Unit (HIU), where this hot water is exchanged via plate heat exchangers to serve the

domestic hot water and space heating loads. This HIU will also provide each tenant metering and isolation of this service.

- A Building Management System (BMS) will be installed to monitor and control landlord plant throughout the development.

Conclusion

The heating, DHW and electrical demands of the Proposed Development will be met, whilst at the same time energy consumption and associated CO_2 emissions to the atmosphere will be reduced, in accordance with the national, regional and local planning policy requirements and considering the site-specific necessities.

From the early design stage analysis, the following energy strategy has been identified for the Proposed Development:

- Specification of energy efficient and passive design measures, with associated site-wide savings in CO_2 emissions of **2.1** tonnes over the baseline building (regulated energy); and
- Renewable heat pump system providing space heating and DHW supplemented by a PV array achieve a further reduction in CO_2 emissions of circa **15.9** tonnes.

In total, this energy strategy will allow the Proposed Development to achieve up to **61.2%** reduction in regulated CO_2 emissions over the baseline, with energy efficiency measures providing **7.3%** reduction and the proposed LZC technologies contributing additional **54%** to the overall CO_2 emissions reduction.

As such, the Proposed Development will meet Draft London Plan aspirational site-wide targets for minimum carbon reduction as illustrated in Figure 7 below.

Table 16: Estimated regulated CO_2 emissions and savings after each stage of the hierarchy

Energy Hierarchy	CO_2 Emissions (Residential)		CO_2 Emissions (Non-residential))	
	Regulated emissions (tCO_2/yr)	Unregulated emissions (tCO_2/yr)	Regulated emissions (tCO_2/yr)	Unregulated emissions (tCO_2/yr)
Baseline	25.0	13.4	4.5	2.5
Be Lean	23.7	13.4	3.6	2.5
Be Clean	23.7	13.4	3.6	2.5
Be Green	8.1	13.4	3.4	2.5

Regulated CO_2 emissions savings	Residential		Non-residential	
	Tonnes CO_2 per annum	%	Tonnes CO_2 per annum	%
Be lean: Savings from energy demand reduction	1.3	5%	0.8	18.9%
Be clean: Savings from heat network	-	-	0.0	-
Be green: Savings from renewable energy	15.6	63%	0.3	6.1%
Total cumulative savings	**16.9**	**68%**	**1.1**	**25.1%**
Annual savings from off-set payment	8.1	-	3.4	-
Shortfall in Regulated CO_2 savings	**Tonnes CO_2**		**Tonnes CO_2**	
Cumulative savings for off-set payment (over 30 years)	242	-	101	
Cash-in-lieu contribution (based on £95/tonne)	£22,973	**-**	£9,572	

Table 17: Combined regulated CO_2 emissions and savings

	Total regulated emissions (tCO_2 / year)	CO_2 savings (tCO_2 / year)	Percentage savings (%)
Baseline	29.4	-	-
Be Lean	27.3	2.1	7.3%
Be Clean	27.3	-	-
Be Green	11.4	15.9	54%
Total savings	**-**	**18**	**61.2%**
Offset (tCO_2)	-	345	-

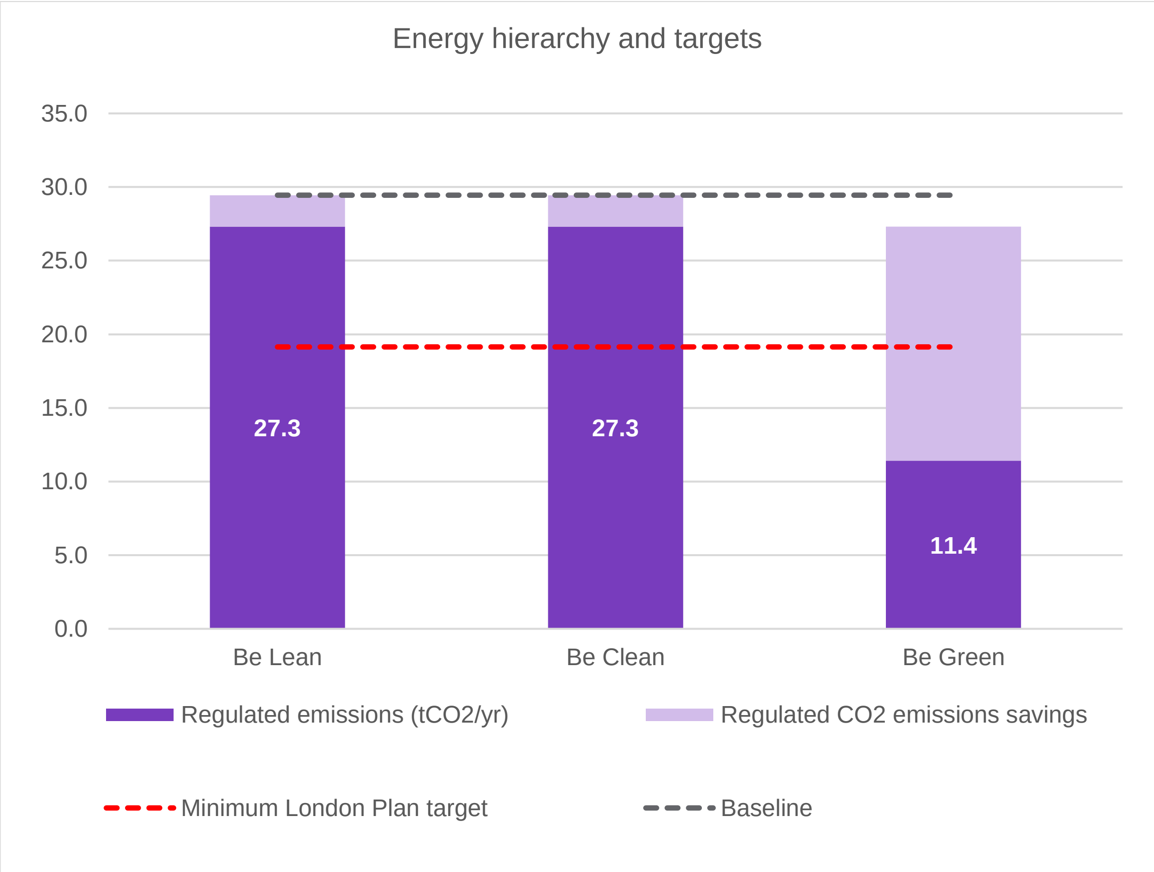


Figure 7: Estimated combined regulated CO_2 emission savings after each stage of the hierarchy

The potential CO_2 emissions savings achievable by the Proposed Development have been maximised through introduction of passive design and energy efficiency measures.

In addition, the application site's potential for installation of renewable technologies has been fully utilised by the design team and the improvements achieved by this energy strategy over the baseline are supportive of the objectives of the local and regional policy.

Please note that the energy efficiency and renewable energy features and associated specifications presented in this report will be subject to confirmation during next RIBA stages by the design team and the contractor. As a result, these are presented for an indicative purpose at this stage and will need to be confirmed once the detailed design has been completed.

APPENDICES

APPENDIX A
SAP REPORTS – "BE LEAN" STAGE

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:43:12

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 85.3m²

Site Reference : Tottenham Mews **Plot Reference:** 0_02 - 2B4P

Address :

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	18.5 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	48.0 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.20 (max. 0.70)	**OK**
Floor	0.06 (max. 0.25)	0.06 (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 using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	2.59m²	
Windows facing: North East	2.59m²	
Windows facing: North East	5m²	
Ventilation rate:	2.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	
10 Key features		
Air permeablility	3.0 m³/m²h	
Windows U-value	1.1 W/m²K	
Floors U-value	0.06 W/m²K	
Community heating, heat from boilers – mains gas		

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 0_02 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.3	(1a) x	2.65	(2a) =	226.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	226.05	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(21)

Infiltration rate modified for monthly wind speed

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

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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 66.3 (23c)

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

(24a)m=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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	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=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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			2.59	x1/[1/(1.1)+ 0.04]	=	2.73			(27)
Windows Type 2			2.59	x1/[1/(1.1)+ 0.04]	=	2.73			(27)
Windows Type 3			5	x1/[1/(1.1)+ 0.04]	=	5.27			(27)
Floor			85.3	x 0.06	=	5.118			(28)
Walls Type1	35.8	10.18	25.62	x 0.2	=	5.12			(29)
Walls Type2	45.1	0	45.1	x 0.19	=	8.35			(29)
Total area of elements, m²			166.2						(31)

** 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) = 29.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6397.5 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 24.93 (36)

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

Total fabric heat loss (33) + (36) = 54.25 (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=	22.56	22.36	22.16	21.18	20.99	20.01	20.01	19.81	20.4	20.99	21.38	21.77	(38)

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

(39)m=	76.81	76.61	76.41	75.43	75.24	74.26	74.26	74.06	74.65	75.24	75.63	76.02	

Average = Sum(39)$_{1…12}$ /12= 75.39 (39)

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

(40)m=	0.9	0.9	0.9	0.88	0.88	0.87	0.87	0.87	0.88	0.88	0.89	0.89

Average = $Sum(40)_{1...12}$ /12= 0.88 (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 2.56 (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 94.9 (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=	104.39	100.59	96.8	93	89.21	85.41	85.41	89.21	93	96.8	100.59	104.39

Total = $Sum(44)_{1...12}$ = 1138.8 (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=	154.81	135.4	139.72	121.81	116.88	100.86	93.46	107.24	108.53	126.48	138.06	149.92

Total = $Sum(45)_{1...12}$ = 1493.14 (45)

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

(46)m=	23.22	20.31	20.96	18.27	17.53	15.13	14.02	16.09	16.28	18.97	20.71	22.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	219.73	194.04	204.64	184.64	181.8	163.69	158.38	172.17	171.36	191.4	200.89	214.85	(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=	219.73	194.04	204.64	184.64	181.8	163.69	158.38	172.17	171.36	191.4	200.89	214.85	

Output from water heater (annual)$_{1...12}$ 2257.6 (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=	103.41	91.93	98.4	90.77	90.8	83.8	83.02	87.6	86.35	93.99	96.17	101.79	(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=	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	(66)

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

(67)m=	23.21	20.62	16.77	12.69	9.49	8.01	8.66	11.25	15.1	19.17	22.38	23.86	(67)

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

(68)m=	230.16	232.55	226.53	213.72	197.54	182.34	172.19	169.8	175.82	188.63	204.8	220.01	(68)

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

(69)m=	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	(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=	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	(71)

Water heating gains (Table 5)

(72)m=	139	136.81	132.25	126.06	122.05	116.39	111.58	117.74	119.93	126.34	133.57	136.81	(72)

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

(73)m=	453.71	451.31	436.89	413.81	390.41	368.08	353.76	360.13	372.19	395.48	422.09	442.01	(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	0.54	x	2.59	x	11.28	x	0.44	x	0.8	=	5	(75)
Northeast 0.9x	0.54	x	2.59	x	11.28	x	0.44	x	0.8	=	5	(75)
Northeast 0.9x	0.54	x	5	x	11.28	x	0.44	x	0.8	=	9.65	(75)
Northeast 0.9x	0.54	x	2.59	x	22.97	x	0.44	x	0.8	=	10.18	(75)
Northeast 0.9x	0.54	x	2.59	x	22.97	x	0.44	x	0.8	=	10.18	(75)

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Northeast	0.9x	0.54	x	5	x	22.97	x	0.44	x	0.8	=	19.64	(75)
Northeast	0.9x	0.54	x	2.59	x	41.38	x	0.44	x	0.8	=	18.33	(75)
Northeast	0.9x	0.54	x	2.59	x	41.38	x	0.44	x	0.8	=	18.33	(75)
Northeast	0.9x	0.54	x	5	x	41.38	x	0.44	x	0.8	=	35.39	(75)
Northeast	0.9x	0.54	x	2.59	x	67.96	x	0.44	x	0.8	=	30.11	(75)
Northeast	0.9x	0.54	x	2.59	x	67.96	x	0.44	x	0.8	=	30.11	(75)
Northeast	0.9x	0.54	x	5	x	67.96	x	0.44	x	0.8	=	58.13	(75)
Northeast	0.9x	0.54	x	2.59	x	91.35	x	0.44	x	0.8	=	40.47	(75)
Northeast	0.9x	0.54	x	2.59	x	91.35	x	0.44	x	0.8	=	40.47	(75)
Northeast	0.9x	0.54	x	5	x	91.35	x	0.44	x	0.8	=	78.13	(75)
Northeast	0.9x	0.54	x	2.59	x	97.38	x	0.44	x	0.8	=	43.15	(75)
Northeast	0.9x	0.54	x	2.59	x	97.38	x	0.44	x	0.8	=	43.15	(75)
Northeast	0.9x	0.54	x	5	x	97.38	x	0.44	x	0.8	=	83.3	(75)
Northeast	0.9x	0.54	x	2.59	x	91.1	x	0.44	x	0.8	=	40.36	(75)
Northeast	0.9x	0.54	x	2.59	x	91.1	x	0.44	x	0.8	=	40.36	(75)
Northeast	0.9x	0.54	x	5	x	91.1	x	0.44	x	0.8	=	77.92	(75)
Northeast	0.9x	0.54	x	2.59	x	72.63	x	0.44	x	0.8	=	32.18	(75)
Northeast	0.9x	0.54	x	2.59	x	72.63	x	0.44	x	0.8	=	32.18	(75)
Northeast	0.9x	0.54	x	5	x	72.63	x	0.44	x	0.8	=	62.12	(75)
Northeast	0.9x	0.54	x	2.59	x	50.42	x	0.44	x	0.8	=	22.34	(75)
Northeast	0.9x	0.54	x	2.59	x	50.42	x	0.44	x	0.8	=	22.34	(75)
Northeast	0.9x	0.54	x	5	x	50.42	x	0.44	x	0.8	=	43.13	(75)
Northeast	0.9x	0.54	x	2.59	x	28.07	x	0.44	x	0.8	=	12.44	(75)
Northeast	0.9x	0.54	x	2.59	x	28.07	x	0.44	x	0.8	=	12.44	(75)
Northeast	0.9x	0.54	x	5	x	28.07	x	0.44	x	0.8	=	24.01	(75)
Northeast	0.9x	0.54	x	2.59	x	14.2	x	0.44	x	0.8	=	6.29	(75)
Northeast	0.9x	0.54	x	2.59	x	14.2	x	0.44	x	0.8	=	6.29	(75)
Northeast	0.9x	0.54	x	5	x	14.2	x	0.44	x	0.8	=	12.14	(75)
Northeast	0.9x	0.54	x	2.59	x	9.21	x	0.44	x	0.8	=	4.08	(75)
Northeast	0.9x	0.54	x	2.59	x	9.21	x	0.44	x	0.8	=	4.08	(75)
Northeast	0.9x	0.54	x	5	x	9.21	x	0.44	x	0.8	=	7.88	(75)

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

(83)m=	19.65	40	72.06	118.35	159.08	169.6	158.65	126.48	87.81	48.88	24.72	16.05	(83)

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

(84)m=	473.35	491.3	508.95	532.16	549.5	537.67	512.41	486.61	459.99	444.36	446.81	458.06	(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=	0.97	0.96	0.95	0.91	0.84	0.71	0.57	0.61	0.8	0.92	0.96	0.97	(86)

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

(87)m=	19.11	19.26	19.56	20.01	20.45	20.78	20.92	20.9	20.66	20.13	19.56	19.09	(87)

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

(88)m=	20.17	20.17	20.17	20.18	20.18	20.19	20.19	20.19	20.19	20.18	20.18	20.17	(88)

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

(89)m=	0.97	0.96	0.94	0.9	0.81	0.65	0.49	0.53	0.75	0.9	0.95	0.97	(89)

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

(90)m=	17.61	17.82	18.27	18.92	19.53	19.97	20.13	20.11	19.82	19.1	18.27	17.58	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

(92)m=	18.34	18.52	18.9	19.45	19.98	20.37	20.52	20.5	20.23	19.6	18.9	18.31	(92)

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

(93)m=	18.34	18.52	18.9	19.45	19.98	20.37	20.52	20.5	20.23	19.6	18.9	18.31	(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=	0.95	0.94	0.93	0.88	0.8	0.67	0.52	0.56	0.76	0.89	0.94	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	451.14	464.13	470.9	469.35	440.24	358.09	267.2	273.17	347.33	394.06	418.85	438.33	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1078.62	1043.54	947.58	796.15	622.84	428.41	290.91	303.5	457.61	677.5	892.78	1073.05	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	466.84	389.36	354.65	235.3	135.85	0	0	0	0	210.88	341.23	472.23	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2606.35 (98)

Space heating requirement in kWh/m²/year 30.56 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2606.35	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2736.67	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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

Water heating

Annual water heating requirement		2257.6	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2370.48	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	51.07	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		165.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	165.46	(331)
Energy for lighting (calculated in Appendix L)		409.9	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			89.5	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	1232.56	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	26.51	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1259.07	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1259.07	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	85.88	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	212.74	(379)
Total CO2, kg/year	sum of (376)…(382) =			1557.68	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.26	(384)
EI rating (section 14)				83.98	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 0_02 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.3	(1a) x	2.65	(2a) =	226.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	226.05	(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) =	0.13	(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)	0.38	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.27	(21)

Infiltration rate modified for monthly wind speed

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

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

0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31

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=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

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

(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			5	x1/[1/(1.4)+ 0.04]		=	6.63			(27)
Floor			85.3	x	0.13	=	11.089			(28)
Walls Type1	35.8	10.18	25.62	x	0.18	=	4.61			(29)
Walls Type2	45.1	0	45.1	x	0.18	=	8.12			(29)
Total area of elements, m²			166.2							(31)

** 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) = 37.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6397.5 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.31 (36)

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

Total fabric heat loss (33) + (36) = 45.62 (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=	41.65	41.48	41.31	40.54	40.39	39.71	39.71	39.59	39.97	40.39	40.69	40.99	(38)

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

(39)m=	87.27	87.1	86.94	86.16	86.02	85.34	85.34	85.21	85.6	86.02	86.31	86.62	

Average = Sum(39)$_{1…12}$ /12= 86.16 (39)

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

(40)m=	1.02	1.02	1.02	1.01	1.01	1	1	1	1	1.01	1.01	1.02

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.56 (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 94.9 (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=	104.39	100.59	96.8	93	89.21	85.41	85.41	89.21	93	96.8	100.59	104.39

Total = Sum(44)$_{1...12}$ = 1138.8 (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=	154.81	135.4	139.72	121.81	116.88	100.86	93.46	107.24	108.53	126.48	138.06	149.92

Total = Sum(45)$_{1...12}$ = 1493.14 (45)

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

(46)m=	23.22	20.31	20.96	18.27	17.53	15.13	14.02	16.09	16.28	18.97	20.71	22.49

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66

(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66

(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	205.73	181.39	190.64	171.09	167.8	150.14	144.38	158.17	157.81	177.4	187.34	200.85	(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=	205.73	181.39	190.64	171.09	167.8	150.14	144.38	158.17	157.81	177.4	187.34	200.85	

Output from water heater (annual)$_{1...12}$ 2092.75 (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=	92.21	81.82	87.2	79.93	79.6	72.96	71.82	76.4	75.51	82.79	85.33	90.59	(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=	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	(66)

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

(67)m=	23.88	21.21	17.25	13.06	9.76	8.24	8.9	11.57	15.53	19.73	23.02	24.54	(67)

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

(68)m=	230.16	232.55	226.53	213.72	197.54	182.34	172.19	169.8	175.82	188.63	204.8	220.01	(68)

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

(69)m=	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	(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=	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	(71)

Water heating gains (Table 5)

(72)m=	123.94	121.75	117.2	111.01	106.99	101.34	96.53	102.69	104.88	111.28	118.52	121.76	(72)

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

(73)m=	442.32	439.85	425.31	402.12	378.63	356.26	341.95	348.4	360.57	383.97	410.68	430.65	(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)	
Northeast 0.9x	0.54	x	2.59	x	11.28	x	0.63	x	0.7	=	6.26	(75)
Northeast 0.9x	0.54	x	2.59	x	11.28	x	0.63	x	0.7	=	6.26	(75)
Northeast 0.9x	0.54	x	5	x	11.28	x	0.63	x	0.7	=	12.09	(75)
Northeast 0.9x	0.54	x	2.59	x	22.97	x	0.63	x	0.7	=	12.75	(75)
Northeast 0.9x	0.54	x	2.59	x	22.97	x	0.63	x	0.7	=	12.75	(75)

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Northeast 0.9x	0.54	x	5	x	22.97	x	0.63	x	0.7	=	24.61	(75)
Northeast 0.9x	0.54	x	2.59	x	41.38	x	0.63	x	0.7	=	22.97	(75)
Northeast 0.9x	0.54	x	2.59	x	41.38	x	0.63	x	0.7	=	22.97	(75)
Northeast 0.9x	0.54	x	5	x	41.38	x	0.63	x	0.7	=	44.34	(75)
Northeast 0.9x	0.54	x	2.59	x	67.96	x	0.63	x	0.7	=	37.72	(75)
Northeast 0.9x	0.54	x	2.59	x	67.96	x	0.63	x	0.7	=	37.72	(75)
Northeast 0.9x	0.54	x	5	x	67.96	x	0.63	x	0.7	=	72.82	(75)
Northeast 0.9x	0.54	x	2.59	x	91.35	x	0.63	x	0.7	=	50.71	(75)
Northeast 0.9x	0.54	x	2.59	x	91.35	x	0.63	x	0.7	=	50.71	(75)
Northeast 0.9x	0.54	x	5	x	91.35	x	0.63	x	0.7	=	97.89	(75)
Northeast 0.9x	0.54	x	2.59	x	97.38	x	0.63	x	0.7	=	54.06	(75)
Northeast 0.9x	0.54	x	2.59	x	97.38	x	0.63	x	0.7	=	54.06	(75)
Northeast 0.9x	0.54	x	5	x	97.38	x	0.63	x	0.7	=	104.36	(75)
Northeast 0.9x	0.54	x	2.59	x	91.1	x	0.63	x	0.7	=	50.57	(75)
Northeast 0.9x	0.54	x	2.59	x	91.1	x	0.63	x	0.7	=	50.57	(75)
Northeast 0.9x	0.54	x	5	x	91.1	x	0.63	x	0.7	=	97.63	(75)
Northeast 0.9x	0.54	x	2.59	x	72.63	x	0.63	x	0.7	=	40.32	(75)
Northeast 0.9x	0.54	x	2.59	x	72.63	x	0.63	x	0.7	=	40.32	(75)
Northeast 0.9x	0.54	x	5	x	72.63	x	0.63	x	0.7	=	77.83	(75)
Northeast 0.9x	0.54	x	2.59	x	50.42	x	0.63	x	0.7	=	27.99	(75)
Northeast 0.9x	0.54	x	2.59	x	50.42	x	0.63	x	0.7	=	27.99	(75)
Northeast 0.9x	0.54	x	5	x	50.42	x	0.63	x	0.7	=	54.03	(75)
Northeast 0.9x	0.54	x	2.59	x	28.07	x	0.63	x	0.7	=	15.58	(75)
Northeast 0.9x	0.54	x	2.59	x	28.07	x	0.63	x	0.7	=	15.58	(75)
Northeast 0.9x	0.54	x	5	x	28.07	x	0.63	x	0.7	=	30.08	(75)
Northeast 0.9x	0.54	x	2.59	x	14.2	x	0.63	x	0.7	=	7.88	(75)
Northeast 0.9x	0.54	x	2.59	x	14.2	x	0.63	x	0.7	=	7.88	(75)
Northeast 0.9x	0.54	x	5	x	14.2	x	0.63	x	0.7	=	15.21	(75)
Northeast 0.9x	0.54	x	2.59	x	9.21	x	0.63	x	0.7	=	5.11	(75)
Northeast 0.9x	0.54	x	2.59	x	9.21	x	0.63	x	0.7	=	5.11	(75)
Northeast 0.9x	0.54	x	5	x	9.21	x	0.63	x	0.7	=	9.87	(75)

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

(83)m=	24.62	50.11	90.28	148.27	199.3	212.48	198.77	158.46	110.01	61.24	30.98	20.1	(83)

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

(84)m=	466.94	489.96	515.6	550.39	577.94	568.73	540.72	506.86	470.58	445.21	441.65	450.75	(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	0.93	0.99	1	1	(86)

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

(87)m=	19.88	19.97	20.16	20.44	20.72	20.92	20.98	20.97	20.83	20.49	20.14	19.87	(87)

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

(88)m=	20.06	20.07	20.07	20.07	20.08	20.08	20.08	20.08	20.08	20.08	20.07	20.07	(88)

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

(89)m=	1	1	0.99	0.98	0.92	0.76	0.54	0.6	0.88	0.98	1	1	(89)

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

(90)m=	18.56	18.69	18.97	19.37	19.77	20.02	20.08	20.07	19.92	19.45	18.95	18.54	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

(92)m=	19.21	19.32	19.55	19.89	20.23	20.46	20.52	20.51	20.36	19.96	19.53	19.19	(92)

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

(93)m=	19.21	19.32	19.55	19.89	20.23	20.46	20.52	20.51	20.36	19.96	19.53	19.19	(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	0.79	0.6	0.66	0.9	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.9	488.32	512.02	538.94	537.19	448.99	325.48	335.52	422.68	437.81	439.81	449.93	(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=	1301.08	1255.75	1134.4	947.2	733.84	499.94	334.38	350.28	536.07	804.95	1073.07	1298.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	621.38	515.71	463.05	293.95	146.31	0	0	0	0	273.16	455.95	631.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3400.72 (98)

Space heating requirement in kWh/m²/year 39.87 (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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	621.38	515.71	463.05	293.95	146.31	0	0	0	0	273.16	455.95	631.22	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	664.58	551.56	495.24	314.38	156.48	0	0	0	0	292.15	487.64	675.1	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3637.13 (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)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

205.73	181.39	190.64	171.09	167.8	150.14	144.38	158.17	157.81	177.4	187.34	200.85

Efficiency of water heater 79.8 (216)

(217)m=	87.58	87.45	87.09	86.25	84.45	79.8	79.8	79.8	79.8	85.96	87.1	87.66	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	234.91	207.43	218.89	198.38	198.7	188.14	180.93	198.21	197.76	206.37	215.09	229.11

Total = Sum(219a)$_{1...12}$ = 2473.92 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3637.13	
Water heating fuel used		2473.92	
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		421.71	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	785.62	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.37	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1319.99	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	218.87	(268)
Total CO2, kg/year		sum of (265)…(271) =		1577.78	(272)

TER = 18.5 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:43:11

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.6m²

Site Reference : Tottenham Mews **Plot Reference:** 2_01 - 3B5P

Address :

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	15.53 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.11 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	37.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**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 using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

Regulations Compliance Report

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

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.61	
Maximum	1.5	**OK**
MVHR efficiency:	79%	
Minimum	70%	**OK**

9 Summertime temperature		
Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	3.29m²	
Windows facing: North West	14.56m²	
Windows facing: South West	1.65m²	
Windows facing: South West	2.12m²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

10 Key features	
Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from boilers – mains gas	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_01 - 3B5P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.6	(1a) x	2.65	(2a) =	242.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.74	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 67.15 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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	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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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			3.29	x1/[1/(1.1)+ 0.04]	=	3.47			(27)
Windows Type 2			3.64	x1/[1/(1.1)+ 0.04]	=	3.84			(27)
Windows Type 3			1.65	x1/[1/(1.1)+ 0.04]	=	1.74			(27)
Windows Type 4			2.12	x1/[1/(1.1)+ 0.04]	=	2.23			(27)
Walls Type1	64.1	21.62	42.48	x 0.2	=	8.5			(29)
Walls Type2	12.2	0	12.2	x 0.19	=	2.26			(29)
Total area of elements, m²			76.3						(31)

** 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) = 33.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.45 (36)

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

Total fabric heat loss (33) + (36) = 44.98 (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=	23.88	23.67	23.46	22.41	22.2	21.15	21.15	20.94	21.57	22.2	22.62	23.04	(38)

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

(39)m=	68.86	68.65	68.44	67.39	67.18	66.13	66.13	65.92	66.55	67.18	67.6	68.02	

Average = Sum(39)$_{1…12}$ /12= 67.34 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	0.75	0.75	0.75	0.74	0.73	0.72	0.72	0.72	0.73	0.73	0.74	0.74

Average = Sum(40)$_{1...12}$ /12= 0.74 (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 2.65 (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 97.07 (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=	106.77	102.89	99.01	95.12	91.24	87.36	87.36	91.24	95.12	99.01	102.89	106.77

Total = Sum(44)$_{1...12}$ = 1164.79 (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=	158.34	138.49	142.91	124.59	119.55	103.16	95.59	109.69	111	129.36	141.21	153.34

Total = Sum(45)$_{1...12}$ = 1527.23 (45)

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

(46)m=	23.75	20.77	21.44	18.69	17.93	15.47	14.34	16.45	16.65	19.4	21.18	23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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=	223.27	197.13	207.83	187.42	184.47	165.99	160.52	174.62	173.83	194.29	204.04	218.27	(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=	223.27	197.13	207.83	187.42	184.47	165.99	160.52	174.62	173.83	194.29	204.04	218.27	

Output from water heater (annual)$_{1...12}$ 2291.68 (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=	104.59	92.96	99.46	91.69	91.69	84.57	83.73	88.41	87.17	94.95	97.22	102.93	(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=	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	(66)

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

(67)m=	21.59	19.18	15.59	11.81	8.83	7.45	8.05	10.46	14.05	17.83	20.81	22.19	(67)

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

(68)m=	241.99	244.5	238.17	224.7	207.7	191.71	181.04	178.53	184.85	198.33	215.33	231.31	(68)

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

(69)m=	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	(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=	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	(71)

Water heating gains (Table 5)

(72)m=	140.58	138.33	133.68	127.35	123.24	117.45	112.53	118.84	121.07	127.63	135.02	138.34	(72)

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

(73)m=	466.86	464.72	450.15	426.56	402.47	379.32	364.33	370.53	382.68	406.49	433.88	454.55	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a	g_ Table 6b		FF Table 6c		Gains (W)	
Southwest 0.9x	0.54	x	3.29	x	36.79	0.44	x	0.8	=	20.71	(79)
Southwest 0.9x	0.54	x	1.65	x	36.79	0.44	x	0.8	=	10.39	(79)
Southwest 0.9x	0.54	x	2.12	x	36.79	0.44	x	0.8	=	13.34	(79)
Southwest 0.9x	0.54	x	3.29	x	62.67	0.44	x	0.8	=	35.27	(79)
Southwest 0.9x	0.54	x	1.65	x	62.67	0.44	x	0.8	=	17.69	(79)

Southwest 0.9x	0.54	x	2.12	x	62.67		0.44	x	0.8	=	22.73	(79)
Southwest 0.9x	0.54	x	3.29	x	85.75		0.44	x	0.8	=	48.26	(79)
Southwest 0.9x	0.54	x	1.65	x	85.75		0.44	x	0.8	=	24.21	(79)
Southwest 0.9x	0.54	x	2.12	x	85.75		0.44	x	0.8	=	31.1	(79)
Southwest 0.9x	0.54	x	3.29	x	106.25		0.44	x	0.8	=	59.8	(79)
Southwest 0.9x	0.54	x	1.65	x	106.25		0.44	x	0.8	=	29.99	(79)
Southwest 0.9x	0.54	x	2.12	x	106.25		0.44	x	0.8	=	38.53	(79)
Southwest 0.9x	0.54	x	3.29	x	119.01		0.44	x	0.8	=	66.98	(79)
Southwest 0.9x	0.54	x	1.65	x	119.01		0.44	x	0.8	=	33.59	(79)
Southwest 0.9x	0.54	x	2.12	x	119.01		0.44	x	0.8	=	43.16	(79)
Southwest 0.9x	0.54	x	3.29	x	118.15		0.44	x	0.8	=	66.5	(79)
Southwest 0.9x	0.54	x	1.65	x	118.15		0.44	x	0.8	=	33.35	(79)
Southwest 0.9x	0.54	x	2.12	x	118.15		0.44	x	0.8	=	42.85	(79)
Southwest 0.9x	0.54	x	3.29	x	113.91		0.44	x	0.8	=	64.11	(79)
Southwest 0.9x	0.54	x	1.65	x	113.91		0.44	x	0.8	=	32.15	(79)
Southwest 0.9x	0.54	x	2.12	x	113.91		0.44	x	0.8	=	41.31	(79)
Southwest 0.9x	0.54	x	3.29	x	104.39		0.44	x	0.8	=	58.75	(79)
Southwest 0.9x	0.54	x	1.65	x	104.39		0.44	x	0.8	=	29.47	(79)
Southwest 0.9x	0.54	x	2.12	x	104.39		0.44	x	0.8	=	37.86	(79)
Southwest 0.9x	0.54	x	3.29	x	92.85		0.44	x	0.8	=	52.26	(79)
Southwest 0.9x	0.54	x	1.65	x	92.85		0.44	x	0.8	=	26.21	(79)
Southwest 0.9x	0.54	x	2.12	x	92.85		0.44	x	0.8	=	33.67	(79)
Southwest 0.9x	0.54	x	3.29	x	69.27		0.44	x	0.8	=	38.99	(79)
Southwest 0.9x	0.54	x	1.65	x	69.27		0.44	x	0.8	=	19.55	(79)
Southwest 0.9x	0.54	x	2.12	x	69.27		0.44	x	0.8	=	25.12	(79)
Southwest 0.9x	0.54	x	3.29	x	44.07		0.44	x	0.8	=	24.8	(79)
Southwest 0.9x	0.54	x	1.65	x	44.07		0.44	x	0.8	=	12.44	(79)
Southwest 0.9x	0.54	x	2.12	x	44.07		0.44	x	0.8	=	15.98	(79)
Southwest 0.9x	0.54	x	3.29	x	31.49		0.44	x	0.8	=	17.72	(79)
Southwest 0.9x	0.54	x	1.65	x	31.49		0.44	x	0.8	=	8.89	(79)
Southwest 0.9x	0.54	x	2.12	x	31.49		0.44	x	0.8	=	11.42	(79)
Northwest 0.9x	0.54	x	3.64	x	11.28	x	0.44	x	0.8	=	28.1	(81)
Northwest 0.9x	0.54	x	3.64	x	22.97	x	0.44	x	0.8	=	57.21	(81)
Northwest 0.9x	0.54	x	3.64	x	41.38	x	0.44	x	0.8	=	103.07	(81)
Northwest 0.9x	0.54	x	3.64	x	67.96	x	0.44	x	0.8	=	169.26	(81)
Northwest 0.9x	0.54	x	3.64	x	91.35	x	0.44	x	0.8	=	227.53	(81)
Northwest 0.9x	0.54	x	3.64	x	97.38	x	0.44	x	0.8	=	242.57	(81)
Northwest 0.9x	0.54	x	3.64	x	91.1	x	0.44	x	0.8	=	226.92	(81)
Northwest 0.9x	0.54	x	3.64	x	72.63	x	0.44	x	0.8	=	180.9	(81)
Northwest 0.9x	0.54	x	3.64	x	50.42	x	0.44	x	0.8	=	125.59	(81)
Northwest 0.9x	0.54	x	3.64	x	28.07	x	0.44	x	0.8	=	69.91	(81)

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Northwest	0.9x	0.54	x	3.64	x	14.2	x	0.44	x	0.8	=	35.36	(81)
Northwest	0.9x	0.54	x	3.64	x	9.21	x	0.44	x	0.8	=	22.95	(81)

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

(83)m=	72.54	132.9	206.64	297.59	371.26	385.26	364.49	306.98	237.73	153.57	88.59	60.98	(83)

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

(84)m=	539.4	597.62	656.79	724.15	773.73	764.59	728.82	677.51	620.41	560.06	522.46	515.53	(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=	0.96	0.94	0.9	0.82	0.69	0.52	0.39	0.43	0.65	0.86	0.94	0.97	(86)

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

(87)m=	19.57	19.77	20.1	20.5	20.79	20.94	20.98	20.98	20.87	20.5	19.98	19.53	(87)

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

(88)m=	20.3	20.3	20.3	20.31	20.31	20.32	20.32	20.32	20.32	20.31	20.31	20.3	(88)

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

(89)m=	0.96	0.93	0.89	0.8	0.66	0.47	0.33	0.37	0.6	0.83	0.93	0.96	(89)

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

(90)m=	18.35	18.64	19.11	19.68	20.07	20.27	20.31	20.31	20.19	19.69	18.95	18.31	(90)

fLA = Living area ÷ (4) = | 0.45 | (91)

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

(92)m=	18.91	19.16	19.56	20.05	20.4	20.57	20.62	20.61	20.5	20.06	19.42	18.86	(92)

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

(93)m=	18.91	19.16	19.56	20.05	20.4	20.57	20.62	20.61	20.5	20.06	19.42	18.86	(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=	0.94	0.92	0.88	0.79	0.66	0.49	0.36	0.4	0.62	0.83	0.92	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	508.58	550.42	577.1	574.14	510.46	376	260.93	270.71	382.99	462.28	479.27	489.36	(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=	1005.74	978.71	893.74	751.54	584.4	395.07	265.59	277.59	425.86	635.5	832.71	997.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	369.88	287.81	235.58	127.73	55.01	0	0	0	0	128.88	254.48	378.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1837.42 | (98)

Space heating requirement in kWh/m²/year | 20.06 | (99)

9b. Energy requirements – Community heating scheme

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

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1837.42	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1929.29	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2291.68	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2406.27	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.36	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		225.81	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	225.81	(331)
Energy for lighting (calculated in Appendix L)		381.27	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			89.5	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	1046.35	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	22.5	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1068.85	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1068.85	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	117.19	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	197.88	(379)
Total CO2, kg/year	sum of (376)…(382) =			1383.92	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.11	(384)
EI rating (section 14)				86.42	(385)

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User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_01 - 3B5P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.6	(1a) x	2.65	(2a) =	242.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	242.74	(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		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.26	(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

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

0.33	0.33	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.31

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=	0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(24d)

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

(25)m=	0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(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			3.29	x1/[1/(1.4)+ 0.04] =	4.36			(27)
Windows Type 2			3.64	x1/[1/(1.4)+ 0.04] =	4.83			(27)
Windows Type 3			1.65	x1/[1/(1.4)+ 0.04] =	2.19			(27)
Windows Type 4			2.12	x1/[1/(1.4)+ 0.04] =	2.81			(27)
Walls Type1	64.1	21.62	42.48	x 0.18 =	7.65			(29)
Walls Type2	12.2	0	12.2	x 0.18 =	2.2			(29)
Total area of elements, m²			76.3					(31)

** 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) =	38.51	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 3.81 (36)

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

Total fabric heat loss (33) + (36) = 42.32 (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=	44.5	44.33	44.16	43.37	43.22	42.52	42.52	42.4	42.79	43.22	43.52	43.83	(38)

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

(39)m=	86.83	86.65	86.48	85.69	85.54	84.84	84.84	84.72	85.11	85.54	85.84	86.15	

Average = $Sum(39)_{1…12}$ /12= 85.69 (39)

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

(40)m=	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.92	0.93	0.93	0.94	0.94

Average = Sum(40)1…12 /12= 0.94 (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 2.65 (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 97.07 (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=	106.77	102.89	99.01	95.12	91.24	87.36	87.36	91.24	95.12	99.01	102.89	106.77

Total = Sum(44)1…12 = 1164.79 (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=	158.34	138.49	142.91	124.59	119.55	103.16	95.59	109.69	111	129.36	141.21	153.34

Total = Sum(45)1…12 = 1527.23 (45)

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

(46)m=	23.75	20.77	21.44	18.69	17.93	15.47	14.34	16.45	16.65	19.4	21.18	23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	209.27	184.48	193.83	173.87	170.47	152.44	146.52	160.62	160.29	180.29	190.49	204.27	(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=	209.27	184.48	193.83	173.87	170.47	152.44	146.52	160.62	160.29	180.29	190.49	204.27	

Output from water heater (annual)$_{1...12}$ 2126.84 (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=	93.39	82.84	88.26	80.85	80.49	73.73	72.53	77.21	76.34	83.75	86.38	91.73	(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=	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	(66)

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

(67)m=	21.85	19.41	15.78	11.95	8.93	7.54	8.15	10.59	14.22	18.05	21.07	22.46	(67)

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

(68)m=	241.99	244.5	238.17	224.7	207.7	191.71	181.04	178.53	184.85	198.33	215.33	231.31	(68)

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

(69)m=	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	(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=	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	(71)

Water heating gains (Table 5)

(72)m=	125.52	123.28	118.62	112.29	108.19	102.4	97.48	103.78	106.02	112.57	119.97	123.29	(72)

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

(73)m=	455.07	452.9	438.29	414.65	390.52	367.36	352.37	358.6	370.8	394.65	422.07	442.77	(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	0.54	x	3.29	x	36.79	0.63	x	0.7	=	25.94	(79)
Southwest 0.9x	0.54	x	1.65	x	36.79	0.63	x	0.7	=	13.01	(79)
Southwest 0.9x	0.54	x	2.12	x	36.79	0.63	x	0.7	=	16.72	(79)
Southwest 0.9x	0.54	x	3.29	x	62.67	0.63	x	0.7	=	44.19	(79)
Southwest 0.9x	0.54	x	1.65	x	62.67	0.63	x	0.7	=	22.16	(79)

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Southwest	0.9x	0.54	x	2.12	x	62.67		0.63	x	0.7	=	28.48	(79)
Southwest	0.9x	0.54	x	3.29	x	85.75		0.63	x	0.7	=	60.47	(79)
Southwest	0.9x	0.54	x	1.65	x	85.75		0.63	x	0.7	=	30.33	(79)
Southwest	0.9x	0.54	x	2.12	x	85.75		0.63	x	0.7	=	38.96	(79)
Southwest	0.9x	0.54	x	3.29	x	106.25		0.63	x	0.7	=	74.92	(79)
Southwest	0.9x	0.54	x	1.65	x	106.25		0.63	x	0.7	=	37.57	(79)
Southwest	0.9x	0.54	x	2.12	x	106.25		0.63	x	0.7	=	48.28	(79)
Southwest	0.9x	0.54	x	3.29	x	119.01		0.63	x	0.7	=	83.92	(79)
Southwest	0.9x	0.54	x	1.65	x	119.01		0.63	x	0.7	=	42.09	(79)
Southwest	0.9x	0.54	x	2.12	x	119.01		0.63	x	0.7	=	54.08	(79)
Southwest	0.9x	0.54	x	3.29	x	118.15		0.63	x	0.7	=	83.31	(79)
Southwest	0.9x	0.54	x	1.65	x	118.15		0.63	x	0.7	=	41.78	(79)
Southwest	0.9x	0.54	x	2.12	x	118.15		0.63	x	0.7	=	53.68	(79)
Southwest	0.9x	0.54	x	3.29	x	113.91		0.63	x	0.7	=	80.32	(79)
Southwest	0.9x	0.54	x	1.65	x	113.91		0.63	x	0.7	=	40.28	(79)
Southwest	0.9x	0.54	x	2.12	x	113.91		0.63	x	0.7	=	51.76	(79)
Southwest	0.9x	0.54	x	3.29	x	104.39		0.63	x	0.7	=	73.61	(79)
Southwest	0.9x	0.54	x	1.65	x	104.39		0.63	x	0.7	=	36.92	(79)
Southwest	0.9x	0.54	x	2.12	x	104.39		0.63	x	0.7	=	47.43	(79)
Southwest	0.9x	0.54	x	3.29	x	92.85		0.63	x	0.7	=	65.47	(79)
Southwest	0.9x	0.54	x	1.65	x	92.85		0.63	x	0.7	=	32.84	(79)
Southwest	0.9x	0.54	x	2.12	x	92.85		0.63	x	0.7	=	42.19	(79)
Southwest	0.9x	0.54	x	3.29	x	69.27		0.63	x	0.7	=	48.84	(79)
Southwest	0.9x	0.54	x	1.65	x	69.27		0.63	x	0.7	=	24.5	(79)
Southwest	0.9x	0.54	x	2.12	x	69.27		0.63	x	0.7	=	31.47	(79)
Southwest	0.9x	0.54	x	3.29	x	44.07		0.63	x	0.7	=	31.08	(79)
Southwest	0.9x	0.54	x	1.65	x	44.07		0.63	x	0.7	=	15.59	(79)
Southwest	0.9x	0.54	x	2.12	x	44.07		0.63	x	0.7	=	20.02	(79)
Southwest	0.9x	0.54	x	3.29	x	31.49		0.63	x	0.7	=	22.2	(79)
Southwest	0.9x	0.54	x	1.65	x	31.49		0.63	x	0.7	=	11.14	(79)
Southwest	0.9x	0.54	x	2.12	x	31.49		0.63	x	0.7	=	14.31	(79)
Northwest	0.9x	0.54	x	3.64	x	11.28	x	0.63	x	0.7	=	35.21	(81)
Northwest	0.9x	0.54	x	3.64	x	22.97	x	0.63	x	0.7	=	71.67	(81)
Northwest	0.9x	0.54	x	3.64	x	41.38	x	0.63	x	0.7	=	129.13	(81)
Northwest	0.9x	0.54	x	3.64	x	67.96	x	0.63	x	0.7	=	212.06	(81)
Northwest	0.9x	0.54	x	3.64	x	91.35	x	0.63	x	0.7	=	285.05	(81)
Northwest	0.9x	0.54	x	3.64	x	97.38	x	0.63	x	0.7	=	303.9	(81)
Northwest	0.9x	0.54	x	3.64	x	91.1	x	0.63	x	0.7	=	284.29	(81)
Northwest	0.9x	0.54	x	3.64	x	72.63	x	0.63	x	0.7	=	226.64	(81)
Northwest	0.9x	0.54	x	3.64	x	50.42	x	0.63	x	0.7	=	157.34	(81)
Northwest	0.9x	0.54	x	3.64	x	28.07	x	0.63	x	0.7	=	87.59	(81)

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Northwest	0.9x	0.54	x	3.64	x	14.2	x	0.63	x	0.7	=	44.3	(81)
Northwest	0.9x	0.54	x	3.64	x	9.21	x	0.63	x	0.7	=	28.75	(81)

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

(83)m=	90.88	166.5	258.88	372.84	465.13	482.67	456.65	384.6	297.84	192.4	110.99	76.4	(83)

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

(84)m=	545.95	619.4	697.17	787.49	855.65	850.03	809.02	743.2	668.64	587.05	533.06	519.17	(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	0.95	0.82	0.62	0.46	0.52	0.8	0.97	1	1	(86)

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

(87)m=	20.04	20.17	20.4	20.69	20.9	20.99	21	21	20.94	20.66	20.29	20.01	(87)

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

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

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

(89)m=	1	0.99	0.98	0.93	0.77	0.55	0.37	0.43	0.73	0.96	0.99	1	(89)

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

(90)m=	18.83	19.03	19.36	19.77	20.05	20.14	20.14	20.14	20.1	19.74	19.22	18.8	(90)

fLA = Living area ÷ (4) = 0.45 (91)

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

(92)m=	19.38	19.55	19.83	20.19	20.44	20.52	20.53	20.53	20.48	20.16	19.7	19.35	(92)

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

(93)m=	19.38	19.55	19.83	20.19	20.44	20.52	20.53	20.53	20.48	20.16	19.7	19.35	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.79	0.58	0.41	0.47	0.75	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	544.1	614.75	682.56	730.85	678.02	493.41	332.65	347.96	504.68	561.49	529	517.83	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1309.31	1269.32	1152.79	967.29	747.21	502.4	333.61	349.98	543.03	817.52	1081.99	1305.14	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	569.32	439.88	349.85	170.23	51.47	0	0	0	0	190.49	398.15	585.75	(98)

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2755.14 (98)

Space heating requirement in kWh/m²/year 30.08 (99)

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

Space heating:

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

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	569.32	439.88	349.85	170.23	51.47	0	0	0	0	190.49	398.15	585.75		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	608.9	470.45	374.17	182.07	55.05	0	0	0	0	203.73	425.83	626.47		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2946.67	(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)	209.27	184.48	193.83	173.87	170.47	152.44	146.52	160.62	160.29	180.29	190.49	204.27		
Efficiency of water heater													79.8	(216)
(217)m=	87.35	87.05	86.37	84.76	82.05	79.8	79.8	79.8	79.8	84.96	86.74	87.47		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	239.57	211.93	224.42	205.14	207.77	191.03	183.61	201.28	200.86	212.2	219.62	233.54		
Total = Sum(219a)$_{1...12}$ =													2530.95	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2946.67	
Water heating fuel used			2530.95	
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			385.9	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	636.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	546.69	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1183.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	200.28	(268)

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Total CO_2, kg/year	sum of (265)…(271) =	1422.37	(272)
TER =		15.53	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:43:10

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 83.2m²

Site Reference : Tottenham Mews **Plot Reference:** 2_02 - 2B4P

Address :

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	15.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.17 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	37.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	32.7 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**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 using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas	
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

Regulations Compliance Report

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

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature		
Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	3.3m²	
Windows facing: North East	6.34m²	
Windows facing: North East	7.29m²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

10 Key features	
Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from boilers – mains gas	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_02 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	83.2	(1a)	x	2.65	(2a)	=	220.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	83.2	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	220.48	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 66.3 (23c)

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

(24a)m=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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	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=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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			1.65	x1/[1/(1.1)+ 0.04] =	1.74			(27)
Windows Type 2			3.17	x1/[1/(1.1)+ 0.04] =	3.34			(27)
Windows Type 3			7.29	x1/[1/(1.1)+ 0.04] =	7.68			(27)
Walls Type1	35	16.93	18.07	x 0.2 =	3.61			(29)
Walls Type2	15.4	0	15.4	x 0.19 =	2.85			(29)
Total area of elements, m²			50.4					(31)

** 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) = 24.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.56 (36)

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

Total fabric heat loss (33) + (36) = 31.86 (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	21.81	21.62	20.66	20.47	19.52	19.52	19.33	19.9	20.47	20.85	21.24	(38)

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

(39)m=	53.86	53.67	53.48	52.53	52.34	51.38	51.38	51.19	51.76	52.34	52.72	53.1	

Average = $Sum(39)_{1…12}$ /12= 52.48 (39)

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

(40)m=	0.65	0.65	0.64	0.63	0.63	0.62	0.62	0.62	0.62	0.63	0.63	0.64

Average = Sum(40)$_{1\ldots12}$ /12= 0.63 (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 2.52 (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 94.07 (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=	103.48	99.71	95.95	92.19	88.42	84.66	84.66	88.42	92.19	95.95	99.71	103.48	
										Total = Sum(44)$_{1\ldots12}$ =		1128.82	(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=	153.45	134.21	138.49	120.74	115.85	99.97	92.64	106.31	107.57	125.37	136.85	148.61	
										Total = Sum(45)$_{1\ldots12}$ =		1480.06	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	23.02	20.13	20.77	18.11	17.38	15	13.9	15.95	16.14	18.81	20.53	22.29	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	218.38	192.85	203.42	183.57	180.78	162.8	157.57	171.23	170.41	190.29	199.68	213.54	(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=	218.38	192.85	203.42	183.57	180.78	162.8	157.57	171.23	170.41	190.29	199.68	213.54	

Output from water heater (annual) 1…12 | 2244.52 | (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=	102.96	91.54	97.99	90.41	90.46	83.51	82.74	87.29	86.03	93.63	95.77	101.35	(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=	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	(66)

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

(67)m=	20.45	18.16	14.77	11.18	8.36	7.06	7.63	9.91	13.3	16.89	19.72	21.02	(67)

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

(68)m=	226	228.34	222.43	209.85	193.97	179.05	169.07	166.73	172.64	185.22	201.1	216.03	(68)

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

(69)m=	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	(71)

Water heating gains (Table 5)

(72)m=	138.39	136.22	131.71	125.57	121.59	115.98	111.21	117.32	119.49	125.84	133.01	136.23	(72)

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

(73)m=	445.65	443.54	429.72	407.42	384.73	362.89	348.73	354.77	366.24	388.76	414.64	434.08	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.44	x	0.8	=	12.24	(75)
Northeast 0.9x	0.54	x	7.29	x	11.28	x	0.44	x	0.8	=	14.07	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.44	x	0.8	=	24.91	(75)
Northeast 0.9x	0.54	x	7.29	x	22.97	x	0.44	x	0.8	=	28.64	(75)
Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.44	x	0.8	=	44.88	(75)

Northeast 0.9x	0.54	x	7.29	x	41.38	x	0.44	x	0.8	=	51.6	(75)
Northeast 0.9x	0.54	x	3.17	x	67.96	x	0.44	x	0.8	=	73.7	(75)
Northeast 0.9x	0.54	x	7.29	x	67.96	x	0.44	x	0.8	=	84.75	(75)
Northeast 0.9x	0.54	x	3.17	x	91.35	x	0.44	x	0.8	=	99.07	(75)
Northeast 0.9x	0.54	x	7.29	x	91.35	x	0.44	x	0.8	=	113.92	(75)
Northeast 0.9x	0.54	x	3.17	x	97.38	x	0.44	x	0.8	=	105.62	(75)
Northeast 0.9x	0.54	x	7.29	x	97.38	x	0.44	x	0.8	=	121.45	(75)
Northeast 0.9x	0.54	x	3.17	x	91.1	x	0.44	x	0.8	=	98.81	(75)
Northeast 0.9x	0.54	x	7.29	x	91.1	x	0.44	x	0.8	=	113.61	(75)
Northeast 0.9x	0.54	x	3.17	x	72.63	x	0.44	x	0.8	=	78.77	(75)
Northeast 0.9x	0.54	x	7.29	x	72.63	x	0.44	x	0.8	=	90.57	(75)
Northeast 0.9x	0.54	x	3.17	x	50.42	x	0.44	x	0.8	=	54.69	(75)
Northeast 0.9x	0.54	x	7.29	x	50.42	x	0.44	x	0.8	=	62.88	(75)
Northeast 0.9x	0.54	x	3.17	x	28.07	x	0.44	x	0.8	=	30.44	(75)
Northeast 0.9x	0.54	x	7.29	x	28.07	x	0.44	x	0.8	=	35	(75)
Northeast 0.9x	0.54	x	3.17	x	14.2	x	0.44	x	0.8	=	15.4	(75)
Northeast 0.9x	0.54	x	7.29	x	14.2	x	0.44	x	0.8	=	17.71	(75)
Northeast 0.9x	0.54	x	3.17	x	9.21	x	0.44	x	0.8	=	9.99	(75)
Northeast 0.9x	0.54	x	7.29	x	9.21	x	0.44	x	0.8	=	11.49	(75)
Southeast 0.9x	0.54	x	1.65	x	36.79	x	0.44	x	0.8	=	20.77	(77)
Southeast 0.9x	0.54	x	1.65	x	62.67	x	0.44	x	0.8	=	35.38	(77)
Southeast 0.9x	0.54	x	1.65	x	85.75	x	0.44	x	0.8	=	48.41	(77)
Southeast 0.9x	0.54	x	1.65	x	106.25	x	0.44	x	0.8	=	59.98	(77)
Southeast 0.9x	0.54	x	1.65	x	119.01	x	0.44	x	0.8	=	67.19	(77)
Southeast 0.9x	0.54	x	1.65	x	118.15	x	0.44	x	0.8	=	66.7	(77)
Southeast 0.9x	0.54	x	1.65	x	113.91	x	0.44	x	0.8	=	64.31	(77)
Southeast 0.9x	0.54	x	1.65	x	104.39	x	0.44	x	0.8	=	58.93	(77)
Southeast 0.9x	0.54	x	1.65	x	92.85	x	0.44	x	0.8	=	52.42	(77)
Southeast 0.9x	0.54	x	1.65	x	69.27	x	0.44	x	0.8	=	39.1	(77)
Southeast 0.9x	0.54	x	1.65	x	44.07	x	0.44	x	0.8	=	24.88	(77)
Southeast 0.9x	0.54	x	1.65	x	31.49	x	0.44	x	0.8	=	17.78	(77)

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

(83)m=	47.08	88.93	144.89	218.44	280.18	293.77	276.73	228.28	169.98	104.55	57.98	39.26	(83)

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

(84)m=	492.73	532.47	574.62	625.86	664.91	656.67	625.45	583.05	536.23	493.31	472.62	473.34	(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=	0.95	0.93	0.89	0.8	0.66	0.48	0.36	0.4	0.62	0.83	0.93	0.96	(86)

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

(87)m=	19.88	20.05	20.32	20.65	20.87	20.97	20.99	20.99	20.93	20.65	20.23	19.86	(87)

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

(88)m=	20.39	20.39	20.39	20.4	20.4	20.41	20.41	20.42	20.41	20.4	20.4	20.4	(88)

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

(89)m=	0.95	0.93	0.88	0.78	0.63	0.44	0.31	0.35	0.57	0.81	0.92	0.95	(89)

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

(90)m=	18.87	19.1	19.49	19.96	20.26	20.39	20.41	20.41	20.34	19.97	19.38	18.83	(90)

fLA = Living area ÷ (4) = 0.54 (91)

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

(92)m=	19.42	19.61	19.94	20.34	20.59	20.7	20.73	20.72	20.66	20.34	19.84	19.39	(92)

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

(93)m=	19.42	19.61	19.94	20.34	20.59	20.7	20.73	20.72	20.66	20.34	19.84	19.39	(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=	0.94	0.92	0.87	0.78	0.64	0.46	0.34	0.37	0.59	0.81	0.91	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	462.07	488.26	501.88	488.57	424.06	304.85	210.1	218.45	316.85	399.9	429.72	446.95	(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=	814.2	789.72	718.79	600.73	465.29	313.59	211.96	221.3	339.36	509.83	671.59	806.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	261.98	202.58	161.38	80.76	30.68	0	0	0	0	81.78	174.14	267.44	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1260.74 (98)

Space heating requirement in kWh/m²/year 15.15 (99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1260.74	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1323.78	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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

Water heating

Annual water heating requirement		2244.52	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2356.75	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.81	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		161.39	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	161.39	(331)
Energy for lighting (calculated in Appendix L)		361.13	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				89.5	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	888.26	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.1	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	907.36	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				907.36	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	83.76	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	187.43	(379)
Total CO2, kg/year	sum of (376)…(382) =				1178.55	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.17	(384)
EI rating (section 14)					87.68	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_02 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	83.2	(1a) x	2.65	(2a) =	220.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	83.2	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	220.48	(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) =	0.14	(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		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.27	(21)

Infiltration rate modified for monthly wind speed

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

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

0.34	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.3	0.32

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=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

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

(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			1.65	x1/[1/(1.4)+ 0.04]		=	2.19			(27)
Windows Type 2			3.17	x1/[1/(1.4)+ 0.04]		=	4.2			(27)
Windows Type 3			7.29	x1/[1/(1.4)+ 0.04]		=	9.66			(27)
Walls Type1	35	16.93	18.07	x	0.18	=	3.25			(29)
Walls Type2	15.4	0	15.4	x	0.18	=	2.77			(29)
Total area of elements, m²			50.4							(31)

** 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) = 28.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (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 2.52 (36)

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

Total fabric heat loss (33) + (36) = 30.99 (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=	40.7	40.53	40.37	39.59	39.45	38.78	38.78	38.65	39.04	39.45	39.74	40.05	(38)

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

(39)m=	71.69	71.52	71.36	70.58	70.44	69.77	69.77	69.64	70.03	70.44	70.73	71.04	

Average = Sum(39)$_{1…12}$ /12= 70.58 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	0.86	0.86	0.86	0.85	0.85	0.84	0.84	0.84	0.84	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 2.52 (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 94.07 (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=	103.48	99.71	95.95	92.19	88.42	84.66	84.66	88.42	92.19	95.95	99.71	103.48	

Total = Sum(44)1…12 = 1128.82 (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=	153.45	134.21	138.49	120.74	115.85	99.97	92.64	106.31	107.57	125.37	136.85	148.61

Total = Sum(45)1…12 = 1480.06 (45)

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

(46)m=	23.02	20.13	20.77	18.11	17.38	15	13.9	15.95	16.14	18.81	20.53	22.29	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	204.38	180.21	189.42	170.02	166.78	149.26	143.57	157.23	156.86	176.29	186.13	199.54	(62)

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

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

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

Output from water heater

(64)m=	204.38	180.21	189.42	170.02	166.78	149.26	143.57	157.23	156.86	176.29	186.13	199.54	

Output from water heater (annual) $_{1...12}$ 2079.68 (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=	91.76	81.42	86.79	79.57	79.26	72.67	71.54	76.09	75.2	82.43	84.93	90.15	(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=	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	(66)

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

(67)m=	20.91	18.57	15.11	11.44	8.55	7.22	7.8	10.14	13.61	17.28	20.16	21.49	(67)

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

(68)m=	226	228.34	222.43	209.85	193.97	179.05	169.07	166.73	172.64	185.22	201.1	216.03	(68)

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

(69)m=	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	(71)

Water heating gains (Table 5)

(72)m=	123.34	121.16	116.65	110.52	106.54	100.93	96.16	102.27	104.44	110.79	117.96	121.17	(72)

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

(73)m=	434.06	431.89	418	395.62	372.87	351	336.84	342.94	354.49	377.09	403.03	422.51	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.63	x	0.7	=	15.33	(75)
Northeast 0.9x	0.54	x	7.29	x	11.28	x	0.63	x	0.7	=	17.63	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.63	x	0.7	=	31.21	(75)
Northeast 0.9x	0.54	x	7.29	x	22.97	x	0.63	x	0.7	=	35.88	(75)
Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.63	x	0.7	=	56.23	(75)

Northeast	0.9x	0.54	x	7.29	x	41.38	x	0.63	x	0.7	=	64.65	(75)
Northeast	0.9x	0.54	x	3.17	x	67.96	x	0.63	x	0.7	=	92.34	(75)
Northeast	0.9x	0.54	x	7.29	x	67.96	x	0.63	x	0.7	=	106.18	(75)
Northeast	0.9x	0.54	x	3.17	x	91.35	x	0.63	x	0.7	=	124.12	(75)
Northeast	0.9x	0.54	x	7.29	x	91.35	x	0.63	x	0.7	=	142.72	(75)
Northeast	0.9x	0.54	x	3.17	x	97.38	x	0.63	x	0.7	=	132.33	(75)
Northeast	0.9x	0.54	x	7.29	x	97.38	x	0.63	x	0.7	=	152.16	(75)
Northeast	0.9x	0.54	x	3.17	x	91.1	x	0.63	x	0.7	=	123.79	(75)
Northeast	0.9x	0.54	x	7.29	x	91.1	x	0.63	x	0.7	=	142.34	(75)
Northeast	0.9x	0.54	x	3.17	x	72.63	x	0.63	x	0.7	=	98.69	(75)
Northeast	0.9x	0.54	x	7.29	x	72.63	x	0.63	x	0.7	=	113.47	(75)
Northeast	0.9x	0.54	x	3.17	x	50.42	x	0.63	x	0.7	=	68.51	(75)
Northeast	0.9x	0.54	x	7.29	x	50.42	x	0.63	x	0.7	=	78.78	(75)
Northeast	0.9x	0.54	x	3.17	x	28.07	x	0.63	x	0.7	=	38.14	(75)
Northeast	0.9x	0.54	x	7.29	x	28.07	x	0.63	x	0.7	=	43.85	(75)
Northeast	0.9x	0.54	x	3.17	x	14.2	x	0.63	x	0.7	=	19.29	(75)
Northeast	0.9x	0.54	x	7.29	x	14.2	x	0.63	x	0.7	=	22.18	(75)
Northeast	0.9x	0.54	x	3.17	x	9.21	x	0.63	x	0.7	=	12.52	(75)
Northeast	0.9x	0.54	x	7.29	x	9.21	x	0.63	x	0.7	=	14.4	(75)
Southeast	0.9x	0.54	x	1.65	x	36.79	x	0.63	x	0.7	=	26.02	(77)
Southeast	0.9x	0.54	x	1.65	x	62.67	x	0.63	x	0.7	=	44.33	(77)
Southeast	0.9x	0.54	x	1.65	x	85.75	x	0.63	x	0.7	=	60.65	(77)
Southeast	0.9x	0.54	x	1.65	x	106.25	x	0.63	x	0.7	=	75.15	(77)
Southeast	0.9x	0.54	x	1.65	x	119.01	x	0.63	x	0.7	=	84.17	(77)
Southeast	0.9x	0.54	x	1.65	x	118.15	x	0.63	x	0.7	=	83.56	(77)
Southeast	0.9x	0.54	x	1.65	x	113.91	x	0.63	x	0.7	=	80.57	(77)
Southeast	0.9x	0.54	x	1.65	x	104.39	x	0.63	x	0.7	=	73.83	(77)
Southeast	0.9x	0.54	x	1.65	x	92.85	x	0.63	x	0.7	=	65.67	(77)
Southeast	0.9x	0.54	x	1.65	x	69.27	x	0.63	x	0.7	=	48.99	(77)
Southeast	0.9x	0.54	x	1.65	x	44.07	x	0.63	x	0.7	=	31.17	(77)
Southeast	0.9x	0.54	x	1.65	x	31.49	x	0.63	x	0.7	=	22.27	(77)

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

(83)m=	58.98	111.42	181.53	273.67	351.02	368.05	346.7	286	212.96	130.98	72.64	49.19	(83)

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

(84)m=	493.04	543.31	599.53	669.28	723.89	719.05	683.54	628.94	567.46	508.08	475.67	471.69	(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	0.95	0.82	0.61	0.45	0.51	0.79	0.97	1	1	(86)

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

(87)m=	20.16	20.27	20.47	20.74	20.93	20.99	21	21	20.96	20.71	20.39	20.14	(87)

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

(88)m=	20.2	20.2	20.2	20.21	20.21	20.22	20.22	20.22	20.22	20.21	20.21	20.21	(88)

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

(89)m=	1	0.99	0.98	0.93	0.77	0.54	0.37	0.42	0.72	0.96	0.99	1	(89)

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

(90)m=	19.07	19.23	19.52	19.9	20.14	20.21	20.22	20.22	20.18	19.88	19.41	19.04	(90)

fLA = Living area ÷ (4) = 0.54 (91)

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

(92)m=	19.66	19.8	20.04	20.35	20.57	20.63	20.64	20.64	20.6	20.33	19.94	19.63	(92)

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

(93)m=	19.66	19.8	20.04	20.35	20.57	20.63	20.64	20.64	20.6	20.33	19.94	19.63	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.79	0.58	0.41	0.47	0.76	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	491.41	539.68	588.45	624.26	575.15	415.56	281.42	294.21	428.7	486.84	472.14	470.5	(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=	1101.07	1065.35	965.95	808.45	624.53	420.98	281.94	295.34	455.3	685.35	908.4	1096.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	453.58	353.25	280.86	132.62	36.74	0	0	0	0	147.69	314.1	465.71	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2184.56 (98)

Space heating requirement in kWh/m²/year 26.26 (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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	453.58	353.25	280.86	132.62	36.74	0	0	0	0	147.69	314.1	465.71	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	485.11	377.81	300.38	141.84	39.29	0	0	0	0	157.96	335.94	498.09	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2336.42 (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)

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Water heating

Output from water heater (calculated above)

204.38	180.21	189.42	170.02	166.78	149.26	143.57	157.23	156.86	176.29	186.13	199.54

Efficiency of water heater 79.8 (216)

(217)m=	86.88	86.58	85.86	84.16	81.54	79.8	79.8	79.8	79.8	84.35	86.2	87	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	235.24	208.14	220.61	202.02	204.54	187.04	179.91	197.03	196.56	209.01	215.93	229.35

Total = Sum(219a)$_{1...12}$ = 2485.38 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2336.42	
Water heating fuel used		2485.38	
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		369.33	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	504.67	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	536.84	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1041.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	191.68	(268)
Total CO2, kg/year		sum of (265)…(271) =		1272.12	(272)

TER = 15.29 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:43:10

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 76m²

Site Reference : Tottenham Mews **Plot Reference:** 2_03 - 2B4P

Address :

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	16.31 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.38 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	35.4 kWh/m²	
		OK

2 Fabric U-values

Element	**Average**	**Highest**	
External wall	0.19 (max. 0.30)	0.20 (max. 0.70)	**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 using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

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7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: North East	12.68m²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from boilers – mains gas	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_03 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76	(1a) x	2.65	(2a) =	201.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	201.4	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(21)

Infiltration rate modified for monthly wind speed

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

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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 66.3 (23c)

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

(24a)m=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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	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=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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			3.17	x1/[1/(1.1)+ 0.04]		=	3.34			(27)
Walls Type1	36.3	12.68	23.62	x	0.2	=	4.72			(29)
Walls Type2	24.1	0	24.1	x	0.19	=	4.46			(29)
Total area of elements, m²			60.4							(31)

** 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) = 22.55 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.06 (36)

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

Total fabric heat loss (33) + (36) = 31.61 (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=	20.1	19.92	19.75	18.88	18.7	17.83	17.83	17.65	18.18	18.7	19.05	19.4	(38)

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

(39)m=	51.7	51.53	51.35	50.48	50.31	49.44	49.44	49.26	49.78	50.31	50.66	51.01	

Average = Sum(39)$_{1…12}$ /12= 50.44 (39)

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

(40)m=	0.68	0.68	0.68	0.66	0.66	0.65	0.65	0.65	0.66	0.66	0.67	0.67

Average = Sum(40)$_{1…12}$ /12= 0.66 (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 2.38 (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 90.79 (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=	99.87	96.23	92.6	88.97	85.34	81.71	81.71	85.34	88.97	92.6	96.23	99.87	
Total = $Sum(44)_{1...12}$ =												1089.44	(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=	148.1	129.53	133.66	116.53	111.81	96.48	89.41	102.6	103.82	120.99	132.07	143.42	
Total = $Sum(45)_{1...12}$ =												1428.42	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.21	19.43	20.05	17.48	16.77	14.47	13.41	15.39	15.57	18.15	19.81	21.51	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	213.02	188.17	198.59	179.36	176.74	159.32	154.33	167.52	166.65	185.92	194.91	208.35	(62)

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

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

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

Output from water heater

(64)m=	213.02	188.17	198.59	179.36	176.74	159.32	154.33	167.52	166.65	185.92	194.91	208.35	

Output from water heater (annual)1…12 2192.88 (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=	101.18	89.98	96.38	89.01	89.12	82.35	81.67	86.05	84.79	92.17	94.18	99.63	(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=	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.77	17.56	14.28	10.81	8.08	6.82	7.37	9.58	12.86	16.33	19.06	20.32	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	210.88	213.07	207.55	195.81	180.99	167.07	157.76	155.57	161.09	172.83	187.65	201.57	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	(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=	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	(71)
Water heating gains (Table 5)													
(72)m=	136	133.9	129.55	123.63	119.78	114.37	109.77	115.66	117.76	123.89	130.81	133.91	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	425.38	423.26	410.12	388.99	367.6	347	333.64	339.56	350.45	371.78	396.25	414.54	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.44	x	0.8	=	24.47	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.44	x	0.8	=	49.82	(75)
Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.44	x	0.8	=	89.76	(75)
Northeast 0.9x	0.54	x	3.17	x	67.96	x	0.44	x	0.8	=	147.41	(75)
Northeast 0.9x	0.54	x	3.17	x	91.35	x	0.44	x	0.8	=	198.15	(75)
Northeast 0.9x	0.54	x	3.17	x	97.38	x	0.44	x	0.8	=	211.25	(75)
Northeast 0.9x	0.54	x	3.17	x	91.1	x	0.44	x	0.8	=	197.62	(75)
Northeast 0.9x	0.54	x	3.17	x	72.63	x	0.44	x	0.8	=	157.54	(75)

Northeast	0.9x	0.54	x	3.17	x	50.42	x	0.44	x	0.8	=	109.37	(75)
Northeast	0.9x	0.54	x	3.17	x	28.07	x	0.44	x	0.8	=	60.88	(75)
Northeast	0.9x	0.54	x	3.17	x	14.2	x	0.44	x	0.8	=	30.8	(75)
Northeast	0.9x	0.54	x	3.17	x	9.21	x	0.44	x	0.8	=	19.99	(75)

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

(83)m=	24.47	49.82	89.76	147.41	198.15	211.25	197.62	157.54	109.37	60.88	30.8	19.99	(83)

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

(84)m=	449.86	473.08	499.87	536.4	565.74	558.24	531.26	497.1	459.82	432.66	427.04	434.53	(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=	0.96	0.94	0.91	0.84	0.71	0.54	0.4	0.44	0.67	0.86	0.93	0.96	(86)

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

(87)m=	19.78	19.92	20.19	20.55	20.81	20.95	20.99	20.98	20.89	20.57	20.14	19.76	(87)

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

(88)m=	20.36	20.36	20.36	20.37	20.37	20.38	20.38	20.39	20.38	20.37	20.37	20.37	(88)

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

(89)m=	0.95	0.94	0.9	0.82	0.68	0.49	0.35	0.39	0.62	0.84	0.93	0.96	(89)

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

(90)m=	18.7	18.9	19.29	19.8	20.16	20.34	20.38	20.37	20.27	19.84	19.23	18.68	(90)

fLA = Living area ÷ (4) = 0.57 (91)

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

(92)m=	19.32	19.49	19.8	20.22	20.53	20.69	20.73	20.72	20.63	20.26	19.75	19.3	(92)

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

(93)m=	19.32	19.49	19.8	20.22	20.53	20.69	20.73	20.72	20.63	20.26	19.75	19.3	(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=	0.94	0.93	0.89	0.82	0.69	0.51	0.38	0.42	0.64	0.83	0.92	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	423.01	438	445.91	437.47	388.81	287.47	200.75	208.17	293.82	361.2	391.12	410.94	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	776.55	751.6	683.14	571.68	444.34	301.04	203.94	212.86	324.84	485.89	640.65	769.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	263.03	210.74	176.5	96.64	41.32	0	0	0	0	92.77	179.66	267.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1327.76 (98)

Space heating requirement in kWh/m²/year 17.47 (99)

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9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1327.76	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1394.15	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2192.88	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2302.52	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.97	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		147.42	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	147.42	(331)
Energy for lighting (calculated in Appendix L)		349.1	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				89.5	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	892.16	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.19	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	911.34	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				911.34	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	76.51	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	181.18	(379)
Total CO2, kg/year	sum of (376)…(382) =			1169.04	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.38	(384)
EI rating (section 14)				87.05	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_03 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	76	(1a)	x	2.65	(2a)	=	201.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	201.4	(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		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(21)

Infiltration rate modified for monthly wind speed

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

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

0.36	0.35	0.34	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.31	0.33

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=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55	(24d)

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

(25)m=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55	(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			3.17	x1/[1/(1.4)+ 0.04]		=	4.2			(27)
Walls Type1	36.3	12.68	23.62	x	0.18	=	4.25			(29)
Walls Type2	24.1	0	24.1	x	0.18	=	4.34			(29)
Total area of elements, m²			60.4							(31)

** 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) = 25.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 3.02 (36)

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

Total fabric heat loss (33) + (36) = 28.42 (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=	37.44	37.28	37.12	36.37	36.23	35.57	35.57	35.45	35.82	36.23	36.51	36.81	(38)

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

(39)m=	65.86	65.7	65.54	64.79	64.65	63.99	63.99	63.87	64.24	64.65	64.93	65.23	

Average = Sum(39)$_{1…12}$ /12= 64.79 (39)

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

(40)m=	0.87	0.86	0.86	0.85	0.85	0.84	0.84	0.84	0.85	0.85	0.85	0.86

Average = Sum(40)$_{1…12}$ /12= 0.85 (40)

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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 2.38 (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 90.79 (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=	99.87	96.23	92.6	88.97	85.34	81.71	81.71	85.34	88.97	92.6	96.23	99.87		
										Total = Sum(44)1...12 =			1089.44	(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=	148.1	129.53	133.66	116.53	111.81	96.48	89.41	102.6	103.82	120.99	132.07	143.42		
										Total = Sum(45)1...12 =			1428.42	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	22.21	19.43	20.05	17.48	16.77	14.47	13.41	15.39	15.57	18.15	19.81	21.51		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	199.02	175.52	184.59	165.81	162.74	145.77	140.33	153.52	153.1	171.92	181.36	194.35	(62)

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

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

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

Output from water heater

(64)m=	199.02	175.52	184.59	165.81	162.74	145.77	140.33	153.52	153.1	171.92	181.36	194.35	

Output from water heater (annual)$_{1...12}$ 2028.04 (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=	89.98	79.87	85.18	78.17	77.92	71.51	70.47	74.85	73.95	80.97	83.34	88.43	(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=	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	20.34	18.07	14.69	11.12	8.31	7.02	7.58	9.86	13.23	16.8	19.61	20.91	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	210.88	213.07	207.55	195.81	180.99	167.07	157.76	155.57	161.09	172.83	187.65	201.57	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	(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=	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	(71)
Water heating gains (Table 5)													
(72)m=	120.95	118.85	114.49	108.57	104.73	99.32	94.72	100.61	102.7	108.83	115.75	118.86	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	413.9	411.72	398.48	377.25	355.78	335.14	321.8	327.78	338.76	360.2	384.75	403.08	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.54	x	3.17	x	11.28	x	0.63	x	0.7	=	30.66	(75)
Northeast	0.9x	0.54	x	3.17	x	22.97	x	0.63	x	0.7	=	62.42	(75)
Northeast	0.9x	0.54	x	3.17	x	41.38	x	0.63	x	0.7	=	112.45	(75)
Northeast	0.9x	0.54	x	3.17	x	67.96	x	0.63	x	0.7	=	184.68	(75)
Northeast	0.9x	0.54	x	3.17	x	91.35	x	0.63	x	0.7	=	248.25	(75)
Northeast	0.9x	0.54	x	3.17	x	97.38	x	0.63	x	0.7	=	264.66	(75)
Northeast	0.9x	0.54	x	3.17	x	91.1	x	0.63	x	0.7	=	247.58	(75)
Northeast	0.9x	0.54	x	3.17	x	72.63	x	0.63	x	0.7	=	197.37	(75)

Northeast 0.9x	0.54	x	3.17	x	50.42	x	0.63	x	0.7	=	137.03	(75)
Northeast 0.9x	0.54	x	3.17	x	28.07	x	0.63	x	0.7	=	76.28	(75)
Northeast 0.9x	0.54	x	3.17	x	14.2	x	0.63	x	0.7	=	38.58	(75)
Northeast 0.9x	0.54	x	3.17	x	9.21	x	0.63	x	0.7	=	25.04	(75)

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

(83)m=	30.66	62.42	112.45	184.68	248.25	264.66	247.58	197.37	137.03	76.28	38.58	25.04	(83)

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

(84)m=	444.57	474.14	510.93	561.93	604.02	599.8	569.38	525.16	475.79	436.48	423.33	428.12	(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	0.86	0.66	0.49	0.55	0.83	0.98	1	1	(86)

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

(87)m=	20.14	20.24	20.42	20.68	20.9	20.98	21	21	20.94	20.68	20.37	20.13	(87)

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

(88)m=	20.2	20.2	20.2	20.21	20.21	20.22	20.22	20.22	20.21	20.21	20.21	20.2	(88)

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

(89)m=	1	1	0.99	0.95	0.82	0.59	0.41	0.46	0.77	0.97	0.99	1	(89)

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

(90)m=	19.04	19.18	19.45	19.83	20.11	20.21	20.22	20.22	20.16	19.83	19.38	19.02	(90)

fLA = Living area ÷ (4) = 0.57 (91)

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

(92)m=	19.67	19.78	20	20.32	20.56	20.65	20.66	20.66	20.61	20.31	19.95	19.65	(92)

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

(93)m=	19.67	19.78	20	20.32	20.56	20.65	20.66	20.66	20.61	20.31	19.95	19.65	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.95	0.84	0.63	0.46	0.51	0.8	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	443.21	471.67	504.28	535.43	508.25	378.92	259.11	270.36	382.62	422.79	420.63	427.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1012.52	977.87	885.06	739.65	572.61	387.22	259.98	272.2	418.01	627.98	834.24	1008.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	423.56	340.17	283.29	147.04	47.88	0	0	0	0	152.66	297.79	432.27	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2124.67 (98)

Space heating requirement in kWh/m²/year 27.96 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	423.56	340.17	283.29	147.04	47.88	0	0	0	0	152.66	297.79	432.27		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	453.01	363.82	302.99	157.26	51.21	0	0	0	0	163.27	318.5	462.32		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2272.37	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)
Water heating Output from water heater (calculated above)	199.02	175.52	184.59	165.81	162.74	145.77	140.33	153.52	153.1	171.92	181.36	194.35		
Efficiency of water heater													79.8	(216)
(217)m=	86.78	86.55	85.95	84.5	82	79.8	79.8	79.8	79.8	84.5	86.13	86.89		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	229.34	202.8	214.75	196.24	198.45	182.67	175.86	192.38	191.86	203.46	210.57	223.68		
Total = Sum(219a)$_{1...12}$ =													2422.05	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2272.37	
Water heating fuel used			2422.05	
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			359.22	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	490.83	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	523.16	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1014	(265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	186.44	(268)
Total CO2, kg/year		sum of (265)…(271) =		1239.36	(272)

TER =	16.31	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:43:09

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 102.3m²

Site Reference : Tottenham Mews **Plot Reference:** 2_04 - 3B5P

Address :

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	14.56 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.98 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	39.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	35.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**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 using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.61	
Maximum	1.5	**OK**
MVHR efficiency:	79%	
Minimum	70%	**OK**

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: North East	6.58m²
Windows facing: South West	2.1m²
Windows facing: North East	3.17m²
Windows facing: South West	6.58m²
Ventilation rate:	6.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from boilers – mains gas	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_04 - 3B5P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	102.3	(1a) x	2.65	(2a) =	271.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	102.3	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		271.1	(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	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.1	(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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 67.15 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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	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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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			6.58	x1/[1/(1.1)+ 0.04]	=	6.93			(27)
Windows Type 2			1.05	x1/[1/(1.1)+ 0.04]	=	1.11			(27)
Windows Type 3			3.17	x1/[1/(1.1)+ 0.04]	=	3.34			(27)
Windows Type 4			3.29	x1/[1/(1.1)+ 0.04]	=	3.47			(27)
Walls Type1	58.8	18.43	40.37	x 0.2	=	8.07			(29)
Walls Type2	20.1	0	20.1	x 0.19	=	3.72			(29)
Total area of elements, m²			78.9						(31)

** 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) = 31.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.84 (36)

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

Total fabric heat loss (33) + (36) = 43.05 (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=	26.67	26.44	26.2	25.03	24.79	23.62	23.62	23.38	24.09	24.79	25.26	25.73	(38)

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

(39)m=	69.72	69.49	69.25	68.08	67.84	66.67	66.67	66.43	67.14	67.84	68.31	68.78	

Average = Sum(39)$_{1…12}$ /12= 68.02 (39)

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

(40)m=	0.68	0.68	0.68	0.67	0.66	0.65	0.65	0.65	0.66	0.66	0.67	0.67	

Average = Sum(40)$_{1…12}$ /12= 0.66 (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 2.76 (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 99.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	109.72	105.73	101.74	97.75	93.76	89.77	89.77	93.76	97.75	101.74	105.73	109.72	
										Total = Sum(44)$_{1…12}$ =		1196.95	(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=	162.71	142.31	146.85	128.03	122.85	106.01	98.23	112.72	114.07	132.93	145.11	157.58	
										Total = Sum(45)$_{1…12}$ =		1569.39	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.41	21.35	22.03	19.2	18.43	15.9	14.73	16.91	17.11	19.94	21.77	23.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	227.64	200.95	211.78	190.86	187.77	168.84	163.16	177.65	176.9	197.86	207.94	222.5	(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=	227.64	200.95	211.78	190.86	187.77	168.84	163.16	177.65	176.9	197.86	207.94	222.5	

Output from water heater (annual)$_{1...12}$ 2333.85 (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=	106.04	94.23	100.77	92.83	92.79	85.51	84.6	89.42	88.19	96.14	98.51	104.34	(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=	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	24.01	21.32	17.34	13.13	9.81	8.28	8.95	11.64	15.62	19.83	23.14	24.67	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	259.99	262.69	255.89	241.42	223.15	205.98	194.51	191.81	198.61	213.08	231.35	248.52	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	(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=	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	(71)
Water heating gains (Table 5)													
(72)m=	142.53	140.23	135.44	128.94	124.71	118.77	113.71	120.19	122.49	129.22	136.83	140.24	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	490.93	488.64	473.07	447.88	422.07	397.43	381.57	388.03	401.11	426.53	455.72	477.83	(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	0.54	x	6.58	x	11.28	x	0.44	x	0.8	=	12.7	(75)
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.44	x	0.8	=	6.12	(75)
Northeast 0.9x	0.54	x	6.58	x	22.97	x	0.44	x	0.8	=	25.85	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.44	x	0.8	=	12.45	(75)
Northeast 0.9x	0.54	x	6.58	x	41.38	x	0.44	x	0.8	=	46.58	(75)

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.44	x	0.8	=	22.44	(75)
Northeast 0.9x	0.54	x	6.58	x	67.96	x	0.44	x	0.8	=	76.49	(75)
Northeast 0.9x	0.54	x	3.17	x	67.96	x	0.44	x	0.8	=	36.85	(75)
Northeast 0.9x	0.54	x	6.58	x	91.35	x	0.44	x	0.8	=	102.82	(75)
Northeast 0.9x	0.54	x	3.17	x	91.35	x	0.44	x	0.8	=	49.54	(75)
Northeast 0.9x	0.54	x	6.58	x	97.38	x	0.44	x	0.8	=	109.62	(75)
Northeast 0.9x	0.54	x	3.17	x	97.38	x	0.44	x	0.8	=	52.81	(75)
Northeast 0.9x	0.54	x	6.58	x	91.1	x	0.44	x	0.8	=	102.55	(75)
Northeast 0.9x	0.54	x	3.17	x	91.1	x	0.44	x	0.8	=	49.4	(75)
Northeast 0.9x	0.54	x	6.58	x	72.63	x	0.44	x	0.8	=	81.75	(75)
Northeast 0.9x	0.54	x	3.17	x	72.63	x	0.44	x	0.8	=	39.39	(75)
Northeast 0.9x	0.54	x	6.58	x	50.42	x	0.44	x	0.8	=	56.76	(75)
Northeast 0.9x	0.54	x	3.17	x	50.42	x	0.44	x	0.8	=	27.34	(75)
Northeast 0.9x	0.54	x	6.58	x	28.07	x	0.44	x	0.8	=	31.59	(75)
Northeast 0.9x	0.54	x	3.17	x	28.07	x	0.44	x	0.8	=	15.22	(75)
Northeast 0.9x	0.54	x	6.58	x	14.2	x	0.44	x	0.8	=	15.98	(75)
Northeast 0.9x	0.54	x	3.17	x	14.2	x	0.44	x	0.8	=	7.7	(75)
Northeast 0.9x	0.54	x	6.58	x	9.21	x	0.44	x	0.8	=	10.37	(75)
Northeast 0.9x	0.54	x	3.17	x	9.21	x	0.44	x	0.8	=	5	(75)
Southwest 0.9x	0.54	x	1.05	x	36.79		0.44	x	0.8	=	13.22	(79)
Southwest 0.9x	0.54	x	3.29	x	36.79		0.44	x	0.8	=	41.42	(79)
Southwest 0.9x	0.54	x	1.05	x	62.67		0.44	x	0.8	=	22.52	(79)
Southwest 0.9x	0.54	x	3.29	x	62.67		0.44	x	0.8	=	70.55	(79)
Southwest 0.9x	0.54	x	1.05	x	85.75		0.44	x	0.8	=	30.81	(79)
Southwest 0.9x	0.54	x	3.29	x	85.75		0.44	x	0.8	=	96.53	(79)
Southwest 0.9x	0.54	x	1.05	x	106.25		0.44	x	0.8	=	38.17	(79)
Southwest 0.9x	0.54	x	3.29	x	106.25		0.44	x	0.8	=	119.6	(79)
Southwest 0.9x	0.54	x	1.05	x	119.01		0.44	x	0.8	=	42.75	(79)
Southwest 0.9x	0.54	x	3.29	x	119.01		0.44	x	0.8	=	133.96	(79)
Southwest 0.9x	0.54	x	1.05	x	118.15		0.44	x	0.8	=	42.45	(79)
Southwest 0.9x	0.54	x	3.29	x	118.15		0.44	x	0.8	=	133	(79)
Southwest 0.9x	0.54	x	1.05	x	113.91		0.44	x	0.8	=	40.92	(79)
Southwest 0.9x	0.54	x	3.29	x	113.91		0.44	x	0.8	=	128.22	(79)
Southwest 0.9x	0.54	x	1.05	x	104.39		0.44	x	0.8	=	37.5	(79)
Southwest 0.9x	0.54	x	3.29	x	104.39		0.44	x	0.8	=	117.51	(79)
Southwest 0.9x	0.54	x	1.05	x	92.85		0.44	x	0.8	=	33.36	(79)
Southwest 0.9x	0.54	x	3.29	x	92.85		0.44	x	0.8	=	104.52	(79)
Southwest 0.9x	0.54	x	1.05	x	69.27		0.44	x	0.8	=	24.88	(79)
Southwest 0.9x	0.54	x	3.29	x	69.27		0.44	x	0.8	=	77.97	(79)
Southwest 0.9x	0.54	x	1.05	x	44.07		0.44	x	0.8	=	15.83	(79)
Southwest 0.9x	0.54	x	3.29	x	44.07		0.44	x	0.8	=	49.61	(79)

Southwest 0.9x	0.54	x	1.05	x	31.49		0.44	x	0.8	=	11.31	(79)
Southwest 0.9x	0.54	x	3.29	x	31.49		0.44	x	0.8	=	35.44	(79)

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

(83)m=	73.45	131.37	196.35	271.12	329.08	337.87	321.1	276.15	221.98	149.67	89.12	62.13	(83)

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

(84)m=	564.38	620.01	669.42	719	751.15	735.3	702.66	664.18	623.09	576.2	544.84	539.95	(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=	0.96	0.95	0.91	0.84	0.72	0.55	0.41	0.45	0.66	0.86	0.94	0.97	(86)

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

(87)m=	19.71	19.89	20.18	20.54	20.81	20.95	20.99	20.98	20.89	20.56	20.09	19.68	(87)

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

(88)m=	20.36	20.36	20.36	20.37	20.37	20.38	20.38	20.39	20.38	20.37	20.37	20.37	(88)

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

(89)m=	0.96	0.94	0.9	0.82	0.69	0.5	0.35	0.39	0.62	0.84	0.94	0.96	(89)

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

(90)m=	18.59	18.86	19.28	19.79	20.15	20.33	20.37	20.37	20.27	19.83	19.15	18.55	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.12	19.35	19.7	20.14	20.46	20.63	20.66	20.66	20.56	20.18	19.6	19.09	(92)

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

(93)m=	19.12	19.35	19.7	20.14	20.46	20.63	20.66	20.66	20.56	20.18	19.6	19.09	(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=	0.95	0.93	0.89	0.81	0.69	0.52	0.38	0.42	0.63	0.84	0.92	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	535.68	576.16	596.93	585.95	518.63	382.85	266.66	276.88	393.95	481.69	503.8	515.7	(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=	1033.3	1003.97	914.44	765.51	594.32	401.73	270.98	283.06	434.03	649.66	853.56	1023.87	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	370.23	287.48	236.23	129.28	56.31	0	0	0	0	124.97	251.82	378.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1834.42 (98)

Space heating requirement in kWh/m²/year 17.93 (99)

9b. Energy requirements – Community heating scheme

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

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1834.42	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1926.14	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2333.85	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2450.54	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.77	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		252.19	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	252.19	(331)
Energy for lighting (calculated in Appendix L)		423.94	(332)

12b. CO_2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
CO_2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			89.5	(367a)
CO_2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	1056.27	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	22.71	(372)
Total CO_2 associated with community systems	(363)…(366) + (368)...(372)		=	1078.98	(373)
CO_2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO_2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO_2 associated with space and water heating	(373) + (374) + (375) =			1078.98	(376)
CO_2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	130.88	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	220.03	(379)
Total CO2, kg/year	sum of (376)…(382) =			1429.89	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.98	(384)
EI rating (section 14)				86.99	(385)

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User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_04 - 3B5P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	102.3	(1a) x	2.65	(2a) =	271.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	102.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	271.1	(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		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(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

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

0.35	0.35	0.34	0.31	0.3	0.26	0.26	0.26	0.28	0.3	0.31	0.33

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=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

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

(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			6.58	x1/[1/(1.4)+ 0.04] =	8.72			(27)
Windows Type 2			1.05	x1/[1/(1.4)+ 0.04] =	1.39			(27)
Windows Type 3			3.17	x1/[1/(1.4)+ 0.04] =	4.2			(27)
Windows Type 4			3.29	x1/[1/(1.4)+ 0.04] =	4.36			(27)
Walls Type1	58.8	18.43	40.37	x 0.18 =	7.27			(29)
Walls Type2	20.1	0	20.1	x 0.18 =	3.62			(29)
Total area of elements, m²			78.9					(31)

** 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) = 35.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

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

Total fabric heat loss (33) + (36) = 39.26 (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=	50.36	50.14	49.93	48.92	48.73	47.86	47.86	47.69	48.19	48.73	49.11	49.51	(38)

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

(39)m=	89.63	89.41	89.19	88.19	88	87.12	87.12	86.96	87.46	88	88.38	88.78	

Average = Sum(39)$_{1…12}$ /12= 88.18 (39)

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

(40)m=	0.88	0.87	0.87	0.86	0.86	0.85	0.85	0.85	0.85	0.86	0.86	0.87

Average = Sum(40)$_{1…12}$ /12= 0.86 (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 2.76 (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 99.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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)

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)

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	
(44)m=	109.72	105.73	101.74	97.75	93.76	89.77	89.77	93.76	97.75	101.74	105.73	109.72	
Total = Sum(44)$_{1…12}$ =												1196.95	(44)
(45)m=	162.71	142.31	146.85	128.03	122.85	106.01	98.23	112.72	114.07	132.93	145.11	157.58	
Total = Sum(45)$_{1…12}$ =												1569.39	(45)
(46)m=	24.41	21.35	22.03	19.2	18.43	15.9	14.73	16.91	17.11	19.94	21.77	23.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	213.64	188.31	197.78	177.31	173.77	155.29	149.16	163.65	163.35	183.86	194.39	208.5	(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=	213.64	188.31	197.78	177.31	173.77	155.29	149.16	163.65	163.35	183.86	194.39	208.5	

Output from water heater (annual)$_{1...12}$ 2169 (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=	94.84	84.12	89.57	82	81.59	74.67	73.4	78.22	77.35	84.94	87.68	93.14	(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=	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	(66)

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

(67)m=	24.66	21.91	17.81	13.49	10.08	8.51	9.2	11.95	16.05	20.37	23.78	25.35	(67)

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

(68)m=	259.99	262.69	255.89	241.42	223.15	205.98	194.51	191.81	198.61	213.08	231.35	248.52	(68)

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

(69)m=	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	(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=	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	(71)

Water heating gains (Table 5)

(72)m=	127.48	125.17	120.39	113.88	109.66	103.71	98.66	105.14	107.44	114.17	121.77	125.18	(72)

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

(73)m=	479.53	477.17	461.49	436.19	410.29	385.6	369.76	376.29	389.48	415.02	444.3	466.45	(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	0.54	x	6.58	x	11.28	x	0.63	x	0.7	=	15.91	(75)
Northeast	0.9x	0.54	x	3.17	x	11.28	x	0.63	x	0.7	=	7.67	(75)
Northeast	0.9x	0.54	x	6.58	x	22.97	x	0.63	x	0.7	=	32.39	(75)
Northeast	0.9x	0.54	x	3.17	x	22.97	x	0.63	x	0.7	=	15.6	(75)
Northeast	0.9x	0.54	x	6.58	x	41.38	x	0.63	x	0.7	=	58.36	(75)

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Northeast	0.9x	0.54	x	3.17	x	41.38	x	0.63	x	0.7	=	28.11	(75)
Northeast	0.9x	0.54	x	6.58	x	67.96	x	0.63	x	0.7	=	95.84	(75)
Northeast	0.9x	0.54	x	3.17	x	67.96	x	0.63	x	0.7	=	46.17	(75)
Northeast	0.9x	0.54	x	6.58	x	91.35	x	0.63	x	0.7	=	128.82	(75)
Northeast	0.9x	0.54	x	3.17	x	91.35	x	0.63	x	0.7	=	62.06	(75)
Northeast	0.9x	0.54	x	6.58	x	97.38	x	0.63	x	0.7	=	137.34	(75)
Northeast	0.9x	0.54	x	3.17	x	97.38	x	0.63	x	0.7	=	66.16	(75)
Northeast	0.9x	0.54	x	6.58	x	91.1	x	0.63	x	0.7	=	128.48	(75)
Northeast	0.9x	0.54	x	3.17	x	91.1	x	0.63	x	0.7	=	61.9	(75)
Northeast	0.9x	0.54	x	6.58	x	72.63	x	0.63	x	0.7	=	102.42	(75)
Northeast	0.9x	0.54	x	3.17	x	72.63	x	0.63	x	0.7	=	49.34	(75)
Northeast	0.9x	0.54	x	6.58	x	50.42	x	0.63	x	0.7	=	71.11	(75)
Northeast	0.9x	0.54	x	3.17	x	50.42	x	0.63	x	0.7	=	34.26	(75)
Northeast	0.9x	0.54	x	6.58	x	28.07	x	0.63	x	0.7	=	39.58	(75)
Northeast	0.9x	0.54	x	3.17	x	28.07	x	0.63	x	0.7	=	19.07	(75)
Northeast	0.9x	0.54	x	6.58	x	14.2	x	0.63	x	0.7	=	20.02	(75)
Northeast	0.9x	0.54	x	3.17	x	14.2	x	0.63	x	0.7	=	9.65	(75)
Northeast	0.9x	0.54	x	6.58	x	9.21	x	0.63	x	0.7	=	12.99	(75)
Northeast	0.9x	0.54	x	3.17	x	9.21	x	0.63	x	0.7	=	6.26	(75)
Southwest	0.9x	0.54	x	1.05	x	36.79		0.63	x	0.7	=	16.56	(79)
Southwest	0.9x	0.54	x	3.29	x	36.79		0.63	x	0.7	=	51.89	(79)
Southwest	0.9x	0.54	x	1.05	x	62.67		0.63	x	0.7	=	28.21	(79)
Southwest	0.9x	0.54	x	3.29	x	62.67		0.63	x	0.7	=	88.39	(79)
Southwest	0.9x	0.54	x	1.05	x	85.75		0.63	x	0.7	=	38.6	(79)
Southwest	0.9x	0.54	x	3.29	x	85.75		0.63	x	0.7	=	120.93	(79)
Southwest	0.9x	0.54	x	1.05	x	106.25		0.63	x	0.7	=	47.82	(79)
Southwest	0.9x	0.54	x	3.29	x	106.25		0.63	x	0.7	=	149.84	(79)
Southwest	0.9x	0.54	x	1.05	x	119.01		0.63	x	0.7	=	53.56	(79)
Southwest	0.9x	0.54	x	3.29	x	119.01		0.63	x	0.7	=	167.84	(79)
Southwest	0.9x	0.54	x	1.05	x	118.15		0.63	x	0.7	=	53.18	(79)
Southwest	0.9x	0.54	x	3.29	x	118.15		0.63	x	0.7	=	166.62	(79)
Southwest	0.9x	0.54	x	1.05	x	113.91		0.63	x	0.7	=	51.27	(79)
Southwest	0.9x	0.54	x	3.29	x	113.91		0.63	x	0.7	=	160.64	(79)
Southwest	0.9x	0.54	x	1.05	x	104.39		0.63	x	0.7	=	46.98	(79)
Southwest	0.9x	0.54	x	3.29	x	104.39		0.63	x	0.7	=	147.22	(79)
Southwest	0.9x	0.54	x	1.05	x	92.85		0.63	x	0.7	=	41.79	(79)
Southwest	0.9x	0.54	x	3.29	x	92.85		0.63	x	0.7	=	130.95	(79)
Southwest	0.9x	0.54	x	1.05	x	69.27		0.63	x	0.7	=	31.18	(79)
Southwest	0.9x	0.54	x	3.29	x	69.27		0.63	x	0.7	=	97.69	(79)
Southwest	0.9x	0.54	x	1.05	x	44.07		0.63	x	0.7	=	19.84	(79)
Southwest	0.9x	0.54	x	3.29	x	44.07		0.63	x	0.7	=	62.15	(79)

Southwest 0.9x	0.54	x	1.05	x	31.49	0.63	x	0.7	=	14.17	(79)
Southwest 0.9x	0.54	x	3.29	x	31.49	0.63	x	0.7	=	44.41	(79)

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

(83)m=	92.03	164.59	246	339.67	412.29	423.3	402.28	345.97	278.1	187.51	111.65	77.83	(83)

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

(84)m=	571.56	641.75	707.49	775.86	822.57	808.9	772.04	722.26	667.58	602.53	555.95	544.28	(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	0.86	0.67	0.49	0.55	0.82	0.98	1	1	(86)

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

(87)m=	20.11	20.23	20.43	20.69	20.89	20.98	21	21	20.94	20.68	20.35	20.08	(87)

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

(88)m=	20.19	20.19	20.19	20.2	20.2	20.21	20.21	20.21	20.21	20.2	20.2	20.19	(88)

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

(89)m=	1	1	0.99	0.95	0.82	0.59	0.41	0.46	0.75	0.96	1	1	(89)

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

(90)m=	18.98	19.16	19.45	19.83	20.1	20.2	20.21	20.21	20.16	19.83	19.34	18.95	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

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

(92)m=	19.51	19.67	19.91	20.24	20.48	20.57	20.58	20.58	20.53	20.23	19.82	19.49	(92)

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

(93)m=	19.51	19.67	19.91	20.24	20.48	20.57	20.58	20.58	20.53	20.23	19.82	19.49	(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=	1	0.99	0.98	0.95	0.84	0.63	0.45	0.5	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	570.15	638.22	696.75	734.98	687.45	508.89	345.84	361.47	521.51	581.07	552.74	543.28	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1363.51	1320.1	1196.34	999.65	772.19	520.14	346.96	363.65	562.56	847.62	1123.98	1357.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	590.26	458.22	371.7	190.56	63.05	0	0	0	0	198.31	411.29	605.59	(98)

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 2888.98 | (98)

Space heating requirement in kWh/m²/year | 28.24 | (99)

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

Space heating:

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

TER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	590.26	458.22	371.7	190.56	63.05	0	0	0	0	198.31	411.29	605.59		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	631.29	490.07	397.54	203.81	67.43	0	0	0	0	212.09	439.88	647.69		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3089.81	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	213.64	188.31	197.78	177.31	173.77	155.29	149.16	163.65	163.35	183.86	194.39	208.5		
Efficiency of water heater													79.8	(216)
(217)m=	87.39	87.1	86.47	85.01	82.39	79.8	79.8	79.8	79.8	85.02	86.77	87.5		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	244.48	216.2	228.71	208.59	210.9	194.6	186.91	205.07	204.7	216.27	224.04	238.3		
Total = Sum(219a)$_{1...12}$ =													2578.77	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3089.81	
Water heating fuel used			2578.77	
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			435.56	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	667.4	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	557.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1224.41	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	226.05	(268)

TER WorkSheet: New dwelling design stage

Total CO_2, kg/year	sum of (265)…(271) =	1489.39	(272)
TER =		14.56	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:43:09

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 81.5m²

Site Reference : Tottenham Mews **Plot Reference:** 4_05 - 1B2P

Address :

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	17.86 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.98 kg/m²	Fail

Excess emissions = 2.12 kg/m² (11.9 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	54.4 kWh/m²	
		Fail

Excess energy = 4.66 kg/m² (09.4 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.23 (max. 0.20)	0.23 (max. 0.35)	Fail
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	OK
Primary pipework insulated:	Yes	OK

Regulations Compliance Report

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	OK
MVHR efficiency:	78%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: North East	4.7m²
Windows facing: South West	6.58m²
Windows facing: South West	2.1m²
Ventilation rate:	6.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from boilers – mains gas	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Vitaliy Troyan **Stroma Number:** STRO018096
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: 4_05 - 1B2P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	81.5	(1a) x	2.65	(2a) =	215.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.98	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(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

	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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 66.3 (23c)

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

(24a)m=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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	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=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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			4.7	x1/[1/(1.1)+ 0.04]		=	4.95			(27)
Windows Type 2			3.29	x1/[1/(1.1)+ 0.04]		=	3.47			(27)
Windows Type 3			1.05	x1/[1/(1.1)+ 0.04]		=	1.11			(27)
Walls Type1	50.4	13.38	37.02	x	0.2	=	7.4			(29)
Walls Type2	20.4	0	20.4	x	0.19	=	3.78			(29)
Roof	81.5	0	81.5	x	0.23	=	18.75			(30)
Total area of elements, m²			152.3							(31)

** 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) = 44.02 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 733.5 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 22.85 (36)

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

Total fabric heat loss (33) + (36) = 66.87 (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=	21.55	21.36	21.18	20.24	20.05	19.12	19.12	18.93	19.49	20.05	20.43	20.8	(38)

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

(39)m=	88.42	88.23	88.05	87.11	86.92	85.99	85.99	85.8	86.36	86.92	87.3	87.67	

Average = Sum(39)$_{1…12}$ /12= 87.06 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	1.08	1.08	1.08	1.07	1.07	1.06	1.06	1.05	1.06	1.07	1.07	1.08	

Average = Sum(40)$_{1\ldots12}$ /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 2.49 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.35 (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=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69	

Total = Sum(44)$_{1\ldots12}$ = 1120.25 (44)

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

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48	

Total = Sum(45)$_{1\ldots12}$ = 1468.83 (45)

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

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	217.21	191.83	202.37	182.66	179.9	162.05	156.86	170.42	169.59	189.34	198.64	212.41	(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=	217.21	191.83	202.37	182.66	179.9	162.05	156.86	170.42	169.59	189.34	198.64	212.41	

Output from water heater (annual)$_{1...12}$ 2233.28 (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=	102.58	91.2	97.64	90.11	90.17	83.25	82.51	87.02	85.76	93.31	95.42	100.98	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	20.93	18.59	15.12	11.45	8.56	7.22	7.81	10.15	13.62	17.29	20.18	21.51	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(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=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	137.87	135.71	131.24	125.15	121.2	115.63	110.9	116.96	119.11	125.42	132.53	135.72	(72)

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

(73)m=	441.71	439.52	425.75	403.6	381.12	359.53	345.56	351.65	363.09	385.46	411.1	430.32	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	4.7	x	11.28	x	0.44	x	0.8	=	9.07	(75)
Northeast 0.9x	0.54	x	4.7	x	22.97	x	0.44	x	0.8	=	18.47	(75)
Northeast 0.9x	0.54	x	4.7	x	41.38	x	0.44	x	0.8	=	33.27	(75)
Northeast 0.9x	0.54	x	4.7	x	67.96	x	0.44	x	0.8	=	54.64	(75)
Northeast 0.9x	0.54	x	4.7	x	91.35	x	0.44	x	0.8	=	73.45	(75)

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Northeast 0.9x	0.54	x	4.7	x	97.38	x	0.44	x	0.8	=	78.3	(75)
Northeast 0.9x	0.54	x	4.7	x	91.1	x	0.44	x	0.8	=	73.25	(75)
Northeast 0.9x	0.54	x	4.7	x	72.63	x	0.44	x	0.8	=	58.39	(75)
Northeast 0.9x	0.54	x	4.7	x	50.42	x	0.44	x	0.8	=	40.54	(75)
Northeast 0.9x	0.54	x	4.7	x	28.07	x	0.44	x	0.8	=	22.57	(75)
Northeast 0.9x	0.54	x	4.7	x	14.2	x	0.44	x	0.8	=	11.41	(75)
Northeast 0.9x	0.54	x	4.7	x	9.21	x	0.44	x	0.8	=	7.41	(75)
Southwest0.9x	0.54	x	3.29	x	36.79		0.44	x	0.8	=	41.42	(79)
Southwest0.9x	0.54	x	1.05	x	36.79		0.44	x	0.8	=	13.22	(79)
Southwest0.9x	0.54	x	3.29	x	62.67		0.44	x	0.8	=	70.55	(79)
Southwest0.9x	0.54	x	1.05	x	62.67		0.44	x	0.8	=	22.52	(79)
Southwest0.9x	0.54	x	3.29	x	85.75		0.44	x	0.8	=	96.53	(79)
Southwest0.9x	0.54	x	1.05	x	85.75		0.44	x	0.8	=	30.81	(79)
Southwest0.9x	0.54	x	3.29	x	106.25		0.44	x	0.8	=	119.6	(79)
Southwest0.9x	0.54	x	1.05	x	106.25		0.44	x	0.8	=	38.17	(79)
Southwest0.9x	0.54	x	3.29	x	119.01		0.44	x	0.8	=	133.96	(79)
Southwest0.9x	0.54	x	1.05	x	119.01		0.44	x	0.8	=	42.75	(79)
Southwest0.9x	0.54	x	3.29	x	118.15		0.44	x	0.8	=	133	(79)
Southwest0.9x	0.54	x	1.05	x	118.15		0.44	x	0.8	=	42.45	(79)
Southwest0.9x	0.54	x	3.29	x	113.91		0.44	x	0.8	=	128.22	(79)
Southwest0.9x	0.54	x	1.05	x	113.91		0.44	x	0.8	=	40.92	(79)
Southwest0.9x	0.54	x	3.29	x	104.39		0.44	x	0.8	=	117.51	(79)
Southwest0.9x	0.54	x	1.05	x	104.39		0.44	x	0.8	=	37.5	(79)
Southwest0.9x	0.54	x	3.29	x	92.85		0.44	x	0.8	=	104.52	(79)
Southwest0.9x	0.54	x	1.05	x	92.85		0.44	x	0.8	=	33.36	(79)
Southwest0.9x	0.54	x	3.29	x	69.27		0.44	x	0.8	=	77.97	(79)
Southwest0.9x	0.54	x	1.05	x	69.27		0.44	x	0.8	=	24.88	(79)
Southwest0.9x	0.54	x	3.29	x	44.07		0.44	x	0.8	=	49.61	(79)
Southwest0.9x	0.54	x	1.05	x	44.07		0.44	x	0.8	=	15.83	(79)
Southwest0.9x	0.54	x	3.29	x	31.49		0.44	x	0.8	=	35.44	(79)
Southwest0.9x	0.54	x	1.05	x	31.49		0.44	x	0.8	=	11.31	(79)

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

(83)m=	63.71	111.53	160.6	212.41	250.17	253.74	242.39	213.4	178.42	125.42	76.86	54.17	(83)

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

(84)m=	505.42	551.05	586.36	616.02	631.29	613.27	587.95	565.05	541.51	510.88	487.96	484.49	(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=	0.96	0.95	0.93	0.89	0.82	0.69	0.56	0.59	0.77	0.9	0.95	0.97	(86)

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

(87)m=	18.78	18.99	19.36	19.86	20.34	20.72	20.89	20.86	20.59	19.99	19.31	18.74	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(88)m=	20.01	20.02	20.02	20.03	20.03	20.04	20.04	20.04	20.03	20.03	20.02	20.02		(88)

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

(89)m=	0.96	0.94	0.92	0.87	0.78	0.63	0.46	0.5	0.71	0.88	0.94	0.96		(89)

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

(90)m=	17.04	17.34	17.88	18.6	19.26	19.76	19.96	19.94	19.61	18.8	17.81	16.99		(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

(92)m=	17.89	18.15	18.6	19.22	19.79	20.23	20.41	20.39	20.09	19.38	18.55	17.85		(92)

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

(93)m=	17.89	18.15	18.6	19.22	19.79	20.23	20.41	20.39	20.09	19.38	18.55	17.85		(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=	0.94	0.93	0.9	0.85	0.77	0.64	0.5	0.54	0.72	0.86	0.92	0.95		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	476.17	510.65	527.89	524.65	486.44	393.87	295.3	302.58	387.96	438.44	450.03	458.98		(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=	1201.97	1169.08	1065.66	898.59	703.24	484.22	328	342.59	517.66	763.55	999.32	1196.44		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	540	442.47	400.1	269.24	161.3	0	0	0	0	241.88	395.49	548.67		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													2999.15	(98)
Space heating requirement in kWh/m²/year													36.8	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2999.15	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3149.11	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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

Water heating

Annual water heating requirement		2233.28	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2344.95	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	54.94	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		158.09	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	158.09	(331)
Energy for lighting (calculated in Appendix L)		369.64	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				89.5	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1325.94	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	28.51	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1354.45	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1354.45	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	82.05	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	191.85	(379)
Total CO2, kg/year	sum of (376)…(382) =				1628.35	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				19.98	(384)
EI rating (section 14)					82.75	(385)

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User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 4_05 - 1B2P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	81.5	(1a) x	2.65	(2a) =	215.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.98	(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) =	0.14	(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			4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27	(21)

Infiltration rate modified for monthly wind speed

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

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

0.35	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32

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=	0.56	0.56	0.56	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

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

(25)m=	0.56	0.56	0.56	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			4.7	x1/[1/(1.4)+ 0.04]	=	6.23			(27)
Windows Type 2			3.29	x1/[1/(1.4)+ 0.04]	=	4.36			(27)
Windows Type 3			1.05	x1/[1/(1.4)+ 0.04]	=	1.39			(27)
Walls Type1	50.4	13.38	37.02	x 0.18	=	6.66			(29)
Walls Type2	20.4	0	20.4	x 0.18	=	3.67			(29)
Roof	81.5	0	81.5	x 0.13	=	10.59			(30)
Total area of elements, m²			152.3						(31)

** 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) = 38.67 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 733.5 (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 7.62 (36)

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

Total fabric heat loss (33) + (36) = 46.28 (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=	39.93	39.76	39.6	38.83	38.69	38.02	38.02	37.9	38.28	38.69	38.98	39.28	(38)

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

(39)m=	86.21	86.05	85.88	85.12	84.97	84.3	84.3	84.18	84.56	84.97	85.26	85.57	

Average = Sum(39)$_{1…12}$ /12= 85.12 (39)

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

(40)m=	1.06	1.06	1.05	1.04	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.04 (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 2.49 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.35 (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=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69	

Total = Sum(44)$_{1...12}$ = 1120.25 (44)

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

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48	

Total = Sum(45)$_{1...12}$ = 1468.83 (45)

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

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	203.21	179.19	188.37	169.11	165.9	148.5	142.86	156.42	156.04	175.34	185.09	198.41	(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=	203.21	179.19	188.37	169.11	165.9	148.5	142.86	156.42	156.04	175.34	185.09	198.41	

Output from water heater (annual)$_{1...12}$ 2068.44 (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=	91.38	81.08	86.44	79.27	78.97	72.42	71.31	75.82	74.92	82.11	84.58	89.78	(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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	21.54	19.13	15.56	11.78	8.81	7.43	8.03	10.44	14.02	17.8	20.77	22.14	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(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=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	122.82	120.66	116.18	110.09	106.14	100.58	95.85	101.91	104.06	110.36	117.48	120.67	(72)

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

(73)m=	430.27	428.01	414.14	391.88	369.32	347.68	333.73	339.89	351.44	373.91	399.64	418.9	(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)	
Northeast 0.9x	0.54	x	4.7	x	11.28	x	0.63	x	0.7	=	11.37	(75)
Northeast 0.9x	0.54	x	4.7	x	22.97	x	0.63	x	0.7	=	23.14	(75)
Northeast 0.9x	0.54	x	4.7	x	41.38	x	0.63	x	0.7	=	41.68	(75)
Northeast 0.9x	0.54	x	4.7	x	67.96	x	0.63	x	0.7	=	68.45	(75)
Northeast 0.9x	0.54	x	4.7	x	91.35	x	0.63	x	0.7	=	92.02	(75)

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Northeast	0.9x	0.54	x	4.7	x	97.38	x	0.63	x	0.7	=	98.1	(75)
Northeast	0.9x	0.54	x	4.7	x	91.1	x	0.63	x	0.7	=	91.77	(75)
Northeast	0.9x	0.54	x	4.7	x	72.63	x	0.63	x	0.7	=	73.16	(75)
Northeast	0.9x	0.54	x	4.7	x	50.42	x	0.63	x	0.7	=	50.79	(75)
Northeast	0.9x	0.54	x	4.7	x	28.07	x	0.63	x	0.7	=	28.27	(75)
Northeast	0.9x	0.54	x	4.7	x	14.2	x	0.63	x	0.7	=	14.3	(75)
Northeast	0.9x	0.54	x	4.7	x	9.21	x	0.63	x	0.7	=	9.28	(75)
Southwest	0.9x	0.54	x	3.29	x	36.79		0.63	x	0.7	=	51.89	(79)
Southwest	0.9x	0.54	x	1.05	x	36.79		0.63	x	0.7	=	16.56	(79)
Southwest	0.9x	0.54	x	3.29	x	62.67		0.63	x	0.7	=	88.39	(79)
Southwest	0.9x	0.54	x	1.05	x	62.67		0.63	x	0.7	=	28.21	(79)
Southwest	0.9x	0.54	x	3.29	x	85.75		0.63	x	0.7	=	120.93	(79)
Southwest	0.9x	0.54	x	1.05	x	85.75		0.63	x	0.7	=	38.6	(79)
Southwest	0.9x	0.54	x	3.29	x	106.25		0.63	x	0.7	=	149.84	(79)
Southwest	0.9x	0.54	x	1.05	x	106.25		0.63	x	0.7	=	47.82	(79)
Southwest	0.9x	0.54	x	3.29	x	119.01		0.63	x	0.7	=	167.84	(79)
Southwest	0.9x	0.54	x	1.05	x	119.01		0.63	x	0.7	=	53.56	(79)
Southwest	0.9x	0.54	x	3.29	x	118.15		0.63	x	0.7	=	166.62	(79)
Southwest	0.9x	0.54	x	1.05	x	118.15		0.63	x	0.7	=	53.18	(79)
Southwest	0.9x	0.54	x	3.29	x	113.91		0.63	x	0.7	=	160.64	(79)
Southwest	0.9x	0.54	x	1.05	x	113.91		0.63	x	0.7	=	51.27	(79)
Southwest	0.9x	0.54	x	3.29	x	104.39		0.63	x	0.7	=	147.22	(79)
Southwest	0.9x	0.54	x	1.05	x	104.39		0.63	x	0.7	=	46.98	(79)
Southwest	0.9x	0.54	x	3.29	x	92.85		0.63	x	0.7	=	130.95	(79)
Southwest	0.9x	0.54	x	1.05	x	92.85		0.63	x	0.7	=	41.79	(79)
Southwest	0.9x	0.54	x	3.29	x	69.27		0.63	x	0.7	=	97.69	(79)
Southwest	0.9x	0.54	x	1.05	x	69.27		0.63	x	0.7	=	31.18	(79)
Southwest	0.9x	0.54	x	3.29	x	44.07		0.63	x	0.7	=	62.15	(79)
Southwest	0.9x	0.54	x	1.05	x	44.07		0.63	x	0.7	=	19.84	(79)
Southwest	0.9x	0.54	x	3.29	x	31.49		0.63	x	0.7	=	44.41	(79)
Southwest	0.9x	0.54	x	1.05	x	31.49		0.63	x	0.7	=	14.17	(79)

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

(83)m=	79.82	139.73	201.21	266.12	313.42	317.9	303.68	267.36	223.53	157.13	96.29	67.86	(83)

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

(84)m=	510.08	567.74	615.35	658	682.73	665.58	637.41	607.25	574.97	531.04	495.92	486.76	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.75	0.57	0.62	0.85	0.97	0.99	1	(86)

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

(87)m=	19.91	20.04	20.25	20.54	20.79	20.95	20.99	20.99	20.89	20.57	20.19	19.88	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(88)m=	20.04	20.04	20.04	20.05	20.05	20.05	20.05	20.06	20.05	20.05	20.05	20.04		(88)

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

(89)m=	1	0.99	0.98	0.95	0.86	0.66	0.45	0.5	0.78	0.96	0.99	1		(89)

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

(90)m=	18.58	18.77	19.08	19.49	19.84	20.02	20.05	20.05	19.96	19.55	18.99	18.55		(90)
										fLA = Living area ÷ (4) =			0.49	(91)

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

(92)m=	19.23	19.39	19.66	20.01	20.31	20.48	20.51	20.51	20.42	20.05	19.58	19.2		(92)

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

(93)m=	19.23	19.39	19.66	20.01	20.31	20.48	20.51	20.51	20.42	20.05	19.58	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=	1	0.99	0.98	0.95	0.87	0.7	0.51	0.56	0.81	0.96	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	507.95	563.24	604.56	627.06	595.51	465.84	325.42	338.89	467.18	510.64	491.68	485.16		(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=	1287.33	1246.98	1129.94	945.28	731.33	495.32	329.8	345.88	534.17	802.79	1064.02	1283.7		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	579.86	459.47	390.88	229.12	101.05	0	0	0	0	217.36	412.09	594.11		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				2983.94	(98)
Space heating requirement in kWh/m²/year													36.61	(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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	579.86	459.47	390.88	229.12	101.05	0	0	0	0	217.36	412.09	594.11		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	620.17	491.41	418.05	245.05	108.08	0	0	0	0	232.47	440.73	635.41		
									Total (kWh/year) =Sum(211)$_{1...5,10....12}$=				3191.38	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10....12}$=				0	(215)

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Water heating

Output from water heater (calculated above)

	203.21	179.19	188.37	169.11	165.9	148.5	142.86	156.42	156.04	175.34	185.09	198.41	
Efficiency of water heater												79.8	(216)
(217)m=	87.46	87.22	86.72	85.62	83.54	79.8	79.8	79.8	79.8	85.39	86.89	87.56	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.36	205.45	217.22	197.5	198.59	186.09	179.03	196.02	195.54	205.35	213.02	226.59	
							Total = $Sum(219a)_{1...12}$ =					2452.74	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3191.38	
Water heating fuel used			2452.74	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			380.45	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	689.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	529.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1219.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.45	(268)
Total CO2, kg/year		sum of (265)…(271) =		1455.51	(272)

TER = 17.86 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:43:08

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 55.3m²

Site Reference : Tottenham Mews **Plot Reference:** 5_01 - 1B2P

Address :

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	19.68 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.19 kg/m²	**Fail**

Excess emissions = 1.51 kg/m² (7.7 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	51.5 kWh/m²	
		Fail

Excess energy = 0.91 kg/m² (01.8 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**OK**
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	**OK**
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

Regulations Compliance Report

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: South West	3.3m²
Windows facing: South West	2.12m²
Windows facing: North West	7.28m²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from boilers – mains gas	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_01 - 1B2P

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	55.3	(1a)	x	2.65	(2a)	=	146.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.3	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			146.55	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.12	(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

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14

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) = 66.3 (23c)

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

(24a)m=	0.32	0.31	0.31	0.3	0.29	0.28	0.28	0.28	0.28	0.29	0.3	0.31	(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	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=	0.32	0.31	0.31	0.3	0.29	0.28	0.28	0.28	0.28	0.29	0.3	0.31	(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			1.65	x1/[1/(1.1)+ 0.04] =	1.74			(27)
Windows Type 2			2.12	x1/[1/(1.1)+ 0.04] =	2.23			(27)
Windows Type 3			3.64	x1/[1/(1.1)+ 0.04] =	3.84			(27)
Walls Type1	43.5	12.7	30.8	x 0.2 =	6.16			(29)
Walls Type2	12.2	0	12.2	x 0.19 =	2.26			(29)
Roof	55.3	0	55.3	x 0.14 =	7.74			(30)
Total area of elements, m²			111					(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 497.7 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 16.65 (36)

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

Total fabric heat loss (33) + (36) = 46.19 (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=	15.32	15.18	15.04	14.33	14.19	13.49	13.49	13.35	13.77	14.19	14.47	14.75	(38)

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

(39)m=	61.51	61.37	61.23	60.53	60.38	59.68	59.68	59.54	59.96	60.38	60.67	60.95	

Average = Sum(39)$_{1…12}$ /12= 60.49 (39)

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

(40)m=	1.11	1.11	1.11	1.09	1.09	1.08	1.08	1.08	1.08	1.09	1.1	1.1

Average = Sum(40)$_{1…12}$ /12= 1.09 (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 — 1.85 (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 — 78.05 (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=	85.85	82.73	79.61	76.49	73.36	70.24	70.24	73.36	76.49	79.61	82.73	85.85

Total = Sum(44)$_{1…12}$ = 936.55 (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=	127.31	111.35	114.9	100.17	96.12	82.94	76.86	88.2	89.25	104.01	113.54	123.3

Total = Sum(45)$_{1…12}$ = 1227.97 (45)

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

(46)m=	19.1	16.7	17.24	15.03	14.42	12.44	11.53	13.23	13.39	15.6	17.03	18.49

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 200 (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): — 2.24 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 1.34 (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) — 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66

(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66

(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	192.24	169.99	179.83	163.01	161.05	145.78	141.79	153.12	152.08	168.94	176.37	188.22	(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=	192.24	169.99	179.83	163.01	161.05	145.78	141.79	153.12	152.08	168.94	176.37	188.22

Output from water heater (annual)$_{1...12}$ 1992.42 (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=	94.27	83.94	90.15	83.57	83.9	77.84	77.5	81.27	79.94	86.53	88.02	92.94	(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=	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.35	12.75	10.37	7.85	5.87	4.95	5.35	6.96	9.34	11.85	13.83	14.75	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	160.96	162.63	158.42	149.46	138.15	127.52	120.42	118.75	122.95	131.92	143.23	153.86	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	(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=	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	(71)
Water heating gains (Table 5)													
(72)m=	126.71	124.91	121.16	116.07	112.77	108.12	104.16	109.23	111.03	116.3	122.25	124.92	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	352.71	350.97	340.64	324.07	307.48	291.28	280.62	285.62	294.01	310.76	330	344.21	(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)	
Southwest 0.9x	0.77	x	1.65	x	36.79	0.44	x	0.8	=	29.62	(79)
Southwest 0.9x	0.77	x	2.12	x	36.79	0.44	x	0.8	=	19.03	(79)
Southwest 0.9x	0.77	x	1.65	x	62.67	0.44	x	0.8	=	50.45	(79)
Southwest 0.9x	0.77	x	2.12	x	62.67	0.44	x	0.8	=	32.41	(79)
Southwest 0.9x	0.77	x	1.65	x	85.75	0.44	x	0.8	=	69.03	(79)

Southwest	0.9x	0.77	x	2.12	x	85.75		0.44	x	0.8	=	44.35	(79)
Southwest	0.9x	0.77	x	1.65	x	106.25		0.44	x	0.8	=	85.53	(79)
Southwest	0.9x	0.77	x	2.12	x	106.25		0.44	x	0.8	=	54.95	(79)
Southwest	0.9x	0.77	x	1.65	x	119.01		0.44	x	0.8	=	95.8	(79)
Southwest	0.9x	0.77	x	2.12	x	119.01		0.44	x	0.8	=	61.55	(79)
Southwest	0.9x	0.77	x	1.65	x	118.15		0.44	x	0.8	=	95.11	(79)
Southwest	0.9x	0.77	x	2.12	x	118.15		0.44	x	0.8	=	61.1	(79)
Southwest	0.9x	0.77	x	1.65	x	113.91		0.44	x	0.8	=	91.7	(79)
Southwest	0.9x	0.77	x	2.12	x	113.91		0.44	x	0.8	=	58.91	(79)
Southwest	0.9x	0.77	x	1.65	x	104.39		0.44	x	0.8	=	84.03	(79)
Southwest	0.9x	0.77	x	2.12	x	104.39		0.44	x	0.8	=	53.98	(79)
Southwest	0.9x	0.77	x	1.65	x	92.85		0.44	x	0.8	=	74.74	(79)
Southwest	0.9x	0.77	x	2.12	x	92.85		0.44	x	0.8	=	48.02	(79)
Southwest	0.9x	0.77	x	1.65	x	69.27		0.44	x	0.8	=	55.76	(79)
Southwest	0.9x	0.77	x	2.12	x	69.27		0.44	x	0.8	=	35.82	(79)
Southwest	0.9x	0.77	x	1.65	x	44.07		0.44	x	0.8	=	35.48	(79)
Southwest	0.9x	0.77	x	2.12	x	44.07		0.44	x	0.8	=	22.79	(79)
Southwest	0.9x	0.77	x	1.65	x	31.49		0.44	x	0.8	=	25.35	(79)
Southwest	0.9x	0.77	x	2.12	x	31.49		0.44	x	0.8	=	16.28	(79)
Northwest	0.9x	0.77	x	3.64	x	11.28	x	0.44	x	0.8	=	20.04	(81)
Northwest	0.9x	0.77	x	3.64	x	22.97	x	0.44	x	0.8	=	40.79	(81)
Northwest	0.9x	0.77	x	3.64	x	41.38	x	0.44	x	0.8	=	73.48	(81)
Northwest	0.9x	0.77	x	3.64	x	67.96	x	0.44	x	0.8	=	120.68	(81)
Northwest	0.9x	0.77	x	3.64	x	91.35	x	0.44	x	0.8	=	162.22	(81)
Northwest	0.9x	0.77	x	3.64	x	97.38	x	0.44	x	0.8	=	172.94	(81)
Northwest	0.9x	0.77	x	3.64	x	91.1	x	0.44	x	0.8	=	161.78	(81)
Northwest	0.9x	0.77	x	3.64	x	72.63	x	0.44	x	0.8	=	128.97	(81)
Northwest	0.9x	0.77	x	3.64	x	50.42	x	0.44	x	0.8	=	89.54	(81)
Northwest	0.9x	0.77	x	3.64	x	28.07	x	0.44	x	0.8	=	49.84	(81)
Northwest	0.9x	0.77	x	3.64	x	14.2	x	0.44	x	0.8	=	25.21	(81)
Northwest	0.9x	0.77	x	3.64	x	9.21	x	0.44	x	0.8	=	16.36	(81)

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

(83)m=	68.68	123.65	186.86	261.16	319.57	329.15	312.39	266.99	212.3	141.42	83.48	57.99	(83)

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

(84)m=	421.39	474.62	527.5	585.23	627.04	620.43	593.01	552.62	506.31	452.18	413.48	402.21	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.94	0.92	0.88	0.8	0.69	0.54	0.41	0.46	0.65	0.84	0.92	0.95	(86)

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

(87)m=	18.94	19.2	19.61	20.14	20.57	20.84	20.94	20.93	20.73	20.18	19.48	18.89	(87)

DER WorkSheet: New dwelling design stage

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

(88)m=	19.99	19.99	19.99	20.01	20.01	20.02	20.02	20.02	20.01	20.01	20	20	(88)

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

(89)m=	0.93	0.91	0.87	0.78	0.64	0.47	0.33	0.37	0.59	0.81	0.91	0.94	(89)

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

(90)m=	17.25	17.62	18.22	18.96	19.53	19.88	19.98	19.97	19.75	19.03	18.04	17.19	(90)

fLA = Living area ÷ (4) = 0.52 (91)

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

(92)m=	18.13	18.44	18.94	19.57	20.07	20.38	20.48	20.47	20.25	19.62	18.78	18.07	(92)

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

(93)m=	18.13	18.44	18.94	19.57	20.07	20.38	20.48	20.47	20.25	19.62	18.78	18.07	(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=	0.92	0.89	0.84	0.76	0.65	0.5	0.37	0.41	0.61	0.79	0.89	0.92	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	385.97	422.24	445.48	447.12	405.7	309.86	220.3	226.99	307.49	358.73	366.59	371.41	(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=	850.51	830.83	761.82	645.86	505.57	344.91	231.63	242.1	369.03	544.8	708.77	845.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	345.61	274.57	235.35	143.09	74.31	0	0	0	0	138.43	246.37	352.65	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1810.39 (98)

Space heating requirement in kWh/m²/year 32.74 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1810.39	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1900.91	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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

Water heating

Annual water heating requirement		1992.42	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2092.04	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	39.93	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		107.27	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	107.27	(331)
Energy for lighting (calculated in Appendix L)		253.42	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				89.5	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	963.66	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.72	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	984.39	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				984.39	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	55.67	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	131.52	(379)
Total CO2, kg/year	sum of (376)…(382) =				1171.58	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				21.19	(384)
EI rating (section 14)					84.35	(385)

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User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_01 - 1B2P

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	55.3	(1a)	x	2.65	(2a)	=	146.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.3	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	146.55	(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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

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

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

0.38	0.37	0.37	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.34	0.35

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=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(24d)

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(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			1.65	x1/[1/(1.4)+ 0.04] =	2.19			(27)
Windows Type 2			2.12	x1/[1/(1.4)+ 0.04] =	2.81			(27)
Windows Type 3			3.64	x1/[1/(1.4)+ 0.04] =	4.83			(27)
Walls Type1	43.5	12.7	30.8	x 0.18 =	5.54			(29)
Walls Type2	12.2	0	12.2	x 0.18 =	2.2			(29)
Roof	55.3	0	55.3	x 0.13 =	7.19			(30)
Total area of elements, m²			111					(31)

** 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) = 31.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 497.7 (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 5.55 (36)

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

Total fabric heat loss (33) + (36) = 37.32 (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=	27.71	27.57	27.44	26.8	26.69	26.14	26.14	26.04	26.35	26.69	26.93	27.17	(38)

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

(39)m=	65.02	64.89	64.75	64.12	64	63.45	63.45	63.35	63.67	64	64.24	64.49	

Average = Sum(39)$_{1…12}$ /12= 64.12 (39)

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

(40)m=	1.18	1.17	1.17	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.16	1.17

Average = Sum(40)$_{1…12}$ /12= 1.16 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.85 (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 — 78.05 (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=	85.85	82.73	79.61	76.49	73.36	70.24	70.24	73.36	76.49	79.61	82.73	85.85

Total = Sum(44)$_{1…12}$ = 936.55 (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=	127.31	111.35	114.9	100.17	96.12	82.94	76.86	88.2	89.25	104.01	113.54	123.3

Total = Sum(45)$_{1…12}$ = 1227.97 (45)

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

(46)m=	19.1	16.7	17.24	15.03	14.42	12.44	11.53	13.23	13.39	15.6	17.03	18.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.65 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.89 (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) — 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	178.24	157.35	165.83	149.46	147.05	132.23	127.79	139.12	138.53	154.94	162.82	174.22	(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=	178.24	157.35	165.83	149.46	147.05	132.23	127.79	139.12	138.53	154.94	162.82	174.22	

Output from water heater (annual)$_{1...12}$ 1827.58 (64)

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

(65)m=	83.07	73.82	78.95	72.73	72.7	67.01	66.3	70.07	69.1	75.33	77.18	81.74	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	(66)

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

(67)m=	14.35	12.75	10.37	7.85	5.87	4.95	5.35	6.96	9.34	11.85	13.83	14.75	(67)

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

(68)m=	160.96	162.63	158.42	149.46	138.15	127.52	120.42	118.75	122.95	131.92	143.23	153.86	(68)

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

(69)m=	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	(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=	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	(71)

Water heating gains (Table 5)

(72)m=	111.66	109.85	106.11	101.02	97.72	93.06	89.11	94.18	95.98	101.24	107.19	109.86	(72)

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

(73)m=	340.66	338.92	328.59	312.02	295.42	279.23	268.57	273.57	281.96	298.7	317.95	332.16	(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	1.65	x	36.79	0.63	x	0.7	=	37.11	(79)
Southwest 0.9x	0.77	x	2.12	x	36.79	0.63	x	0.7	=	23.84	(79)
Southwest 0.9x	0.77	x	1.65	x	62.67	0.63	x	0.7	=	63.21	(79)
Southwest 0.9x	0.77	x	2.12	x	62.67	0.63	x	0.7	=	40.61	(79)
Southwest 0.9x	0.77	x	1.65	x	85.75	0.63	x	0.7	=	86.48	(79)

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Southwest	0.9x	0.77	x	2.12	x	85.75		0.63	x	0.7	=	55.56	(79)
Southwest	0.9x	0.77	x	1.65	x	106.25		0.63	x	0.7	=	107.16	(79)
Southwest	0.9x	0.77	x	2.12	x	106.25		0.63	x	0.7	=	68.84	(79)
Southwest	0.9x	0.77	x	1.65	x	119.01		0.63	x	0.7	=	120.02	(79)
Southwest	0.9x	0.77	x	2.12	x	119.01		0.63	x	0.7	=	77.11	(79)
Southwest	0.9x	0.77	x	1.65	x	118.15		0.63	x	0.7	=	119.16	(79)
Southwest	0.9x	0.77	x	2.12	x	118.15		0.63	x	0.7	=	76.55	(79)
Southwest	0.9x	0.77	x	1.65	x	113.91		0.63	x	0.7	=	114.88	(79)
Southwest	0.9x	0.77	x	2.12	x	113.91		0.63	x	0.7	=	73.8	(79)
Southwest	0.9x	0.77	x	1.65	x	104.39		0.63	x	0.7	=	105.28	(79)
Southwest	0.9x	0.77	x	2.12	x	104.39		0.63	x	0.7	=	67.63	(79)
Southwest	0.9x	0.77	x	1.65	x	92.85		0.63	x	0.7	=	93.64	(79)
Southwest	0.9x	0.77	x	2.12	x	92.85		0.63	x	0.7	=	60.16	(79)
Southwest	0.9x	0.77	x	1.65	x	69.27		0.63	x	0.7	=	69.86	(79)
Southwest	0.9x	0.77	x	2.12	x	69.27		0.63	x	0.7	=	44.88	(79)
Southwest	0.9x	0.77	x	1.65	x	44.07		0.63	x	0.7	=	44.45	(79)
Southwest	0.9x	0.77	x	2.12	x	44.07		0.63	x	0.7	=	28.55	(79)
Southwest	0.9x	0.77	x	1.65	x	31.49		0.63	x	0.7	=	31.76	(79)
Southwest	0.9x	0.77	x	2.12	x	31.49		0.63	x	0.7	=	20.4	(79)
Northwest	0.9x	0.77	x	3.64	x	11.28	x	0.63	x	0.7	=	25.1	(81)
Northwest	0.9x	0.77	x	3.64	x	22.97	x	0.63	x	0.7	=	51.1	(81)
Northwest	0.9x	0.77	x	3.64	x	41.38	x	0.63	x	0.7	=	92.06	(81)
Northwest	0.9x	0.77	x	3.64	x	67.96	x	0.63	x	0.7	=	151.19	(81)
Northwest	0.9x	0.77	x	3.64	x	91.35	x	0.63	x	0.7	=	203.23	(81)
Northwest	0.9x	0.77	x	3.64	x	97.38	x	0.63	x	0.7	=	216.67	(81)
Northwest	0.9x	0.77	x	3.64	x	91.1	x	0.63	x	0.7	=	202.69	(81)
Northwest	0.9x	0.77	x	3.64	x	72.63	x	0.63	x	0.7	=	161.58	(81)
Northwest	0.9x	0.77	x	3.64	x	50.42	x	0.63	x	0.7	=	112.18	(81)
Northwest	0.9x	0.77	x	3.64	x	28.07	x	0.63	x	0.7	=	62.45	(81)
Northwest	0.9x	0.77	x	3.64	x	14.2	x	0.63	x	0.7	=	31.59	(81)
Northwest	0.9x	0.77	x	3.64	x	9.21	x	0.63	x	0.7	=	20.5	(81)

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

(83)m=	86.05	154.91	234.1	327.19	400.36	412.37	391.37	334.5	265.98	177.18	104.59	72.66	(83)

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

(84)m=	426.71	493.83	562.69	639.21	695.79	691.6	659.94	608.07	547.94	475.89	422.53	404.82	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.9	0.76	0.57	0.42	0.47	0.73	0.94	0.99	1	(86)

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

(87)m=	19.88	20.06	20.33	20.66	20.89	20.98	21	20.99	20.93	20.63	20.19	19.85	(87)

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

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

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

(89)m=	0.99	0.98	0.96	0.87	0.7	0.48	0.32	0.37	0.65	0.91	0.98	0.99	(89)

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

(90)m=	18.47	18.73	19.12	19.58	19.86	19.95	19.96	19.96	19.91	19.55	18.93	18.43	(90)

fLA = Living area ÷ (4) = 0.52 (91)

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

(92)m=	19.2	19.42	19.75	20.14	20.39	20.48	20.5	20.5	20.44	20.11	19.59	19.16	(92)

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

(93)m=	19.2	19.42	19.75	20.14	20.39	20.48	20.5	20.5	20.44	20.11	19.59	19.16	(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	0.73	0.53	0.37	0.42	0.69	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	422.51	483.98	536.61	561.81	507.01	365.48	246.26	257.51	376.5	436.55	414.16	401.67	(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=	968.99	941.95	857.86	720.79	556.34	373.39	247.37	259.56	403.77	608.54	802.17	965.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	406.58	307.75	239.02	114.46	36.7	0	0	0	0	127.96	279.36	419.15	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1930.98 (98)

Space heating requirement in kWh/m²/year 34.92 (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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	406.58	307.75	239.02	114.46	36.7	0	0	0	0	127.96	279.36	419.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	434.84	329.15	255.63	122.42	39.26	0	0	0	0	136.85	298.78	448.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2065.22 (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)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

	178.24	157.35	165.83	149.46	147.05	132.23	127.79	139.12	138.53	154.94	162.82	174.22	
Efficiency of water heater													79.8 (216)
(217)m=	86.95	86.57	85.79	84.11	81.73	79.8	79.8	79.8	79.8	84.31	86.24	87.07	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	205	181.75	193.3	177.69	179.92	165.7	160.13	174.34	173.6	183.78	188.8	200.09

Total = Sum(219a)$_{1...12}$ = 2184.1 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2065.22	
Water heating fuel used			2184.1	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			253.42	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	446.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	471.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =			917.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	131.52	(268)
Total CO2, kg/year		sum of (265)…(271) =		1088.3	(272)

TER = 19.68 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:43:08

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 64.7m²

Site Reference : Tottenham Mews **Plot Reference:** 5_02 - 2B3P

Address :

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	20.35 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.70 kg/m²	Fail

Excess emissions = 1.35 kg/m² (6.6 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	56.9 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

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

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature		
Overheating risk (Thames valley):	Medium	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	6.82m²	
Windows facing: North East	9.51m²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

10 Key features	
Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from boilers – mains gas	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_02 - 2B3P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	64.7	(1a) x	2.65	(2a) =	171.45	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		171.45	(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	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.12	(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

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14

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) = 66.3 (23c)

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

(24a)m=	0.32	0.31	0.31	0.3	0.29	0.28	0.28	0.28	0.28	0.29	0.3	0.31	(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	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=	0.32	0.31	0.31	0.3	0.29	0.28	0.28	0.28	0.28	0.29	0.3	0.31	(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			6.82	x1/[1/(1.1)+ 0.04]		=	7.19			(27)
Windows Type 2			3.17	x1/[1/(1.1)+ 0.04]		=	3.34			(27)
Walls Type1	57.5	16.33	41.17	x	0.2	=	8.23			(29)
Walls Type2	14.8	0	14.8	x	0.19	=	2.74			(29)
Roof	64.7	0	64.7	x	0.14	=	9.06			(30)
Total area of elements, m²			137							(31)

** 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) = 37.24 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 582.3 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 20.55 (36)

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

Total fabric heat loss (33) + (36) = 57.79 (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=	17.92	17.76	17.59	16.77	16.6	15.78	15.78	15.62	16.11	16.6	16.93	17.26	(38)

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

(39)m=	75.71	75.54	75.38	74.56	74.39	73.57	73.57	73.41	73.9	74.39	74.72	75.05	

Average = Sum(39)$_{1\dots12}$ /12= 74.52 (39)

DER WorkSheet: New dwelling design stage

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

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

Average = Sum(40)$_{1…12}$ /12= 1.15 (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 2.11 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 84.33 (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=	92.77	89.39	86.02	82.65	79.27	75.9	75.9	79.27	82.65	86.02	89.39	92.77

Total = Sum(44)$_{1…12}$ = 1012.02 (44)

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

(45)m=	137.57	120.32	124.16	108.25	103.87	89.63	83.05	95.31	96.44	112.4	122.69	133.23

Total = Sum(45)$_{1…12}$ = 1326.91 (45)

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

(46)m=	20.64	18.05	18.62	16.24	15.58	13.44	12.46	14.3	14.47	16.86	18.4	19.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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=	202.5	178.97	189.09	171.08	168.79	152.46	147.98	160.23	159.28	177.32	185.52	198.16	(62)

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

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

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

Output from water heater

(64)m=	202.5	178.97	189.09	171.08	168.79	152.46	147.98	160.23	159.28	177.32	185.52	198.16	

Output from water heater (annual)$_{1...12}$ 2091.37 (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=	97.68	86.92	93.22	86.26	86.48	80.07	79.56	83.63	82.33	89.31	91.06	96.24	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	16.46	14.62	11.89	9	6.73	5.68	6.14	7.98	10.71	13.6	15.87	16.92	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	184.63	186.54	181.71	171.44	158.46	146.27	138.12	136.21	141.03	151.31	164.29	176.48	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	(71)
Water heating gains (Table 5)													
(72)m=	131.3	129.35	125.3	119.8	116.23	111.2	106.93	112.41	114.35	120.04	126.47	129.36	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	387.05	385.17	373.57	354.9	336.09	317.82	305.85	311.25	320.76	339.62	361.29	377.42	(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	6.82	x	11.28	x	0.44	x	0.8	=	18.77	(75)
Northeast 0.9x	0.77	x	3.17	x	11.28	x	0.44	x	0.8	=	26.17	(75)
Northeast 0.9x	0.77	x	6.82	x	22.97	x	0.44	x	0.8	=	38.21	(75)
Northeast 0.9x	0.77	x	3.17	x	22.97	x	0.44	x	0.8	=	53.28	(75)
Northeast 0.9x	0.77	x	6.82	x	41.38	x	0.44	x	0.8	=	68.84	(75)

Northeast 0.9x	0.77	x	3.17	x	41.38	x	0.44	x	0.8	=	95.99	(75)
Northeast 0.9x	0.77	x	6.82	x	67.96	x	0.44	x	0.8	=	113.05	(75)
Northeast 0.9x	0.77	x	3.17	x	67.96	x	0.44	x	0.8	=	157.65	(75)
Northeast 0.9x	0.77	x	6.82	x	91.35	x	0.44	x	0.8	=	151.97	(75)
Northeast 0.9x	0.77	x	3.17	x	91.35	x	0.44	x	0.8	=	211.91	(75)
Northeast 0.9x	0.77	x	6.82	x	97.38	x	0.44	x	0.8	=	162.01	(75)
Northeast 0.9x	0.77	x	3.17	x	97.38	x	0.44	x	0.8	=	225.92	(75)
Northeast 0.9x	0.77	x	6.82	x	91.1	x	0.44	x	0.8	=	151.56	(75)
Northeast 0.9x	0.77	x	3.17	x	91.1	x	0.44	x	0.8	=	211.34	(75)
Northeast 0.9x	0.77	x	6.82	x	72.63	x	0.44	x	0.8	=	120.83	(75)
Northeast 0.9x	0.77	x	3.17	x	72.63	x	0.44	x	0.8	=	168.48	(75)
Northeast 0.9x	0.77	x	6.82	x	50.42	x	0.44	x	0.8	=	83.88	(75)
Northeast 0.9x	0.77	x	3.17	x	50.42	x	0.44	x	0.8	=	116.97	(75)
Northeast 0.9x	0.77	x	6.82	x	28.07	x	0.44	x	0.8	=	46.69	(75)
Northeast 0.9x	0.77	x	3.17	x	28.07	x	0.44	x	0.8	=	65.11	(75)
Northeast 0.9x	0.77	x	6.82	x	14.2	x	0.44	x	0.8	=	23.62	(75)
Northeast 0.9x	0.77	x	3.17	x	14.2	x	0.44	x	0.8	=	32.93	(75)
Northeast 0.9x	0.77	x	6.82	x	9.21	x	0.44	x	0.8	=	15.33	(75)
Northeast 0.9x	0.77	x	3.17	x	9.21	x	0.44	x	0.8	=	21.38	(75)

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

(83)m=	44.95	91.49	164.83	270.7	363.87	387.93	362.9	289.31	200.85	111.8	56.55	36.7	(83)

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

(84)m=	431.99	476.66	538.4	625.6	699.96	705.75	668.75	600.56	521.61	451.42	417.84	414.12	(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=	0.96	0.94	0.91	0.84	0.72	0.57	0.44	0.5	0.72	0.88	0.94	0.96	(86)

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

(87)m=	18.67	18.9	19.35	19.96	20.48	20.81	20.93	20.9	20.62	19.96	19.22	18.63	(87)

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

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

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

(89)m=	0.95	0.94	0.9	0.81	0.67	0.5	0.35	0.41	0.65	0.86	0.93	0.96	(89)

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

(90)m=	16.84	17.17	17.82	18.68	19.38	19.8	19.92	19.9	19.59	18.71	17.65	16.78	(90)

fLA = Living area ÷ (4) = 0.56 (91)

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

(92)m=	17.86	18.13	18.67	19.4	20	20.36	20.48	20.46	20.17	19.41	18.53	17.81	(92)

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

(93)m=	17.86	18.13	18.67	19.4	20	20.36	20.48	20.46	20.17	19.41	18.53	17.81	(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=	0.94	0.92	0.88	0.8	0.68	0.53	0.4	0.45	0.67	0.84	0.91	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	403.97	437.15	472.75	499.23	473.25	371.15	267.31	272.1	347.97	379.63	381.91	389.55	(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=	1026.54	999.72	917.35	782.5	617.1	423.68	285.63	297.81	448.31	655.21	853.85	1021.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	463.19	378.04	330.79	203.95	107.02	0	0	0	0	205.03	339.79	470.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2498.06	(98)
Space heating requirement in kWh/m²/year	38.61	(99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2498.06	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2622.96	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2091.37	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2195.94	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.19	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		125.51	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			125.51	(331)
Energy for lighting (calculated in Appendix L)				290.68	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				89.5	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1163	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.01	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1188.01	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1188.01	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	65.14	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	150.86	(379)
Total CO2, kg/year	sum of (376)…(382) =				1404.01	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				21.7	(384)
EI rating (section 14)					82.85	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_02 - 2B3P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	64.7	(1a) x	2.65	(2a) =	171.45	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.45	(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) =	0.12	(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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(21)

Infiltration rate modified for monthly wind speed

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

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

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

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=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(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			6.76	x1/[1/(1.4)+ 0.04]		=	8.96			(27)
Windows Type 2			3.14	x1/[1/(1.4)+ 0.04]		=	4.16			(27)
Walls Type1	57.5	16.18	41.32	x	0.18	=	7.44			(29)
Walls Type2	14.8	0	14.8	x	0.18	=	2.66			(29)
Roof	64.7	0	64.7	x	0.13	=	8.41			(30)
Total area of elements, m²			137							(31)

** 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) = 39.96 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 582.3 (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 6.85 (36)

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

Total fabric heat loss (33) + (36) = 46.81 (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=	32	31.86	31.72	31.05	30.93	30.35	30.35	30.24	30.57	30.93	31.18	31.44	(38)

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

(39)m=	78.82	78.67	78.53	77.87	77.74	77.16	77.16	77.06	77.39	77.74	77.99	78.26	

Average = Sum(39)$_{1…12}$ /12= 77.87 (39)

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

(40)m=	1.22	1.22	1.21	1.2	1.2	1.19	1.19	1.19	1.2	1.2	1.21	1.21

Average = Sum(40)1…12 /12= 1.2 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.11 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 84.33 (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=	92.77	89.39	86.02	82.65	79.27	75.9	75.9	79.27	82.65	86.02	89.39	92.77	
Total = Sum(44)1…12 =												1012.02	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	137.57	120.32	124.16	108.25	103.87	89.63	83.05	95.31	96.44	112.4	122.69	133.23	
Total = Sum(45)1…12 =												1326.91	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	20.64	18.05	18.62	16.24	15.58	13.44	12.46	14.3	14.47	16.86	18.4	19.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	188.5	166.32	175.09	157.53	154.79	138.91	133.98	146.23	145.73	163.32	171.97	184.16	(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=	188.5	166.32	175.09	157.53	154.79	138.91	133.98	146.23	145.73	163.32	171.97	184.16

Output from water heater (annual)$_{1...12}$ 1926.53 (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=	86.48	76.81	82.02	75.42	75.28	69.23	68.36	72.43	71.49	78.11	80.22	85.04	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	16.46	14.62	11.89	9	6.73	5.68	6.14	7.98	10.71	13.6	15.87	16.92	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	184.63	186.54	181.71	171.44	158.46	146.27	138.12	136.21	141.03	151.31	164.29	176.48	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	(71)
Water heating gains (Table 5)													
(72)m=	116.24	114.29	110.25	104.75	101.18	96.15	91.88	97.35	99.3	104.99	111.42	114.3	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	374.99	373.12	361.52	342.85	324.03	305.76	293.8	299.2	308.7	327.56	349.24	365.36	(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	6.76	x	11.28	x	0.63	x	0.7	=	23.31	(75)
Northeast 0.9x	0.77	x	3.14	x	11.28	x	0.63	x	0.7	=	32.48	(75)
Northeast 0.9x	0.77	x	6.76	x	22.97	x	0.63	x	0.7	=	47.45	(75)
Northeast 0.9x	0.77	x	3.14	x	22.97	x	0.63	x	0.7	=	66.12	(75)
Northeast 0.9x	0.77	x	6.76	x	41.38	x	0.63	x	0.7	=	85.49	(75)

Northeast 0.9x	0.77	x	3.14	x	41.38	x	0.63	x	0.7	=	119.12	(75)
Northeast 0.9x	0.77	x	6.76	x	67.96	x	0.63	x	0.7	=	140.39	(75)
Northeast 0.9x	0.77	x	3.14	x	67.96	x	0.63	x	0.7	=	195.64	(75)
Northeast 0.9x	0.77	x	6.76	x	91.35	x	0.63	x	0.7	=	188.72	(75)
Northeast 0.9x	0.77	x	3.14	x	91.35	x	0.63	x	0.7	=	262.97	(75)
Northeast 0.9x	0.77	x	6.76	x	97.38	x	0.63	x	0.7	=	201.19	(75)
Northeast 0.9x	0.77	x	3.14	x	97.38	x	0.63	x	0.7	=	280.36	(75)
Northeast 0.9x	0.77	x	6.76	x	91.1	x	0.63	x	0.7	=	188.21	(75)
Northeast 0.9x	0.77	x	3.14	x	91.1	x	0.63	x	0.7	=	262.27	(75)
Northeast 0.9x	0.77	x	6.76	x	72.63	x	0.63	x	0.7	=	150.04	(75)
Northeast 0.9x	0.77	x	3.14	x	72.63	x	0.63	x	0.7	=	209.08	(75)
Northeast 0.9x	0.77	x	6.76	x	50.42	x	0.63	x	0.7	=	104.17	(75)
Northeast 0.9x	0.77	x	3.14	x	50.42	x	0.63	x	0.7	=	145.15	(75)
Northeast 0.9x	0.77	x	6.76	x	28.07	x	0.63	x	0.7	=	57.99	(75)
Northeast 0.9x	0.77	x	3.14	x	28.07	x	0.63	x	0.7	=	80.8	(75)
Northeast 0.9x	0.77	x	6.76	x	14.2	x	0.63	x	0.7	=	29.33	(75)
Northeast 0.9x	0.77	x	3.14	x	14.2	x	0.63	x	0.7	=	40.87	(75)
Northeast 0.9x	0.77	x	6.76	x	9.21	x	0.63	x	0.7	=	19.04	(75)
Northeast 0.9x	0.77	x	3.14	x	9.21	x	0.63	x	0.7	=	26.53	(75)

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

(83)m=	55.79	113.57	204.61	336.03	451.69	481.55	450.48	359.13	249.32	138.79	70.2	45.56	(83)

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

(84)m=	430.78	486.69	566.13	678.88	775.72	787.31	744.28	658.33	558.02	466.35	419.44	410.93	(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	0.8	0.6	0.45	0.53	0.81	0.97	0.99	1	(86)

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

(87)m=	19.73	19.88	20.16	20.56	20.85	20.97	20.99	20.99	20.88	20.49	20.04	19.7	(87)

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

(88)m=	19.91	19.91	19.91	19.92	19.92	19.93	19.93	19.93	19.92	19.92	19.92	19.91	(88)

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

(89)m=	1	0.99	0.98	0.91	0.74	0.51	0.34	0.41	0.73	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=	18.22	18.44	18.86	19.41	19.78	19.91	19.92	19.92	19.83	19.33	18.69	18.19	(90)

fLA = Living area ÷ (4) = 0.56 (91)

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

(92)m=	19.06	19.24	19.59	20.05	20.38	20.5	20.52	20.52	20.42	19.98	19.44	19.03	(92)

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

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	19.06	19.24	19.59	20.05	20.38	20.5	20.52	20.52	20.42	19.98	19.44	19.03		(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	0.77	0.56	0.4	0.47	0.77	0.96	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	428.48	481.79	551.25	619.96	594.71	441.55	300.34	312.56	430.04	445.6	415.16	409.16		(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=	1163.59	1128.33	1027.69	868.24	674.71	455.36	302.57	317.27	488.98	728.92	962.65	1160.7		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	546.92	434.48	354.47	178.76	59.52	0	0	0	0	210.79	394.19	559.15		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													2738.27	(98)
Space heating requirement in kWh/m²/year													42.32	(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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	546.92	434.48	354.47	178.76	59.52	0	0	0	0	210.79	394.19	559.15		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	584.94	464.68	379.11	191.18	63.66	0	0	0	0	225.44	421.59	598.02		
Total (kWh/year) =Sum(211)1...5,10...12=													2928.63	(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)														
	188.5	166.32	175.09	157.53	154.79	138.91	133.98	146.23	145.73	163.32	171.97	184.16		
Efficiency of water heater													79.8	(216)
(217)m=	87.49	87.26	86.66	85.15	82.51	79.8	79.8	79.8	79.8	85.5	86.96	87.59		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	215.44	190.6	202.04	185	187.61	174.07	167.89	183.25	182.61	191.03	197.76	210.25		
Total = Sum(219a)1...12 =													2287.57	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2928.63

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Water heating fuel used			2287.57	
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			290.68	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	632.58	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	494.11	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1126.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	150.86	(268)
Total CO2, kg/year		sum of (265)…(271) =		1316.49	(272)

TER = 20.35 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:43:07

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 63.8m²

Site Reference : Tottenham Mews **Plot Reference:** 5_03 - 2B3P

Address :

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	20.77 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.03 kg/m²	**Fail**

Excess emissions = 2.26 kg/m² (10.9 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	61.5 kWh/m²	
		Fail

Excess energy = 1.22 kg/m² (02.0 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**OK**
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	**OK**
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

Regulations Compliance Report

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: North East	9.51m²
Windows facing: South East	6.82m²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from boilers – mains gas	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_03 - 2B3P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	63.8	(1a) x	2.65	(2a) =	169.07	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	169.07	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) = 66.3 (23c)

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

(24a)m=	0.33	0.33	0.32	0.31	0.31	0.29	0.29	0.29	0.3	0.31	0.31	0.32	(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	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=	0.33	0.33	0.32	0.31	0.31	0.29	0.29	0.29	0.3	0.31	0.31	0.32	(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			3.17	x1/[1/(1.1)+ 0.04]		=	3.34			(27)
Windows Type 2			6.82	x1/[1/(1.1)+ 0.04]		=	7.19			(27)
Walls Type1	81.6	16.33	65.27	x	0.2	=	13.05			(29)
Walls Type2	15.6	0	15.6	x	0.19	=	2.89			(29)
Roof	63.8	0	63.8	x	0.14	=	8.93			(30)
Total area of elements, m²			161							(31)

** 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) = 42.08 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 574.2 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 24.15 (36)

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

Total fabric heat loss (33) + (36) = 66.23 (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=	18.47	18.29	18.12	17.23	17.05	16.16	16.16	15.98	16.51	17.05	17.4	17.76	(38)

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

(39)m=	84.7	84.52	84.35	83.46	83.28	82.39	82.39	82.21	82.75	83.28	83.63	83.99	

Average = Sum(39)$_{1…12}$ /12= 83.41 (39)

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

(40)m=	1.33	1.32	1.32	1.31	1.31	1.29	1.29	1.29	1.3	1.31	1.31	1.32

Average = Sum(40)1…12 /12= 1.31 (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 2.09 (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 83.76 (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=	92.14	88.79	85.44	82.09	78.74	75.39	75.39	78.74	82.09	85.44	88.79	92.14	
												Total = Sum(44)1…12 = 1005.13	(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=	136.64	119.5	123.32	107.51	103.16	89.02	82.49	94.66	95.79	111.63	121.85	132.33	
												Total = Sum(45)1…12 = 1317.89	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	20.5	17.93	18.5	16.13	15.47	13.35	12.37	14.2	14.37	16.74	18.28	19.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	201.56	178.15	188.24	170.34	168.09	151.85	147.42	159.58	158.62	176.56	184.69	197.25	(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=	201.56	178.15	188.24	170.34	168.09	151.85	147.42	159.58	158.62	176.56	184.69	197.25	

Output from water heater (annual)$_{1...12}$ 2082.35 (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=	97.37	86.65	92.94	86.01	86.24	79.86	79.37	83.41	82.11	89.06	90.78	95.94	(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=	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	(66)

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

(67)m=	16.26	14.44	11.75	8.89	6.65	5.61	6.06	7.88	10.58	13.43	15.68	16.71	(67)

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

(68)m=	182.42	184.31	179.54	169.39	156.57	144.52	136.47	134.58	139.35	149.5	162.32	174.37	(68)

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

(69)m=	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	(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=	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	(71)

Water heating gains (Table 5)

(72)m=	130.88	128.94	124.92	119.46	115.92	110.92	106.68	112.12	114.05	119.7	126.09	128.95	(72)

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

(73)m=	383.86	382	370.52	352.04	333.43	315.36	303.52	308.88	318.28	336.94	358.39	374.34	(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	3.17	x	11.28	x	0.44	x	0.8	=	26.17	(75)
Northeast 0.9x	0.77	x	3.17	x	22.97	x	0.44	x	0.8	=	53.28	(75)
Northeast 0.9x	0.77	x	3.17	x	41.38	x	0.44	x	0.8	=	95.99	(75)
Northeast 0.9x	0.77	x	3.17	x	67.96	x	0.44	x	0.8	=	157.65	(75)
Northeast 0.9x	0.77	x	3.17	x	91.35	x	0.44	x	0.8	=	211.91	(75)

Northeast	0.9x	0.77	x	3.17	x	97.38	x	0.44	x	0.8	=	225.92	(75)
Northeast	0.9x	0.77	x	3.17	x	91.1	x	0.44	x	0.8	=	211.34	(75)
Northeast	0.9x	0.77	x	3.17	x	72.63	x	0.44	x	0.8	=	168.48	(75)
Northeast	0.9x	0.77	x	3.17	x	50.42	x	0.44	x	0.8	=	116.97	(75)
Northeast	0.9x	0.77	x	3.17	x	28.07	x	0.44	x	0.8	=	65.11	(75)
Northeast	0.9x	0.77	x	3.17	x	14.2	x	0.44	x	0.8	=	32.93	(75)
Northeast	0.9x	0.77	x	3.17	x	9.21	x	0.44	x	0.8	=	21.38	(75)
Southeast	0.9x	0.77	x	6.82	x	36.79	x	0.44	x	0.8	=	61.21	(77)
Southeast	0.9x	0.77	x	6.82	x	62.67	x	0.44	x	0.8	=	104.27	(77)
Southeast	0.9x	0.77	x	6.82	x	85.75	x	0.44	x	0.8	=	142.66	(77)
Southeast	0.9x	0.77	x	6.82	x	106.25	x	0.44	x	0.8	=	176.76	(77)
Southeast	0.9x	0.77	x	6.82	x	119.01	x	0.44	x	0.8	=	197.99	(77)
Southeast	0.9x	0.77	x	6.82	x	118.15	x	0.44	x	0.8	=	196.56	(77)
Southeast	0.9x	0.77	x	6.82	x	113.91	x	0.44	x	0.8	=	189.5	(77)
Southeast	0.9x	0.77	x	6.82	x	104.39	x	0.44	x	0.8	=	173.67	(77)
Southeast	0.9x	0.77	x	6.82	x	92.85	x	0.44	x	0.8	=	154.47	(77)
Southeast	0.9x	0.77	x	6.82	x	69.27	x	0.44	x	0.8	=	115.24	(77)
Southeast	0.9x	0.77	x	6.82	x	44.07	x	0.44	x	0.8	=	73.32	(77)
Southeast	0.9x	0.77	x	6.82	x	31.49	x	0.44	x	0.8	=	52.38	(77)

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

(83)m=	87.39	157.55	238.65	334.41	409.9	422.48	400.84	342.15	271.44	180.35	106.25	73.76	(83)

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

(84)m=	471.25	539.55	609.17	686.46	743.33	737.83	704.36	651.03	589.72	517.29	464.64	448.1	(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=	0.95	0.93	0.9	0.83	0.72	0.58	0.46	0.5	0.7	0.86	0.93	0.96	(86)

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

(87)m=	18.45	18.73	19.21	19.83	20.37	20.74	20.9	20.87	20.57	19.88	19.06	18.4	(87)

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

(88)m=	19.82	19.82	19.82	19.83	19.84	19.85	19.85	19.85	19.84	19.84	19.83	19.83	(88)

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

(89)m=	0.94	0.92	0.88	0.8	0.67	0.51	0.36	0.4	0.63	0.83	0.92	0.95	(89)

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

(90)m=	16.46	16.87	17.55	18.42	19.15	19.62	19.78	19.76	19.44	18.52	17.35	16.39	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	17.56	17.9	18.47	19.2	19.83	20.24	20.4	20.37	20.07	19.27	18.3	17.5	(92)

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

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(93)m=	17.56	17.9	18.47	19.2	19.83	20.24	20.4	20.37	20.07	19.27	18.3	17.5	(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=	0.92	0.9	0.86	0.78	0.67	0.53	0.41	0.45	0.64	0.81	0.9	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	435.2	484.78	521.63	536.71	500.7	394.63	287.38	293.32	379.26	421.08	417.18	416.94	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1123.45	1098.99	1009.67	859.73	676.69	464.87	313.16	326.79	493.73	722.31	936.97	1117.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	512.06	412.75	363.1	232.57	130.94	0	0	0	0	224.12	374.25	521.09	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2770.86	(98)
Space heating requirement in kWh/m²/year		43.43	(99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2770.86	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2909.41	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2082.35	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2186.46	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		123.76	(330a)

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	123.76	(331)
Energy for lighting (calculated in Appendix L)		287.21	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				89.5	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1229.84	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.45	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1256.29	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1256.29	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	64.23	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	149.06	(379)
Total CO2, kg/year	sum of (376)…(382) =				1469.58	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				23.03	(384)
EI rating (section 14)					81.9	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_03 - 2B3P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	63.8	(1a) x	2.65	(2a) =	169.07	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	169.07	(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) =	0.12	(8)

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

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

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.37	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

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

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

0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			3.1	x1/[1/(1.4)+ 0.04]		=	4.11			(27)
Windows Type 2			6.66	x1/[1/(1.4)+ 0.04]		=	8.83			(27)
Walls Type1	81.6	15.96	65.64	x	0.18	=	11.82			(29)
Walls Type2	15.6	0	15.6	x	0.18	=	2.81			(29)
Roof	63.8	0	63.8	x	0.13	=	8.29			(30)
Total area of elements, m²			161							(31)

** 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) = 44.08 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 574.2 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.05 (36)

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

Total fabric heat loss (33) + (36) = 52.13 (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=	32.34	32.17	32	31.2	31.06	30.36	30.36	30.24	30.63	31.06	31.36	31.67	(38)

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

(39)m=	84.47	84.29	84.13	83.33	83.18	82.49	82.49	82.36	82.76	83.18	83.48	83.8	

Average = Sum(39)$_{1…12}$ /12= 83.33 (39)

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

(40)m=	1.32	1.32	1.32	1.31	1.3	1.29	1.29	1.29	1.3	1.3	1.31	1.31

Average = Sum(40)$_{1…12}$ /12= 1.31 (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 — 2.09 (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 — 83.76 (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
(44)m=	92.14	88.79	85.44	82.09	78.74	75.39	75.39	78.74	82.09	85.44	88.79	92.14

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

Total = Sum(44)$_{1…12}$ = 1005.13 (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=	136.64	119.5	123.32	107.51	103.16	89.02	82.49	94.66	95.79	111.63	121.85	132.33

Total = Sum(45)$_{1…12}$ = 1317.89 (45)

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

(46)m=	20.5	17.93	18.5	16.13	15.47	13.35	12.37	14.2	14.37	16.74	18.28	19.85

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.65 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.89 (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) — 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66

(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66

(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	187.56	165.5	174.24	156.79	154.09	138.3	133.41	145.58	145.07	162.56	171.14	183.25	(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=	187.56	165.5	174.24	156.79	154.09	138.3	133.41	145.58	145.07	162.56	171.14	183.25	

Output from water heater (annual)$_{1...12}$ 1917.5 (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=	86.17	76.53	81.74	75.17	75.04	69.03	68.17	72.21	71.28	77.86	79.94	84.74	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	(66)

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

(67)m=	16.26	14.44	11.75	8.89	6.65	5.61	6.06	7.88	10.58	13.43	15.68	16.71	(67)

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

(68)m=	182.42	184.31	179.54	169.39	156.57	144.52	136.47	134.58	139.35	149.5	162.32	174.37	(68)

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

(69)m=	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	(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=	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	(71)

Water heating gains (Table 5)

(72)m=	115.82	113.89	109.87	104.41	100.86	95.87	91.62	97.06	98.99	104.65	111.03	113.9	(72)

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

(73)m=	371.81	369.95	358.46	339.99	321.38	303.3	291.46	296.82	306.22	324.89	346.34	362.28	(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	3.1	x	11.28	x	0.63	x	0.7	=	32.07	(75)
Northeast 0.9x	0.77	x	3.1	x	22.97	x	0.63	x	0.7	=	65.28	(75)
Northeast 0.9x	0.77	x	3.1	x	41.38	x	0.63	x	0.7	=	117.61	(75)
Northeast 0.9x	0.77	x	3.1	x	67.96	x	0.63	x	0.7	=	193.14	(75)
Northeast 0.9x	0.77	x	3.1	x	91.35	x	0.63	x	0.7	=	259.62	(75)

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Northeast	0.9x	0.77	x	3.1	x	97.38	x	0.63	x	0.7	=	276.79	(75)
Northeast	0.9x	0.77	x	3.1	x	91.1	x	0.63	x	0.7	=	258.93	(75)
Northeast	0.9x	0.77	x	3.1	x	72.63	x	0.63	x	0.7	=	206.42	(75)
Northeast	0.9x	0.77	x	3.1	x	50.42	x	0.63	x	0.7	=	143.31	(75)
Northeast	0.9x	0.77	x	3.1	x	28.07	x	0.63	x	0.7	=	79.77	(75)
Northeast	0.9x	0.77	x	3.1	x	14.2	x	0.63	x	0.7	=	40.35	(75)
Northeast	0.9x	0.77	x	3.1	x	9.21	x	0.63	x	0.7	=	26.19	(75)
Southeast	0.9x	0.77	x	6.66	x	36.79	x	0.63	x	0.7	=	74.89	(77)
Southeast	0.9x	0.77	x	6.66	x	62.67	x	0.63	x	0.7	=	127.56	(77)
Southeast	0.9x	0.77	x	6.66	x	85.75	x	0.63	x	0.7	=	174.54	(77)
Southeast	0.9x	0.77	x	6.66	x	106.25	x	0.63	x	0.7	=	216.26	(77)
Southeast	0.9x	0.77	x	6.66	x	119.01	x	0.63	x	0.7	=	242.23	(77)
Southeast	0.9x	0.77	x	6.66	x	118.15	x	0.63	x	0.7	=	240.48	(77)
Southeast	0.9x	0.77	x	6.66	x	113.91	x	0.63	x	0.7	=	231.85	(77)
Southeast	0.9x	0.77	x	6.66	x	104.39	x	0.63	x	0.7	=	212.47	(77)
Southeast	0.9x	0.77	x	6.66	x	92.85	x	0.63	x	0.7	=	188.99	(77)
Southeast	0.9x	0.77	x	6.66	x	69.27	x	0.63	x	0.7	=	140.99	(77)
Southeast	0.9x	0.77	x	6.66	x	44.07	x	0.63	x	0.7	=	89.7	(77)
Southeast	0.9x	0.77	x	6.66	x	31.49	x	0.63	x	0.7	=	64.09	(77)

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

(83)m=	106.96	192.84	292.15	409.41	501.86	517.27	490.78	418.89	332.29	220.76	130.05	90.28	(83)

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

(84)m=	478.76	562.79	650.61	749.4	823.24	820.57	782.24	715.72	638.52	545.65	476.39	452.56	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.79	0.61	0.46	0.52	0.77	0.95	0.99	1	(86)

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

(87)m=	19.67	19.86	20.16	20.54	20.83	20.96	20.99	20.99	20.89	20.5	20.01	19.63	(87)

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

(88)m=	19.82	19.82	19.83	19.84	19.84	19.85	19.85	19.85	19.84	19.84	19.83	19.83	(88)

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

(89)m=	0.99	0.99	0.96	0.89	0.73	0.51	0.34	0.39	0.68	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=	18.08	18.35	18.79	19.32	19.68	19.82	19.84	19.84	19.76	19.29	18.59	18.03	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	18.96	19.19	19.55	20	20.32	20.45	20.48	20.48	20.39	19.96	19.38	18.92	(92)

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

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(93)m=	18.96	19.19	19.55	20	20.32	20.45	20.48	20.48	20.39	19.96	19.38	18.92	(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	0.57	0.41	0.46	0.73	0.93	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	474.65	552.9	624.11	670.02	624.78	464.44	316.93	330.16	464.69	508.08	468.4	449.48		(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=	1238.17	1204.36	1097.91	924.88	716.82	482.92	320.11	335.78	520.23	778.84	1025.2	1233.42		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	568.06	437.79	352.51	183.49	68.48	0	0	0	0	201.44	400.89	583.25		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													2795.91	(98)
Space heating requirement in kWh/m²/year													43.82	(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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	568.06	437.79	352.51	183.49	68.48	0	0	0	0	201.44	400.89	583.25		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	607.55	468.22	377.01	196.25	73.24	0	0	0	0	215.45	428.76	623.8		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2990.28	(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)														
	187.56	165.5	174.24	156.79	154.09	138.3	133.41	145.58	145.07	162.56	171.14	183.25		
Efficiency of water heater													79.8	(216)
(217)m=	87.58	87.29	86.66	85.23	82.81	79.8	79.8	79.8	79.8	85.39	87.01	87.69		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	214.15	189.6	201.07	183.96	186.07	173.31	167.19	182.43	181.79	190.38	196.69	208.98		
Total = Sum(219a)$_{1...12}$ =													2275.62	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2990.28

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Water heating fuel used			2275.62	
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			287.21	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	645.9	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	491.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1137.43	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	149.06	(268)
Total CO2, kg/year		sum of (265)…(271) =		1325.42	(272)

TER = 20.77 (273)

APPENDIX B
SAP REPORTS – “BE GREEN” STAGE

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:44:48

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 85.3m²
Site Reference : Tottenham Mews **Plot Reference:** 0_02 - 2B4P
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 (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	27.01 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.30 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	48.0 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.20 (max. 0.70)	**OK**
Floor	0.06 (max. 0.25)	0.06 (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 using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Medium	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	2.59m²	
Windows facing: North East	2.59m²	
Windows facing: North East	5m²	
Ventilation rate:	2.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Floors U-value	0.06 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 0_02 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.3	(1a) x	2.65	(2a) =	226.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	226.05	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 66.3 (23c)

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

(24a)m=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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	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=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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			2.59	x1/[1/(1.1)+ 0.04]	=	2.73			(27)
Windows Type 2			2.59	x1/[1/(1.1)+ 0.04]	=	2.73			(27)
Windows Type 3			5	x1/[1/(1.1)+ 0.04]	=	5.27			(27)
Floor			85.3	x 0.06	=	5.118			(28)
Walls Type1	35.8	10.18	25.62	x 0.2	=	5.12			(29)
Walls Type2	45.1	0	45.1	x 0.19	=	8.35			(29)
Total area of elements, m²			166.2						(31)

* *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) = 29.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6397.5 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 24.93 (36)

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

Total fabric heat loss (33) + (36) = 54.25 (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=	22.56	22.36	22.16	21.18	20.99	20.01	20.01	19.81	20.4	20.99	21.38	21.77	(38)

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

(39)m=	76.81	76.61	76.41	75.43	75.24	74.26	74.26	74.06	74.65	75.24	75.63	76.02	

Average = Sum(39)$_{1…12}$ /12= 75.39 (39)

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

(40)m=	0.9	0.9	0.9	0.88	0.88	0.87	0.87	0.87	0.88	0.88	0.89	0.89

Average = Sum(40)$_{1…12}$ /12= 0.88 (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 2.56 (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 94.9 (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=	104.39	100.59	96.8	93	89.21	85.41	85.41	89.21	93	96.8	100.59	104.39

Total = Sum(44)$_{1…12}$ = 1138.8 (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=	154.81	135.4	139.72	121.81	116.88	100.86	93.46	107.24	108.53	126.48	138.06	149.92

Total = Sum(45)$_{1…12}$ = 1493.14 (45)

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

(46)m=	23.22	20.31	20.96	18.27	17.53	15.13	14.02	16.09	16.28	18.97	20.71	22.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	219.73	194.04	204.64	184.64	181.8	163.69	158.38	172.17	171.36	191.4	200.89	214.85	(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=	219.73	194.04	204.64	184.64	181.8	163.69	158.38	172.17	171.36	191.4	200.89	214.85

Output from water heater (annual)$_{1...12}$ 2257.6 (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=	103.41	91.93	98.4	90.77	90.8	83.8	83.02	87.6	86.35	93.99	96.17	101.79	(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=	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	(66)

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

(67)m=	23.21	20.62	16.77	12.69	9.49	8.01	8.66	11.25	15.1	19.17	22.38	23.86	(67)

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

(68)m=	230.16	232.55	226.53	213.72	197.54	182.34	172.19	169.8	175.82	188.63	204.8	220.01	(68)

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

(69)m=	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	(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=	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	(71)

Water heating gains (Table 5)

(72)m=	139	136.81	132.25	126.06	122.05	116.39	111.58	117.74	119.93	126.34	133.57	136.81	(72)

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

(73)m=	453.71	451.31	436.89	413.81	390.41	368.08	353.76	360.13	372.19	395.48	422.09	442.01	(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	0.54	x	2.59	x	11.28	x	0.44	x	0.8	=	5	(75)
Northeast 0.9x	0.54	x	2.59	x	11.28	x	0.44	x	0.8	=	5	(75)
Northeast 0.9x	0.54	x	5	x	11.28	x	0.44	x	0.8	=	9.65	(75)
Northeast 0.9x	0.54	x	2.59	x	22.97	x	0.44	x	0.8	=	10.18	(75)
Northeast 0.9x	0.54	x	2.59	x	22.97	x	0.44	x	0.8	=	10.18	(75)

Northeast 0.9x	0.54	x	5	x	22.97	x	0.44	x	0.8	=	19.64	(75)
Northeast 0.9x	0.54	x	2.59	x	41.38	x	0.44	x	0.8	=	18.33	(75)
Northeast 0.9x	0.54	x	2.59	x	41.38	x	0.44	x	0.8	=	18.33	(75)
Northeast 0.9x	0.54	x	5	x	41.38	x	0.44	x	0.8	=	35.39	(75)
Northeast 0.9x	0.54	x	2.59	x	67.96	x	0.44	x	0.8	=	30.11	(75)
Northeast 0.9x	0.54	x	2.59	x	67.96	x	0.44	x	0.8	=	30.11	(75)
Northeast 0.9x	0.54	x	5	x	67.96	x	0.44	x	0.8	=	58.13	(75)
Northeast 0.9x	0.54	x	2.59	x	91.35	x	0.44	x	0.8	=	40.47	(75)
Northeast 0.9x	0.54	x	2.59	x	91.35	x	0.44	x	0.8	=	40.47	(75)
Northeast 0.9x	0.54	x	5	x	91.35	x	0.44	x	0.8	=	78.13	(75)
Northeast 0.9x	0.54	x	2.59	x	97.38	x	0.44	x	0.8	=	43.15	(75)
Northeast 0.9x	0.54	x	2.59	x	97.38	x	0.44	x	0.8	=	43.15	(75)
Northeast 0.9x	0.54	x	5	x	97.38	x	0.44	x	0.8	=	83.3	(75)
Northeast 0.9x	0.54	x	2.59	x	91.1	x	0.44	x	0.8	=	40.36	(75)
Northeast 0.9x	0.54	x	2.59	x	91.1	x	0.44	x	0.8	=	40.36	(75)
Northeast 0.9x	0.54	x	5	x	91.1	x	0.44	x	0.8	=	77.92	(75)
Northeast 0.9x	0.54	x	2.59	x	72.63	x	0.44	x	0.8	=	32.18	(75)
Northeast 0.9x	0.54	x	2.59	x	72.63	x	0.44	x	0.8	=	32.18	(75)
Northeast 0.9x	0.54	x	5	x	72.63	x	0.44	x	0.8	=	62.12	(75)
Northeast 0.9x	0.54	x	2.59	x	50.42	x	0.44	x	0.8	=	22.34	(75)
Northeast 0.9x	0.54	x	2.59	x	50.42	x	0.44	x	0.8	=	22.34	(75)
Northeast 0.9x	0.54	x	5	x	50.42	x	0.44	x	0.8	=	43.13	(75)
Northeast 0.9x	0.54	x	2.59	x	28.07	x	0.44	x	0.8	=	12.44	(75)
Northeast 0.9x	0.54	x	2.59	x	28.07	x	0.44	x	0.8	=	12.44	(75)
Northeast 0.9x	0.54	x	5	x	28.07	x	0.44	x	0.8	=	24.01	(75)
Northeast 0.9x	0.54	x	2.59	x	14.2	x	0.44	x	0.8	=	6.29	(75)
Northeast 0.9x	0.54	x	2.59	x	14.2	x	0.44	x	0.8	=	6.29	(75)
Northeast 0.9x	0.54	x	5	x	14.2	x	0.44	x	0.8	=	12.14	(75)
Northeast 0.9x	0.54	x	2.59	x	9.21	x	0.44	x	0.8	=	4.08	(75)
Northeast 0.9x	0.54	x	2.59	x	9.21	x	0.44	x	0.8	=	4.08	(75)
Northeast 0.9x	0.54	x	5	x	9.21	x	0.44	x	0.8	=	7.88	(75)

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

(83)m=	19.65	40	72.06	118.35	159.08	169.6	158.65	126.48	87.81	48.88	24.72	16.05	(83)

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

(84)m=	473.35	491.3	508.95	532.16	549.5	537.67	512.41	486.61	459.99	444.36	446.81	458.06	(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=	0.97	0.96	0.95	0.91	0.84	0.71	0.57	0.61	0.8	0.92	0.96	0.97	(86)

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

(87)m=	19.11	19.26	19.56	20.01	20.45	20.78	20.92	20.9	20.66	20.13	19.56	19.09	(87)

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

(88)m=	20.17	20.17	20.17	20.18	20.18	20.19	20.19	20.19	20.19	20.18	20.18	20.17	(88)

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

(89)m=	0.97	0.96	0.94	0.9	0.81	0.65	0.49	0.53	0.75	0.9	0.95	0.97	(89)

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

(90)m=	17.61	17.82	18.27	18.92	19.53	19.97	20.13	20.11	19.82	19.1	18.27	17.58	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

(92)m=	18.34	18.52	18.9	19.45	19.98	20.37	20.52	20.5	20.23	19.6	18.9	18.31	(92)

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

(93)m=	18.34	18.52	18.9	19.45	19.98	20.37	20.52	20.5	20.23	19.6	18.9	18.31	(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=	0.95	0.94	0.93	0.88	0.8	0.67	0.52	0.56	0.76	0.89	0.94	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	451.14	464.13	470.9	469.35	440.24	358.09	267.2	273.17	347.33	394.06	418.85	438.33	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1078.62	1043.54	947.58	796.15	622.84	428.41	290.91	303.5	457.61	677.5	892.78	1073.05	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	466.84	389.36	354.65	235.3	135.85	0	0	0	0	210.88	341.23	472.23	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2606.35 (98)

Space heating requirement in kWh/m²/year 30.56 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2606.35	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2736.67	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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

Water heating

Annual water heating requirement		2257.6	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2370.48	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	51.07	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		165.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	165.46	(331)
Energy for lighting (calculated in Appendix L)		409.9	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-647.15	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1060.24	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.51	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1086.75	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1086.75	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	85.88	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	212.74	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-335.87	(380)
Total CO2, kg/year	sum of (376)…(382) =				1049.49	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				12.3	(384)
EI rating (section 14)					89.21	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 0_02 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	85.3	(1a)	x	2.65	(2a)	=	226.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.3	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	226.05	(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) =	0.13	(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)	0.38	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.27	(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

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

0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31

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=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

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

(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			2.59	x1/[1/(1.4)+ 0.04] =	3.43			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04] =	3.43			(27)
Windows Type 3			5	x1/[1/(1.4)+ 0.04] =	6.63			(27)
Floor			85.3	x 0.13 =	11.089			(28)
Walls Type1	35.8	10.18	25.62	x 0.18 =	4.61			(29)
Walls Type2	45.1	0	45.1	x 0.18 =	8.12			(29)
Total area of elements, m²			166.2					(31)

** 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) = 37.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6397.5 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.31 (36)

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

Total fabric heat loss (33) + (36) = 45.62 (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=	41.65	41.48	41.31	40.54	40.39	39.71	39.71	39.59	39.97	40.39	40.69	40.99	(38)

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

(39)m=	87.27	87.1	86.94	86.16	86.02	85.34	85.34	85.21	85.6	86.02	86.31	86.62	

Average = Sum(39)$_{1…12}$ /12= 86.16 (39)

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

(40)m=	1.02	1.02	1.02	1.01	1.01	1	1	1	1	1.01	1.01	1.02

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.56 (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 94.9 (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=	104.39	100.59	96.8	93	89.21	85.41	85.41	89.21	93	96.8	100.59	104.39	
									Total = Sum(44)$_{1...12}$ =			1138.8	(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=	154.81	135.4	139.72	121.81	116.88	100.86	93.46	107.24	108.53	126.48	138.06	149.92	
									Total = Sum(45)$_{1...12}$ =			1493.14	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	23.22	20.31	20.96	18.27	17.53	15.13	14.02	16.09	16.28	18.97	20.71	22.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	205.73	181.39	190.64	171.09	167.8	150.14	144.38	158.17	157.81	177.4	187.34	200.85	(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=	205.73	181.39	190.64	171.09	167.8	150.14	144.38	158.17	157.81	177.4	187.34	200.85	

Output from water heater (annual)$_{1...12}$ 2092.75 (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=	92.21	81.82	87.2	79.93	79.6	72.96	71.82	76.4	75.51	82.79	85.33	90.59	(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=	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	(66)

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

(67)m=	23.88	21.21	17.25	13.06	9.76	8.24	8.9	11.57	15.53	19.73	23.02	24.54	(67)

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

(68)m=	230.16	232.55	226.53	213.72	197.54	182.34	172.19	169.8	175.82	188.63	204.8	220.01	(68)

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

(69)m=	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	(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=	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	(71)

Water heating gains (Table 5)

(72)m=	123.94	121.75	117.2	111.01	106.99	101.34	96.53	102.69	104.88	111.28	118.52	121.76	(72)

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

(73)m=	442.32	439.85	425.31	402.12	378.63	356.26	341.95	348.4	360.57	383.97	410.68	430.65	(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)	
Northeast 0.9x	0.54	x	2.59	x	11.28	x	0.63	x	0.7	=	6.26	(75)
Northeast 0.9x	0.54	x	2.59	x	11.28	x	0.63	x	0.7	=	6.26	(75)
Northeast 0.9x	0.54	x	5	x	11.28	x	0.63	x	0.7	=	12.09	(75)
Northeast 0.9x	0.54	x	2.59	x	22.97	x	0.63	x	0.7	=	12.75	(75)
Northeast 0.9x	0.54	x	2.59	x	22.97	x	0.63	x	0.7	=	12.75	(75)

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Northeast 0.9x	0.54	x	5	x	22.97	x	0.63	x	0.7	=	24.61	(75)
Northeast 0.9x	0.54	x	2.59	x	41.38	x	0.63	x	0.7	=	22.97	(75)
Northeast 0.9x	0.54	x	2.59	x	41.38	x	0.63	x	0.7	=	22.97	(75)
Northeast 0.9x	0.54	x	5	x	41.38	x	0.63	x	0.7	=	44.34	(75)
Northeast 0.9x	0.54	x	2.59	x	67.96	x	0.63	x	0.7	=	37.72	(75)
Northeast 0.9x	0.54	x	2.59	x	67.96	x	0.63	x	0.7	=	37.72	(75)
Northeast 0.9x	0.54	x	5	x	67.96	x	0.63	x	0.7	=	72.82	(75)
Northeast 0.9x	0.54	x	2.59	x	91.35	x	0.63	x	0.7	=	50.71	(75)
Northeast 0.9x	0.54	x	2.59	x	91.35	x	0.63	x	0.7	=	50.71	(75)
Northeast 0.9x	0.54	x	5	x	91.35	x	0.63	x	0.7	=	97.89	(75)
Northeast 0.9x	0.54	x	2.59	x	97.38	x	0.63	x	0.7	=	54.06	(75)
Northeast 0.9x	0.54	x	2.59	x	97.38	x	0.63	x	0.7	=	54.06	(75)
Northeast 0.9x	0.54	x	5	x	97.38	x	0.63	x	0.7	=	104.36	(75)
Northeast 0.9x	0.54	x	2.59	x	91.1	x	0.63	x	0.7	=	50.57	(75)
Northeast 0.9x	0.54	x	2.59	x	91.1	x	0.63	x	0.7	=	50.57	(75)
Northeast 0.9x	0.54	x	5	x	91.1	x	0.63	x	0.7	=	97.63	(75)
Northeast 0.9x	0.54	x	2.59	x	72.63	x	0.63	x	0.7	=	40.32	(75)
Northeast 0.9x	0.54	x	2.59	x	72.63	x	0.63	x	0.7	=	40.32	(75)
Northeast 0.9x	0.54	x	5	x	72.63	x	0.63	x	0.7	=	77.83	(75)
Northeast 0.9x	0.54	x	2.59	x	50.42	x	0.63	x	0.7	=	27.99	(75)
Northeast 0.9x	0.54	x	2.59	x	50.42	x	0.63	x	0.7	=	27.99	(75)
Northeast 0.9x	0.54	x	5	x	50.42	x	0.63	x	0.7	=	54.03	(75)
Northeast 0.9x	0.54	x	2.59	x	28.07	x	0.63	x	0.7	=	15.58	(75)
Northeast 0.9x	0.54	x	2.59	x	28.07	x	0.63	x	0.7	=	15.58	(75)
Northeast 0.9x	0.54	x	5	x	28.07	x	0.63	x	0.7	=	30.08	(75)
Northeast 0.9x	0.54	x	2.59	x	14.2	x	0.63	x	0.7	=	7.88	(75)
Northeast 0.9x	0.54	x	2.59	x	14.2	x	0.63	x	0.7	=	7.88	(75)
Northeast 0.9x	0.54	x	5	x	14.2	x	0.63	x	0.7	=	15.21	(75)
Northeast 0.9x	0.54	x	2.59	x	9.21	x	0.63	x	0.7	=	5.11	(75)
Northeast 0.9x	0.54	x	2.59	x	9.21	x	0.63	x	0.7	=	5.11	(75)
Northeast 0.9x	0.54	x	5	x	9.21	x	0.63	x	0.7	=	9.87	(75)

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

(83)m=	24.62	50.11	90.28	148.27	199.3	212.48	198.77	158.46	110.01	61.24	30.98	20.1	(83)

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

(84)m=	466.94	489.96	515.6	550.39	577.94	568.73	540.72	506.86	470.58	445.21	441.65	450.75	(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	0.93	0.99	1	1	(86)

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

(87)m=	19.88	19.97	20.16	20.44	20.72	20.92	20.98	20.97	20.83	20.49	20.14	19.87	(87)

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

(88)m=	20.06	20.07	20.07	20.07	20.08	20.08	20.08	20.08	20.08	20.08	20.07	20.07	(88)

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

(89)m=	1	1	0.99	0.98	0.92	0.76	0.54	0.6	0.88	0.98	1	1	(89)

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

(90)m=	18.56	18.69	18.97	19.37	19.77	20.02	20.08	20.07	19.92	19.45	18.95	18.54	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

(92)m=	19.21	19.32	19.55	19.89	20.23	20.46	20.52	20.51	20.36	19.96	19.53	19.19	(92)

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

(93)m=	19.21	19.32	19.55	19.89	20.23	20.46	20.52	20.51	20.36	19.96	19.53	19.19	(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	0.79	0.6	0.66	0.9	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.9	488.32	512.02	538.94	537.19	448.99	325.48	335.52	422.68	437.81	439.81	449.93	(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=	1301.08	1255.75	1134.4	947.2	733.84	499.94	334.38	350.28	536.07	804.95	1073.07	1298.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	621.38	515.71	463.05	293.95	146.31	0	0	0	0	273.16	455.95	631.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3400.72 (98)

Space heating requirement in kWh/m²/year 39.87 (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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	621.38	515.71	463.05	293.95	146.31	0	0	0	0	273.16	455.95	631.22	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	664.58	551.56	495.24	314.38	156.48	0	0	0	0	292.15	487.64	675.1	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3637.13 (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)

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Water heating

Output from water heater (calculated above)

205.73	181.39	190.64	171.09	167.8	150.14	144.38	158.17	157.81	177.4	187.34	200.85

Efficiency of water heater 79.8 (216)

(217)m=	87.58	87.45	87.09	86.25	84.45	79.8	79.8	79.8	79.8	85.96	87.1	87.66	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	234.91	207.43	218.89	198.38	198.7	188.14	180.93	198.21	197.76	206.37	215.09	229.11

Total = Sum(219a)$_{1...12}$ = 2473.92 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3637.13	
Water heating fuel used		2473.92	
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		421.71	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	785.62	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.37	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1319.99	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	218.87	(268)
Total CO2, kg/year		sum of (265)…(271) =		1577.78	(272)

TER = 27.01 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
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Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.6m²
Site Reference : Tottenham Mews **Plot Reference:** 2_01 - 3B5P
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 (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	22.63 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.57 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	37.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**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 using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

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

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.61	
Maximum	1.5	**OK**
MVHR efficiency:	79%	
Minimum	70%	**OK**

9 Summertime temperature		
Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	3.29m²	
Windows facing: North West	14.56m²	
Windows facing: South West	1.65m²	
Windows facing: South West	2.12m²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

10 Key features	
Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_01 - 3B5P

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	91.6	(1a)	x	2.65	(2a)	=	242.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.6	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	242.74	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(21)

Infiltration rate modified for monthly wind speed

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

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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 67.15 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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	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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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			3.29	x1/[1/(1.1)+ 0.04] =	3.47			(27)
Windows Type 2			3.64	x1/[1/(1.1)+ 0.04] =	3.84			(27)
Windows Type 3			1.65	x1/[1/(1.1)+ 0.04] =	1.74			(27)
Windows Type 4			2.12	x1/[1/(1.1)+ 0.04] =	2.23			(27)
Walls Type1	64.1	21.62	42.48	x 0.2 =	8.5			(29)
Walls Type2	12.2	0	12.2	x 0.19 =	2.26			(29)
Total area of elements, m²			76.3					(31)

** 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) = 33.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.45 (36)

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

Total fabric heat loss (33) + (36) = 44.98 (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=	23.88	23.67	23.46	22.41	22.2	21.15	21.15	20.94	21.57	22.2	22.62	23.04	(38)

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

(39)m=	68.86	68.65	68.44	67.39	67.18	66.13	66.13	65.92	66.55	67.18	67.6	68.02	

Average = Sum(39)$_{1…12}$ /12= 67.34 (39)

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

(40)m=	0.75	0.75	0.75	0.74	0.73	0.72	0.72	0.72	0.73	0.73	0.74	0.74

Average = Sum(40)$_{1…12}$ /12= 0.74 (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 2.65 (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 97.07 (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=	106.77	102.89	99.01	95.12	91.24	87.36	87.36	91.24	95.12	99.01	102.89	106.77

Total = Sum(44)$_{1…12}$ = 1164.79 (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=	158.34	138.49	142.91	124.59	119.55	103.16	95.59	109.69	111	129.36	141.21	153.34

Total = Sum(45)$_{1…12}$ = 1527.23 (45)

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

(46)m=	23.75	20.77	21.44	18.69	17.93	15.47	14.34	16.45	16.65	19.4	21.18	23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	223.27	197.13	207.83	187.42	184.47	165.99	160.52	174.62	173.83	194.29	204.04	218.27	(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=	223.27	197.13	207.83	187.42	184.47	165.99	160.52	174.62	173.83	194.29	204.04	218.27	

Output from water heater (annual)$_{1...12}$ 2291.68 (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=	104.59	92.96	99.46	91.69	91.69	84.57	83.73	88.41	87.17	94.95	97.22	102.93	(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=	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	(66)

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

(67)m=	21.59	19.18	15.59	11.81	8.83	7.45	8.05	10.46	14.05	17.83	20.81	22.19	(67)

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

(68)m=	241.99	244.5	238.17	224.7	207.7	191.71	181.04	178.53	184.85	198.33	215.33	231.31	(68)

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

(69)m=	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	(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=	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	(71)

Water heating gains (Table 5)

(72)m=	140.58	138.33	133.68	127.35	123.24	117.45	112.53	118.84	121.07	127.63	135.02	138.34	(72)

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

(73)m=	466.86	464.72	450.15	426.56	402.47	379.32	364.33	370.53	382.68	406.49	433.88	454.55	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a	g_ Table 6b		FF Table 6c		Gains (W)	
Southwest 0.9x	0.54	x	3.29	x	36.79	0.44	x	0.8	=	20.71	(79)
Southwest 0.9x	0.54	x	1.65	x	36.79	0.44	x	0.8	=	10.39	(79)
Southwest 0.9x	0.54	x	2.12	x	36.79	0.44	x	0.8	=	13.34	(79)
Southwest 0.9x	0.54	x	3.29	x	62.67	0.44	x	0.8	=	35.27	(79)
Southwest 0.9x	0.54	x	1.65	x	62.67	0.44	x	0.8	=	17.69	(79)

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Southwest	0.9x	0.54	x	2.12	x	62.67		0.44	x	0.8	=	22.73	(79)
Southwest	0.9x	0.54	x	3.29	x	85.75		0.44	x	0.8	=	48.26	(79)
Southwest	0.9x	0.54	x	1.65	x	85.75		0.44	x	0.8	=	24.21	(79)
Southwest	0.9x	0.54	x	2.12	x	85.75		0.44	x	0.8	=	31.1	(79)
Southwest	0.9x	0.54	x	3.29	x	106.25		0.44	x	0.8	=	59.8	(79)
Southwest	0.9x	0.54	x	1.65	x	106.25		0.44	x	0.8	=	29.99	(79)
Southwest	0.9x	0.54	x	2.12	x	106.25		0.44	x	0.8	=	38.53	(79)
Southwest	0.9x	0.54	x	3.29	x	119.01		0.44	x	0.8	=	66.98	(79)
Southwest	0.9x	0.54	x	1.65	x	119.01		0.44	x	0.8	=	33.59	(79)
Southwest	0.9x	0.54	x	2.12	x	119.01		0.44	x	0.8	=	43.16	(79)
Southwest	0.9x	0.54	x	3.29	x	118.15		0.44	x	0.8	=	66.5	(79)
Southwest	0.9x	0.54	x	1.65	x	118.15		0.44	x	0.8	=	33.35	(79)
Southwest	0.9x	0.54	x	2.12	x	118.15		0.44	x	0.8	=	42.85	(79)
Southwest	0.9x	0.54	x	3.29	x	113.91		0.44	x	0.8	=	64.11	(79)
Southwest	0.9x	0.54	x	1.65	x	113.91		0.44	x	0.8	=	32.15	(79)
Southwest	0.9x	0.54	x	2.12	x	113.91		0.44	x	0.8	=	41.31	(79)
Southwest	0.9x	0.54	x	3.29	x	104.39		0.44	x	0.8	=	58.75	(79)
Southwest	0.9x	0.54	x	1.65	x	104.39		0.44	x	0.8	=	29.47	(79)
Southwest	0.9x	0.54	x	2.12	x	104.39		0.44	x	0.8	=	37.86	(79)
Southwest	0.9x	0.54	x	3.29	x	92.85		0.44	x	0.8	=	52.26	(79)
Southwest	0.9x	0.54	x	1.65	x	92.85		0.44	x	0.8	=	26.21	(79)
Southwest	0.9x	0.54	x	2.12	x	92.85		0.44	x	0.8	=	33.67	(79)
Southwest	0.9x	0.54	x	3.29	x	69.27		0.44	x	0.8	=	38.99	(79)
Southwest	0.9x	0.54	x	1.65	x	69.27		0.44	x	0.8	=	19.55	(79)
Southwest	0.9x	0.54	x	2.12	x	69.27		0.44	x	0.8	=	25.12	(79)
Southwest	0.9x	0.54	x	3.29	x	44.07		0.44	x	0.8	=	24.8	(79)
Southwest	0.9x	0.54	x	1.65	x	44.07		0.44	x	0.8	=	12.44	(79)
Southwest	0.9x	0.54	x	2.12	x	44.07		0.44	x	0.8	=	15.98	(79)
Southwest	0.9x	0.54	x	3.29	x	31.49		0.44	x	0.8	=	17.72	(79)
Southwest	0.9x	0.54	x	1.65	x	31.49		0.44	x	0.8	=	8.89	(79)
Southwest	0.9x	0.54	x	2.12	x	31.49		0.44	x	0.8	=	11.42	(79)
Northwest	0.9x	0.54	x	3.64	x	11.28	x	0.44	x	0.8	=	28.1	(81)
Northwest	0.9x	0.54	x	3.64	x	22.97	x	0.44	x	0.8	=	57.21	(81)
Northwest	0.9x	0.54	x	3.64	x	41.38	x	0.44	x	0.8	=	103.07	(81)
Northwest	0.9x	0.54	x	3.64	x	67.96	x	0.44	x	0.8	=	169.26	(81)
Northwest	0.9x	0.54	x	3.64	x	91.35	x	0.44	x	0.8	=	227.53	(81)
Northwest	0.9x	0.54	x	3.64	x	97.38	x	0.44	x	0.8	=	242.57	(81)
Northwest	0.9x	0.54	x	3.64	x	91.1	x	0.44	x	0.8	=	226.92	(81)
Northwest	0.9x	0.54	x	3.64	x	72.63	x	0.44	x	0.8	=	180.9	(81)
Northwest	0.9x	0.54	x	3.64	x	50.42	x	0.44	x	0.8	=	125.59	(81)
Northwest	0.9x	0.54	x	3.64	x	28.07	x	0.44	x	0.8	=	69.91	(81)

Northwest	0.9x	0.54	x	3.64	x	14.2	x	0.44	x	0.8	=	35.36	(81)
Northwest	0.9x	0.54	x	3.64	x	9.21	x	0.44	x	0.8	=	22.95	(81)

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

(83)m=	72.54	132.9	206.64	297.59	371.26	385.26	364.49	306.98	237.73	153.57	88.59	60.98	(83)

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

(84)m=	539.4	597.62	656.79	724.15	773.73	764.59	728.82	677.51	620.41	560.06	522.46	515.53	(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=	0.96	0.94	0.9	0.82	0.69	0.52	0.39	0.43	0.65	0.86	0.94	0.97	(86)

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

(87)m=	19.57	19.77	20.1	20.5	20.79	20.94	20.98	20.98	20.87	20.5	19.98	19.53	(87)

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

(88)m=	20.3	20.3	20.3	20.31	20.31	20.32	20.32	20.32	20.32	20.31	20.31	20.3	(88)

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

(89)m=	0.96	0.93	0.89	0.8	0.66	0.47	0.33	0.37	0.6	0.83	0.93	0.96	(89)

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

(90)m=	18.35	18.64	19.11	19.68	20.07	20.27	20.31	20.31	20.19	19.69	18.95	18.31	(90)

fLA = Living area ÷ (4) = 0.45 (91)

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

(92)m=	18.91	19.16	19.56	20.05	20.4	20.57	20.62	20.61	20.5	20.06	19.42	18.86	(92)

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

(93)m=	18.91	19.16	19.56	20.05	20.4	20.57	20.62	20.61	20.5	20.06	19.42	18.86	(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=	0.94	0.92	0.88	0.79	0.66	0.49	0.36	0.4	0.62	0.83	0.92	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	508.58	550.42	577.1	574.14	510.46	376	260.93	270.71	382.99	462.28	479.27	489.36	(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=	1005.74	978.71	893.74	751.54	584.4	395.07	265.59	277.59	425.86	635.5	832.71	997.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	369.88	287.81	235.58	127.73	55.01	0	0	0	0	128.88	254.48	378.05	

Total per year (kWh/year) = $Sum(98)_{1…5,9…12}$ = 1837.42 (98)

Space heating requirement in kWh/m²/year 20.06 (99)

9b. Energy requirements – Community heating scheme

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

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1837.42	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1929.29	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2291.68	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2406.27	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.36	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		225.81	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	225.81	(331)
Energy for lighting (calculated in Appendix L)		381.27	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-694.91	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	900.06	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	22.5	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	922.56	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			922.56	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	117.19	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	197.88	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-360.66	(380)
Total CO2, kg/year	sum of (376)…(382) =			876.98	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			9.57	(384)
EI rating (section 14)				91.4	(385)

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User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_01 - 3B5P

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	91.6	(1a)	x	2.65	(2a)	=	242.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.6	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	242.74	(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		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.26	(21)

Infiltration rate modified for monthly wind speed

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

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

0.33	0.33	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.31

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=	0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(24d)

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

(25)m=	0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(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			3.29	x1/[1/(1.4)+ 0.04]	=	4.36			(27)
Windows Type 2			3.64	x1/[1/(1.4)+ 0.04]	=	4.83			(27)
Windows Type 3			1.65	x1/[1/(1.4)+ 0.04]	=	2.19			(27)
Windows Type 4			2.12	x1/[1/(1.4)+ 0.04]	=	2.81			(27)
Walls Type1	64.1	21.62	42.48	x 0.18	=	7.65			(29)
Walls Type2	12.2	0	12.2	x 0.18	=	2.2			(29)
Total area of elements, m²			76.3						(31)

** 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) = 38.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 3.81 (36)

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

Total fabric heat loss (33) + (36) = 42.32 (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=	44.5	44.33	44.16	43.37	43.22	42.52	42.52	42.4	42.79	43.22	43.52	43.83	(38)

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

(39)m=	86.83	86.65	86.48	85.69	85.54	84.84	84.84	84.72	85.11	85.54	85.84	86.15	

Average = Sum(39)$_{1…12}$ /12= 85.69 (39)

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

(40)m=	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.92	0.93	0.93	0.94	0.94

Average = Sum(40)$_{1…12}$ /12= 0.94 (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 2.65 (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 97.07 (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	
(44)m=	106.77	102.89	99.01	95.12	91.24	87.36	87.36	91.24	95.12	99.01	102.89	106.77	
(45)m=	158.34	138.49	142.91	124.59	119.55	103.16	95.59	109.69	111	129.36	141.21	153.34	
(46)m=	23.75	20.77	21.44	18.69	17.93	15.47	14.34	16.45	16.65	19.4	21.18	23	(46)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (applies to row 44)

Total = Sum(44)$_{1…12}$ = 1164.79 (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) (applies to row 45)

Total = Sum(45)$_{1…12}$ = 1527.23 (45)

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

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	209.27	184.48	193.83	173.87	170.47	152.44	146.52	160.62	160.29	180.29	190.49	204.27	(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=	209.27	184.48	193.83	173.87	170.47	152.44	146.52	160.62	160.29	180.29	190.49	204.27	

Output from water heater (annual)$_{1...12}$ 2126.84 (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=	93.39	82.84	88.26	80.85	80.49	73.73	72.53	77.21	76.34	83.75	86.38	91.73	(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=	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	132.35	(66)

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

(67)m=	21.85	19.41	15.78	11.95	8.93	7.54	8.15	10.59	14.22	18.05	21.07	22.46	(67)

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

(68)m=	241.99	244.5	238.17	224.7	207.7	191.71	181.04	178.53	184.85	198.33	215.33	231.31	(68)

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

(69)m=	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	36.23	(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=	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	-105.88	(71)

Water heating gains (Table 5)

(72)m=	125.52	123.28	118.62	112.29	108.19	102.4	97.48	103.78	106.02	112.57	119.97	123.29	(72)

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

(73)m=	455.07	452.9	438.29	414.65	390.52	367.36	352.37	358.6	370.8	394.65	422.07	442.77	(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)	
Southwest0.9x	0.54	x	3.29	x	36.79	0.63	x	0.7	=	25.94	(79)
Southwest0.9x	0.54	x	1.65	x	36.79	0.63	x	0.7	=	13.01	(79)
Southwest0.9x	0.54	x	2.12	x	36.79	0.63	x	0.7	=	16.72	(79)
Southwest0.9x	0.54	x	3.29	x	62.67	0.63	x	0.7	=	44.19	(79)
Southwest0.9x	0.54	x	1.65	x	62.67	0.63	x	0.7	=	22.16	(79)

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Southwest	0.9x	0.54	x	2.12	x	62.67		0.63	x	0.7	=	28.48	(79)
Southwest	0.9x	0.54	x	3.29	x	85.75		0.63	x	0.7	=	60.47	(79)
Southwest	0.9x	0.54	x	1.65	x	85.75		0.63	x	0.7	=	30.33	(79)
Southwest	0.9x	0.54	x	2.12	x	85.75		0.63	x	0.7	=	38.96	(79)
Southwest	0.9x	0.54	x	3.29	x	106.25		0.63	x	0.7	=	74.92	(79)
Southwest	0.9x	0.54	x	1.65	x	106.25		0.63	x	0.7	=	37.57	(79)
Southwest	0.9x	0.54	x	2.12	x	106.25		0.63	x	0.7	=	48.28	(79)
Southwest	0.9x	0.54	x	3.29	x	119.01		0.63	x	0.7	=	83.92	(79)
Southwest	0.9x	0.54	x	1.65	x	119.01		0.63	x	0.7	=	42.09	(79)
Southwest	0.9x	0.54	x	2.12	x	119.01		0.63	x	0.7	=	54.08	(79)
Southwest	0.9x	0.54	x	3.29	x	118.15		0.63	x	0.7	=	83.31	(79)
Southwest	0.9x	0.54	x	1.65	x	118.15		0.63	x	0.7	=	41.78	(79)
Southwest	0.9x	0.54	x	2.12	x	118.15		0.63	x	0.7	=	53.68	(79)
Southwest	0.9x	0.54	x	3.29	x	113.91		0.63	x	0.7	=	80.32	(79)
Southwest	0.9x	0.54	x	1.65	x	113.91		0.63	x	0.7	=	40.28	(79)
Southwest	0.9x	0.54	x	2.12	x	113.91		0.63	x	0.7	=	51.76	(79)
Southwest	0.9x	0.54	x	3.29	x	104.39		0.63	x	0.7	=	73.61	(79)
Southwest	0.9x	0.54	x	1.65	x	104.39		0.63	x	0.7	=	36.92	(79)
Southwest	0.9x	0.54	x	2.12	x	104.39		0.63	x	0.7	=	47.43	(79)
Southwest	0.9x	0.54	x	3.29	x	92.85		0.63	x	0.7	=	65.47	(79)
Southwest	0.9x	0.54	x	1.65	x	92.85		0.63	x	0.7	=	32.84	(79)
Southwest	0.9x	0.54	x	2.12	x	92.85		0.63	x	0.7	=	42.19	(79)
Southwest	0.9x	0.54	x	3.29	x	69.27		0.63	x	0.7	=	48.84	(79)
Southwest	0.9x	0.54	x	1.65	x	69.27		0.63	x	0.7	=	24.5	(79)
Southwest	0.9x	0.54	x	2.12	x	69.27		0.63	x	0.7	=	31.47	(79)
Southwest	0.9x	0.54	x	3.29	x	44.07		0.63	x	0.7	=	31.08	(79)
Southwest	0.9x	0.54	x	1.65	x	44.07		0.63	x	0.7	=	15.59	(79)
Southwest	0.9x	0.54	x	2.12	x	44.07		0.63	x	0.7	=	20.02	(79)
Southwest	0.9x	0.54	x	3.29	x	31.49		0.63	x	0.7	=	22.2	(79)
Southwest	0.9x	0.54	x	1.65	x	31.49		0.63	x	0.7	=	11.14	(79)
Southwest	0.9x	0.54	x	2.12	x	31.49		0.63	x	0.7	=	14.31	(79)
Northwest	0.9x	0.54	x	3.64	x	11.28	x	0.63	x	0.7	=	35.21	(81)
Northwest	0.9x	0.54	x	3.64	x	22.97	x	0.63	x	0.7	=	71.67	(81)
Northwest	0.9x	0.54	x	3.64	x	41.38	x	0.63	x	0.7	=	129.13	(81)
Northwest	0.9x	0.54	x	3.64	x	67.96	x	0.63	x	0.7	=	212.06	(81)
Northwest	0.9x	0.54	x	3.64	x	91.35	x	0.63	x	0.7	=	285.05	(81)
Northwest	0.9x	0.54	x	3.64	x	97.38	x	0.63	x	0.7	=	303.9	(81)
Northwest	0.9x	0.54	x	3.64	x	91.1	x	0.63	x	0.7	=	284.29	(81)
Northwest	0.9x	0.54	x	3.64	x	72.63	x	0.63	x	0.7	=	226.64	(81)
Northwest	0.9x	0.54	x	3.64	x	50.42	x	0.63	x	0.7	=	157.34	(81)
Northwest	0.9x	0.54	x	3.64	x	28.07	x	0.63	x	0.7	=	87.59	(81)

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Northwest	0.9x	0.54	x	3.64	x	14.2	x	0.63	x	0.7	=	44.3	(81)
Northwest	0.9x	0.54	x	3.64	x	9.21	x	0.63	x	0.7	=	28.75	(81)

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

(83)m=	90.88	166.5	258.88	372.84	465.13	482.67	456.65	384.6	297.84	192.4	110.99	76.4	(83)

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

(84)m=	545.95	619.4	697.17	787.49	855.65	850.03	809.02	743.2	668.64	587.05	533.06	519.17	(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	0.95	0.82	0.62	0.46	0.52	0.8	0.97	1	1	(86)

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

(87)m=	20.04	20.17	20.4	20.69	20.9	20.99	21	21	20.94	20.66	20.29	20.01	(87)

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

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

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

(89)m=	1	0.99	0.98	0.93	0.77	0.55	0.37	0.43	0.73	0.96	0.99	1	(89)

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

(90)m=	18.83	19.03	19.36	19.77	20.05	20.14	20.14	20.14	20.1	19.74	19.22	18.8	(90)

fLA = Living area ÷ (4) = 0.45 (91)

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

(92)m=	19.38	19.55	19.83	20.19	20.44	20.52	20.53	20.53	20.48	20.16	19.7	19.35	(92)

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

(93)m=	19.38	19.55	19.83	20.19	20.44	20.52	20.53	20.53	20.48	20.16	19.7	19.35	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.79	0.58	0.41	0.47	0.75	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	544.1	614.75	682.56	730.85	678.02	493.41	332.65	347.96	504.68	561.49	529	517.83	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1309.31	1269.32	1152.79	967.29	747.21	502.4	333.61	349.98	543.03	817.52	1081.99	1305.14	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	569.32	439.88	349.85	170.23	51.47	0	0	0	0	190.49	398.15	585.75	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2755.14 (98)

Space heating requirement in kWh/m²/year — 30.08 (99)

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

Space heating:

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

TER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	569.32	439.88	349.85	170.23	51.47	0	0	0	0	190.49	398.15	585.75		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	608.9	470.45	374.17	182.07	55.05	0	0	0	0	203.73	425.83	626.47		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2946.67	(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)	209.27	184.48	193.83	173.87	170.47	152.44	146.52	160.62	160.29	180.29	190.49	204.27		
Efficiency of water heater													79.8	(216)
(217)m=	87.35	87.05	86.37	84.76	82.05	79.8	79.8	79.8	79.8	84.96	86.74	87.47		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	239.57	211.93	224.42	205.14	207.77	191.03	183.61	201.28	200.86	212.2	219.62	233.54		
Total = Sum(219a)$_{1...12}$ =													2530.95	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2946.67	
Water heating fuel used			2530.95	
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			385.9	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	636.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	546.69	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1183.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	200.28	(268)

TER WorkSheet: New dwelling design stage

Total CO_2, kg/year	sum of (265)…(271) =	1422.37	(272)
TER =		22.63	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:44:47

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 83.2m²

Site Reference : Tottenham Mews **Plot Reference:** 2_02 - 2B4P

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 (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	22.17 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	8.73 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	37.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	32.7 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	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 using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**
9 Summertime temperature		
Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	3.3m²	
Windows facing: North East	6.34m²	
Windows facing: North East	7.29m²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	
10 Key features		
Air permeablility	3.0 m³/m²h	
Windows U-value	1.1 W/m²K	
Community heating, heat from electric heat pump		
Photovoltaic array		

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_02 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	83.2	(1a) x	2.65	(2a) =	220.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	83.2	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	220.48	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 66.3 (23c)

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

(24a)m=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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	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=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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			1.65	x1/[1/(1.1)+ 0.04]		=	1.74			(27)
Windows Type 2			3.17	x1/[1/(1.1)+ 0.04]		=	3.34			(27)
Windows Type 3			7.29	x1/[1/(1.1)+ 0.04]		=	7.68			(27)
Walls Type1	35	16.93	18.07	x	0.2	=	3.61			(29)
Walls Type2	15.4	0	15.4	x	0.19	=	2.85			(29)
Total area of elements, m²			50.4							(31)

** 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) = 24.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.56 (36)

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

Total fabric heat loss (33) + (36) = 31.86 (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	21.81	21.62	20.66	20.47	19.52	19.52	19.33	19.9	20.47	20.85	21.24	(38)

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

(39)m=	53.86	53.67	53.48	52.53	52.34	51.38	51.38	51.19	51.76	52.34	52.72	53.1

Average = Sum(39)$_{1…12}$ /12= 52.48 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	0.65	0.65	0.64	0.63	0.63	0.62	0.62	0.62	0.62	0.63	0.63	0.64

Average = Sum(40)$_{1…12}$ /12= 0.63 (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 2.52 (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 94.07 (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=	103.48	99.71	95.95	92.19	88.42	84.66	84.66	88.42	92.19	95.95	99.71	103.48	
										Total = Sum(44)$_{1…12}$ =		1128.82	(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=	153.45	134.21	138.49	120.74	115.85	99.97	92.64	106.31	107.57	125.37	136.85	148.61	
										Total = Sum(45)$_{1…12}$ =		1480.06	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	23.02	20.13	20.77	18.11	17.38	15	13.9	15.95	16.14	18.81	20.53	22.29	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	218.38	192.85	203.42	183.57	180.78	162.8	157.57	171.23	170.41	190.29	199.68	213.54	(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=	218.38	192.85	203.42	183.57	180.78	162.8	157.57	171.23	170.41	190.29	199.68	213.54	

Output from water heater (annual)$_{1...12}$ 2244.52 (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=	102.96	91.54	97.99	90.41	90.46	83.51	82.74	87.29	86.03	93.63	95.77	101.35	(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=	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	(66)

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

(67)m=	20.45	18.16	14.77	11.18	8.36	7.06	7.63	9.91	13.3	16.89	19.72	21.02	(67)

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

(68)m=	226	228.34	222.43	209.85	193.97	179.05	169.07	166.73	172.64	185.22	201.1	216.03	(68)

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

(69)m=	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	(71)

Water heating gains (Table 5)

(72)m=	138.39	136.22	131.71	125.57	121.59	115.98	111.21	117.32	119.49	125.84	133.01	136.23	(72)

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

(73)m=	445.65	443.54	429.72	407.42	384.73	362.89	348.73	354.77	366.24	388.76	414.64	434.08	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.44	x	0.8	=	12.24	(75)
Northeast 0.9x	0.54	x	7.29	x	11.28	x	0.44	x	0.8	=	14.07	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.44	x	0.8	=	24.91	(75)
Northeast 0.9x	0.54	x	7.29	x	22.97	x	0.44	x	0.8	=	28.64	(75)
Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.44	x	0.8	=	44.88	(75)

Northeast	0.9x	0.54	x	7.29	x	41.38	x	0.44	x	0.8	=	51.6	(75)
Northeast	0.9x	0.54	x	3.17	x	67.96	x	0.44	x	0.8	=	73.7	(75)
Northeast	0.9x	0.54	x	7.29	x	67.96	x	0.44	x	0.8	=	84.75	(75)
Northeast	0.9x	0.54	x	3.17	x	91.35	x	0.44	x	0.8	=	99.07	(75)
Northeast	0.9x	0.54	x	7.29	x	91.35	x	0.44	x	0.8	=	113.92	(75)
Northeast	0.9x	0.54	x	3.17	x	97.38	x	0.44	x	0.8	=	105.62	(75)
Northeast	0.9x	0.54	x	7.29	x	97.38	x	0.44	x	0.8	=	121.45	(75)
Northeast	0.9x	0.54	x	3.17	x	91.1	x	0.44	x	0.8	=	98.81	(75)
Northeast	0.9x	0.54	x	7.29	x	91.1	x	0.44	x	0.8	=	113.61	(75)
Northeast	0.9x	0.54	x	3.17	x	72.63	x	0.44	x	0.8	=	78.77	(75)
Northeast	0.9x	0.54	x	7.29	x	72.63	x	0.44	x	0.8	=	90.57	(75)
Northeast	0.9x	0.54	x	3.17	x	50.42	x	0.44	x	0.8	=	54.69	(75)
Northeast	0.9x	0.54	x	7.29	x	50.42	x	0.44	x	0.8	=	62.88	(75)
Northeast	0.9x	0.54	x	3.17	x	28.07	x	0.44	x	0.8	=	30.44	(75)
Northeast	0.9x	0.54	x	7.29	x	28.07	x	0.44	x	0.8	=	35	(75)
Northeast	0.9x	0.54	x	3.17	x	14.2	x	0.44	x	0.8	=	15.4	(75)
Northeast	0.9x	0.54	x	7.29	x	14.2	x	0.44	x	0.8	=	17.71	(75)
Northeast	0.9x	0.54	x	3.17	x	9.21	x	0.44	x	0.8	=	9.99	(75)
Northeast	0.9x	0.54	x	7.29	x	9.21	x	0.44	x	0.8	=	11.49	(75)
Southeast	0.9x	0.54	x	1.65	x	36.79	x	0.44	x	0.8	=	20.77	(77)
Southeast	0.9x	0.54	x	1.65	x	62.67	x	0.44	x	0.8	=	35.38	(77)
Southeast	0.9x	0.54	x	1.65	x	85.75	x	0.44	x	0.8	=	48.41	(77)
Southeast	0.9x	0.54	x	1.65	x	106.25	x	0.44	x	0.8	=	59.98	(77)
Southeast	0.9x	0.54	x	1.65	x	119.01	x	0.44	x	0.8	=	67.19	(77)
Southeast	0.9x	0.54	x	1.65	x	118.15	x	0.44	x	0.8	=	66.7	(77)
Southeast	0.9x	0.54	x	1.65	x	113.91	x	0.44	x	0.8	=	64.31	(77)
Southeast	0.9x	0.54	x	1.65	x	104.39	x	0.44	x	0.8	=	58.93	(77)
Southeast	0.9x	0.54	x	1.65	x	92.85	x	0.44	x	0.8	=	52.42	(77)
Southeast	0.9x	0.54	x	1.65	x	69.27	x	0.44	x	0.8	=	39.1	(77)
Southeast	0.9x	0.54	x	1.65	x	44.07	x	0.44	x	0.8	=	24.88	(77)
Southeast	0.9x	0.54	x	1.65	x	31.49	x	0.44	x	0.8	=	17.78	(77)

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

(83)m=	47.08	88.93	144.89	218.44	280.18	293.77	276.73	228.28	169.98	104.55	57.98	39.26	(83)

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

(84)m=	492.73	532.47	574.62	625.86	664.91	656.67	625.45	583.05	536.23	493.31	472.62	473.34	(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=	0.95	0.93	0.89	0.8	0.66	0.48	0.36	0.4	0.62	0.83	0.93	0.96	(86)

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

(87)m=	19.88	20.05	20.32	20.65	20.87	20.97	20.99	20.99	20.93	20.65	20.23	19.86	(87)

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

(88)m=	20.39	20.39	20.39	20.4	20.4	20.41	20.41	20.42	20.41	20.4	20.4	20.4	(88)

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

(89)m=	0.95	0.93	0.88	0.78	0.63	0.44	0.31	0.35	0.57	0.81	0.92	0.95	(89)

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

(90)m=	18.87	19.1	19.49	19.96	20.26	20.39	20.41	20.41	20.34	19.97	19.38	18.83	(90)

fLA = Living area ÷ (4) = 0.54 (91)

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

(92)m=	19.42	19.61	19.94	20.34	20.59	20.7	20.73	20.72	20.66	20.34	19.84	19.39	(92)

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

(93)m=	19.42	19.61	19.94	20.34	20.59	20.7	20.73	20.72	20.66	20.34	19.84	19.39	(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=	0.94	0.92	0.87	0.78	0.64	0.46	0.34	0.37	0.59	0.81	0.91	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	462.07	488.26	501.88	488.57	424.06	304.85	210.1	218.45	316.85	399.9	429.72	446.95	(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=	814.2	789.72	718.79	600.73	465.29	313.59	211.96	221.3	339.36	509.83	671.59	806.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	261.98	202.58	161.38	80.76	30.68	0	0	0	0	81.78	174.14	267.44	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1260.74 (98)

Space heating requirement in kWh/m²/year 15.15 (99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1260.74	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1323.78	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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

Water heating

Annual water heating requirement		2244.52	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2356.75	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.81	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		161.39	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	161.39	(331)
Energy for lighting (calculated in Appendix L)		361.13	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-631.51	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	764.08	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.1	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	783.18	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				783.18	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	83.76	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	187.43	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-327.75	(380)
Total CO2, kg/year	sum of (376)…(382) =				726.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				8.73	(384)
EI rating (section 14)					92.41	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_02 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	83.2	(1a) x	2.65	(2a) =	220.48	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	83.2	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	220.48	(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) =	0.14	(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		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.27	(21)

Infiltration rate modified for monthly wind speed

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

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

0.34	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.3	0.32

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=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

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

(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			1.65	x1/[1/(1.4)+ 0.04] =	2.19			(27)
Windows Type 2			3.17	x1/[1/(1.4)+ 0.04] =	4.2			(27)
Windows Type 3			7.29	x1/[1/(1.4)+ 0.04] =	9.66			(27)
Walls Type1	35	16.93	18.07	x 0.18 =	3.25			(29)
Walls Type2	15.4	0	15.4	x 0.18 =	2.77			(29)
Total area of elements, m²			50.4					(31)

** 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) = 28.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (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 2.52 (36)

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

Total fabric heat loss (33) + (36) = 30.99 (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=	40.7	40.53	40.37	39.59	39.45	38.78	38.78	38.65	39.04	39.45	39.74	40.05	(38)

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

(39)m=	71.69	71.52	71.36	70.58	70.44	69.77	69.77	69.64	70.03	70.44	70.73	71.04	

Average = Sum(39)$_{1…12}$ /12= 70.58 (39)

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

(40)m=	0.86	0.86	0.86	0.85	0.85	0.84	0.84	0.84	0.84	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 2.52 (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 94.07 (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=	103.48	99.71	95.95	92.19	88.42	84.66	84.66	88.42	92.19	95.95	99.71	103.48	
									Total = Sum(44)$_{1…12}$ =			1128.82	(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=	153.45	134.21	138.49	120.74	115.85	99.97	92.64	106.31	107.57	125.37	136.85	148.61	
									Total = Sum(45)$_{1…12}$ =			1480.06	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	23.02	20.13	20.77	18.11	17.38	15	13.9	15.95	16.14	18.81	20.53	22.29	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	204.38	180.21	189.42	170.02	166.78	149.26	143.57	157.23	156.86	176.29	186.13	199.54	(62)

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

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

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

Output from water heater

(64)m=	204.38	180.21	189.42	170.02	166.78	149.26	143.57	157.23	156.86	176.29	186.13	199.54	

Output from water heater (annual)$_{1...12}$ 2079.68 (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=	91.76	81.42	86.79	79.57	79.26	72.67	71.54	76.09	75.2	82.43	84.93	90.15	(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=	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	126.04	(66)

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

(67)m=	20.91	18.57	15.11	11.44	8.55	7.22	7.8	10.14	13.61	17.28	20.16	21.49	(67)

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

(68)m=	226	228.34	222.43	209.85	193.97	179.05	169.07	166.73	172.64	185.22	201.1	216.03	(68)

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

(69)m=	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	-100.83	(71)

Water heating gains (Table 5)

(72)m=	123.34	121.16	116.65	110.52	106.54	100.93	96.16	102.27	104.44	110.79	117.96	121.17	(72)

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

(73)m=	434.06	431.89	418	395.62	372.87	351	336.84	342.94	354.49	377.09	403.03	422.51	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.63	x	0.7	=	15.33	(75)
Northeast 0.9x	0.54	x	7.29	x	11.28	x	0.63	x	0.7	=	17.63	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.63	x	0.7	=	31.21	(75)
Northeast 0.9x	0.54	x	7.29	x	22.97	x	0.63	x	0.7	=	35.88	(75)
Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.63	x	0.7	=	56.23	(75)

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Northeast 0.9x	0.54	x	7.29	x	41.38	x	0.63	x	0.7	=	64.65	(75)
Northeast 0.9x	0.54	x	3.17	x	67.96	x	0.63	x	0.7	=	92.34	(75)
Northeast 0.9x	0.54	x	7.29	x	67.96	x	0.63	x	0.7	=	106.18	(75)
Northeast 0.9x	0.54	x	3.17	x	91.35	x	0.63	x	0.7	=	124.12	(75)
Northeast 0.9x	0.54	x	7.29	x	91.35	x	0.63	x	0.7	=	142.72	(75)
Northeast 0.9x	0.54	x	3.17	x	97.38	x	0.63	x	0.7	=	132.33	(75)
Northeast 0.9x	0.54	x	7.29	x	97.38	x	0.63	x	0.7	=	152.16	(75)
Northeast 0.9x	0.54	x	3.17	x	91.1	x	0.63	x	0.7	=	123.79	(75)
Northeast 0.9x	0.54	x	7.29	x	91.1	x	0.63	x	0.7	=	142.34	(75)
Northeast 0.9x	0.54	x	3.17	x	72.63	x	0.63	x	0.7	=	98.69	(75)
Northeast 0.9x	0.54	x	7.29	x	72.63	x	0.63	x	0.7	=	113.47	(75)
Northeast 0.9x	0.54	x	3.17	x	50.42	x	0.63	x	0.7	=	68.51	(75)
Northeast 0.9x	0.54	x	7.29	x	50.42	x	0.63	x	0.7	=	78.78	(75)
Northeast 0.9x	0.54	x	3.17	x	28.07	x	0.63	x	0.7	=	38.14	(75)
Northeast 0.9x	0.54	x	7.29	x	28.07	x	0.63	x	0.7	=	43.85	(75)
Northeast 0.9x	0.54	x	3.17	x	14.2	x	0.63	x	0.7	=	19.29	(75)
Northeast 0.9x	0.54	x	7.29	x	14.2	x	0.63	x	0.7	=	22.18	(75)
Northeast 0.9x	0.54	x	3.17	x	9.21	x	0.63	x	0.7	=	12.52	(75)
Northeast 0.9x	0.54	x	7.29	x	9.21	x	0.63	x	0.7	=	14.4	(75)
Southeast 0.9x	0.54	x	1.65	x	36.79	x	0.63	x	0.7	=	26.02	(77)
Southeast 0.9x	0.54	x	1.65	x	62.67	x	0.63	x	0.7	=	44.33	(77)
Southeast 0.9x	0.54	x	1.65	x	85.75	x	0.63	x	0.7	=	60.65	(77)
Southeast 0.9x	0.54	x	1.65	x	106.25	x	0.63	x	0.7	=	75.15	(77)
Southeast 0.9x	0.54	x	1.65	x	119.01	x	0.63	x	0.7	=	84.17	(77)
Southeast 0.9x	0.54	x	1.65	x	118.15	x	0.63	x	0.7	=	83.56	(77)
Southeast 0.9x	0.54	x	1.65	x	113.91	x	0.63	x	0.7	=	80.57	(77)
Southeast 0.9x	0.54	x	1.65	x	104.39	x	0.63	x	0.7	=	73.83	(77)
Southeast 0.9x	0.54	x	1.65	x	92.85	x	0.63	x	0.7	=	65.67	(77)
Southeast 0.9x	0.54	x	1.65	x	69.27	x	0.63	x	0.7	=	48.99	(77)
Southeast 0.9x	0.54	x	1.65	x	44.07	x	0.63	x	0.7	=	31.17	(77)
Southeast 0.9x	0.54	x	1.65	x	31.49	x	0.63	x	0.7	=	22.27	(77)

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

(83)m=	58.98	111.42	181.53	273.67	351.02	368.05	346.7	286	212.96	130.98	72.64	49.19	(83)

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

(84)m=	493.04	543.31	599.53	669.28	723.89	719.05	683.54	628.94	567.46	508.08	475.67	471.69	(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	0.95	0.82	0.61	0.45	0.51	0.79	0.97	1	1	(86)

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

(87)m=	20.16	20.27	20.47	20.74	20.93	20.99	21	21	20.96	20.71	20.39	20.14	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(88)m=	20.2	20.2	20.2	20.21	20.21	20.22	20.22	20.22	20.22	20.21	20.21	20.21		(88)

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

(89)m=	1	0.99	0.98	0.93	0.77	0.54	0.37	0.42	0.72	0.96	0.99	1		(89)

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

(90)m=	19.07	19.23	19.52	19.9	20.14	20.21	20.22	20.22	20.18	19.88	19.41	19.04		(90)
											fLA = Living area ÷ (4) =		0.54	(91)

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

(92)m=	19.66	19.8	20.04	20.35	20.57	20.63	20.64	20.64	20.6	20.33	19.94	19.63		(92)

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

(93)m=	19.66	19.8	20.04	20.35	20.57	20.63	20.64	20.64	20.6	20.33	19.94	19.63		(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	0.99	0.98	0.93	0.79	0.58	0.41	0.47	0.76	0.96	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	491.41	539.68	588.45	624.26	575.15	415.56	281.42	294.21	428.7	486.84	472.14	470.5		(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=	1101.07	1065.35	965.95	808.45	624.53	420.98	281.94	295.34	455.3	685.35	908.4	1096.45		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	453.58	353.25	280.86	132.62	36.74	0	0	0	0	147.69	314.1	465.71		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				2184.56	(98)

Space heating requirement in kWh/m²/year | 26.26 | (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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	453.58	353.25	280.86	132.62	36.74	0	0	0	0	147.69	314.1	465.71		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	485.11	377.81	300.38	141.84	39.29	0	0	0	0	157.96	335.94	498.09		
									Total (kWh/year) =Sum(211)$_{1...5,10....12}$=				2336.42	(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)

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Water heating

Output from water heater (calculated above)

204.38	180.21	189.42	170.02	166.78	149.26	143.57	157.23	156.86	176.29	186.13	199.54

Efficiency of water heater 79.8 (216)

(217)m=	86.88	86.58	85.86	84.16	81.54	79.8	79.8	79.8	79.8	84.35	86.2	87	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	235.24	208.14	220.61	202.02	204.54	187.04	179.91	197.03	196.56	209.01	215.93	229.35

Total = Sum(219a)$_{1...12}$ = 2485.38 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2336.42	
Water heating fuel used		2485.38	
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		369.33	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	504.67	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	536.84	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1041.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	191.68	(268)
Total CO2, kg/year		sum of (265)…(271) =		1272.12	(272)

TER = 22.17 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:44:46

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 76m²

Site Reference : Tottenham Mews **Plot Reference:** 2_03 - 2B4P

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 (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	23.65 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.81 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	35.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.20 (max. 0.70)	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 using user-specified y-value of 0.15

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

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

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature		
Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	12.68m²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

10 Key features	
Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_03 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76	(1a) x	2.65	(2a) =	201.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		201.4	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(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

	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

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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 66.3 (23c)

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

(24a)m=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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	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=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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			3.17	x1/[1/(1.1)+ 0.04]		=	3.34			(27)
Walls Type1	36.3	12.68	23.62	x	0.2	=	4.72			(29)
Walls Type2	24.1	0	24.1	x	0.19	=	4.46			(29)
Total area of elements, m²			60.4							(31)

** 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) = 22.55 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.06 (36)

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

Total fabric heat loss (33) + (36) = 31.61 (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=	20.1	19.92	19.75	18.88	18.7	17.83	17.83	17.65	18.18	18.7	19.05	19.4	(38)

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

(39)m=	51.7	51.53	51.35	50.48	50.31	49.44	49.44	49.26	49.78	50.31	50.66	51.01	

Average = Sum(39)$_{1…12}$ /12= 50.44 (39)

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

(40)m=	0.68	0.68	0.68	0.66	0.66	0.65	0.65	0.65	0.66	0.66	0.67	0.67	

Average = Sum(40)$_{1…12}$ /12= 0.66 (40)

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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 2.38 (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 90.79 (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=	99.87	96.23	92.6	88.97	85.34	81.71	81.71	85.34	88.97	92.6	96.23	99.87	
											Total = Sum(44)$_{1...12}$ =	1089.44	(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=	148.1	129.53	133.66	116.53	111.81	96.48	89.41	102.6	103.82	120.99	132.07	143.42	
											Total = Sum(45)$_{1...12}$ =	1428.42	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.21	19.43	20.05	17.48	16.77	14.47	13.41	15.39	15.57	18.15	19.81	21.51	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	213.02	188.17	198.59	179.36	176.74	159.32	154.33	167.52	166.65	185.92	194.91	208.35	(62)

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

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

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

Output from water heater

(64)m=	213.02	188.17	198.59	179.36	176.74	159.32	154.33	167.52	166.65	185.92	194.91	208.35	

Output from water heater (annual) 1…12 | 2192.88 | (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=	101.18	89.98	96.38	89.01	89.12	82.35	81.67	86.05	84.79	92.17	94.18	99.63	(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=	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.77	17.56	14.28	10.81	8.08	6.82	7.37	9.58	12.86	16.33	19.06	20.32	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	210.88	213.07	207.55	195.81	180.99	167.07	157.76	155.57	161.09	172.83	187.65	201.57	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	(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=	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	(71)
Water heating gains (Table 5)													
(72)m=	136	133.9	129.55	123.63	119.78	114.37	109.77	115.66	117.76	123.89	130.81	133.91	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	425.38	423.26	410.12	388.99	367.6	347	333.64	339.56	350.45	371.78	396.25	414.54	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.44	x	0.8	=	24.47	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.44	x	0.8	=	49.82	(75)
Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.44	x	0.8	=	89.76	(75)
Northeast 0.9x	0.54	x	3.17	x	67.96	x	0.44	x	0.8	=	147.41	(75)
Northeast 0.9x	0.54	x	3.17	x	91.35	x	0.44	x	0.8	=	198.15	(75)
Northeast 0.9x	0.54	x	3.17	x	97.38	x	0.44	x	0.8	=	211.25	(75)
Northeast 0.9x	0.54	x	3.17	x	91.1	x	0.44	x	0.8	=	197.62	(75)
Northeast 0.9x	0.54	x	3.17	x	72.63	x	0.44	x	0.8	=	157.54	(75)

Northeast	0.9x	0.54	x	3.17	x	50.42	x	0.44	x	0.8	=	109.37	(75)
Northeast	0.9x	0.54	x	3.17	x	28.07	x	0.44	x	0.8	=	60.88	(75)
Northeast	0.9x	0.54	x	3.17	x	14.2	x	0.44	x	0.8	=	30.8	(75)
Northeast	0.9x	0.54	x	3.17	x	9.21	x	0.44	x	0.8	=	19.99	(75)

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

(83)m=	24.47	49.82	89.76	147.41	198.15	211.25	197.62	157.54	109.37	60.88	30.8	19.99	(83)

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

(84)m=	449.86	473.08	499.87	536.4	565.74	558.24	531.26	497.1	459.82	432.66	427.04	434.53	(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=	0.96	0.94	0.91	0.84	0.71	0.54	0.4	0.44	0.67	0.86	0.93	0.96	(86)

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

(87)m=	19.78	19.92	20.19	20.55	20.81	20.95	20.99	20.98	20.89	20.57	20.14	19.76	(87)

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

(88)m=	20.36	20.36	20.36	20.37	20.37	20.38	20.38	20.39	20.38	20.37	20.37	20.37	(88)

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

(89)m=	0.95	0.94	0.9	0.82	0.68	0.49	0.35	0.39	0.62	0.84	0.93	0.96	(89)

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

(90)m=	18.7	18.9	19.29	19.8	20.16	20.34	20.38	20.37	20.27	19.84	19.23	18.68	(90)

fLA = Living area ÷ (4) = | 0.57 | (91)

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

(92)m=	19.32	19.49	19.8	20.22	20.53	20.69	20.73	20.72	20.63	20.26	19.75	19.3	(92)

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

(93)m=	19.32	19.49	19.8	20.22	20.53	20.69	20.73	20.72	20.63	20.26	19.75	19.3	(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=	0.94	0.93	0.89	0.82	0.69	0.51	0.38	0.42	0.64	0.83	0.92	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	423.01	438	445.91	437.47	388.81	287.47	200.75	208.17	293.82	361.2	391.12	410.94	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	776.55	751.6	683.14	571.68	444.34	301.04	203.94	212.86	324.84	485.89	640.65	769.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	263.03	210.74	176.5	96.64	41.32	0	0	0	0	92.77	179.66	267.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1327.76 | (98)

Space heating requirement in kWh/m²/year | 17.47 | (99)

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9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1327.76	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1394.15	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2192.88	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2302.52	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.97	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		147.42	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	147.42	(331)
Energy for lighting (calculated in Appendix L)		349.1	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-576.34	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	767.43	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.19	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	786.62	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			786.62	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	76.51	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	181.18	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-299.12	(380)
Total CO2, kg/year	sum of (376)…(382) =			745.19	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			9.81	(384)
EI rating (section 14)				91.75	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_03 - 2B4P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76	(1a) x	2.65	(2a) =	201.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		201.4	(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		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(21)

Infiltration rate modified for monthly wind speed

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

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

0.36	0.35	0.34	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.31	0.33

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=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55	(24d)

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

(25)m=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55	(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			3.17	x1/[1/(1.4)+ 0.04]		=	4.2			(27)
Walls Type1	36.3	12.68	23.62	x	0.18	=	4.25			(29)
Walls Type2	24.1	0	24.1	x	0.18	=	4.34			(29)
Total area of elements, m²			60.4							(31)

** 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) = 25.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 3.02 (36)

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

Total fabric heat loss (33) + (36) = 28.42 (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=	37.44	37.28	37.12	36.37	36.23	35.57	35.57	35.45	35.82	36.23	36.51	36.81	(38)

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

(39)m=	65.86	65.7	65.54	64.79	64.65	63.99	63.99	63.87	64.24	64.65	64.93	65.23

Average = Sum(39)$_{1…12}$ /12= 64.79 (39)

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

(40)m=	0.87	0.86	0.86	0.85	0.85	0.84	0.84	0.84	0.85	0.85	0.85	0.86

Average = Sum(40)$_{1…12}$ /12= 0.85 (40)

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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 — 2.38 (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 — 90.79 (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=	99.87	96.23	92.6	88.97	85.34	81.71	81.71	85.34	88.97	92.6	96.23	99.87	
											Total = Sum(44)1…12 =		1089.44 (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=	148.1	129.53	133.66	116.53	111.81	96.48	89.41	102.6	103.82	120.99	132.07	143.42	
											Total = Sum(45)1…12 =		1428.42 (45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.21	19.43	20.05	17.48	16.77	14.47	13.41	15.39	15.57	18.15	19.81	21.51	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): — 1.65 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) — 0.89 (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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	199.02	175.52	184.59	165.81	162.74	145.77	140.33	153.52	153.1	171.92	181.36	194.35	(62)

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

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

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

Output from water heater

(64)m=	199.02	175.52	184.59	165.81	162.74	145.77	140.33	153.52	153.1	171.92	181.36	194.35	

Output from water heater (annual)$_{1...12}$ 2028.04 (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=	89.98	79.87	85.18	78.17	77.92	71.51	70.47	74.85	73.95	80.97	83.34	88.43	(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=	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	119.13	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	20.34	18.07	14.69	11.12	8.31	7.02	7.58	9.86	13.23	16.8	19.61	20.91	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	210.88	213.07	207.55	195.81	180.99	167.07	157.76	155.57	161.09	172.83	187.65	201.57	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	34.91	(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=	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	-95.3	(71)
Water heating gains (Table 5)													
(72)m=	120.95	118.85	114.49	108.57	104.73	99.32	94.72	100.61	102.7	108.83	115.75	118.86	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	413.9	411.72	398.48	377.25	355.78	335.14	321.8	327.78	338.76	360.2	384.75	403.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.63	x	0.7	=	30.66	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.63	x	0.7	=	62.42	(75)
Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.63	x	0.7	=	112.45	(75)
Northeast 0.9x	0.54	x	3.17	x	67.96	x	0.63	x	0.7	=	184.68	(75)
Northeast 0.9x	0.54	x	3.17	x	91.35	x	0.63	x	0.7	=	248.25	(75)
Northeast 0.9x	0.54	x	3.17	x	97.38	x	0.63	x	0.7	=	264.66	(75)
Northeast 0.9x	0.54	x	3.17	x	91.1	x	0.63	x	0.7	=	247.58	(75)
Northeast 0.9x	0.54	x	3.17	x	72.63	x	0.63	x	0.7	=	197.37	(75)

Northeast	0.9x	0.54	x	3.17	x	50.42	x	0.63	x	0.7	=	137.03	(75)
Northeast	0.9x	0.54	x	3.17	x	28.07	x	0.63	x	0.7	=	76.28	(75)
Northeast	0.9x	0.54	x	3.17	x	14.2	x	0.63	x	0.7	=	38.58	(75)
Northeast	0.9x	0.54	x	3.17	x	9.21	x	0.63	x	0.7	=	25.04	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.66	62.42	112.45	184.68	248.25	264.66	247.58	197.37	137.03	76.28	38.58	25.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	444.57	474.14	510.93	561.93	604.02	599.8	569.38	525.16	475.79	436.48	423.33	428.12	(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	0.86	0.66	0.49	0.55	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.24	20.42	20.68	20.9	20.98	21	21	20.94	20.68	20.37	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.2	20.21	20.21	20.22	20.22	20.22	20.21	20.21	20.21	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.82	0.59	0.41	0.46	0.77	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.18	19.45	19.83	20.11	20.21	20.22	20.22	20.16	19.83	19.38	19.02	(90)

fLA = Living area ÷ (4) = | 0.57 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.78	20	20.32	20.56	20.65	20.66	20.66	20.61	20.31	19.95	19.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.78	20	20.32	20.56	20.65	20.66	20.66	20.61	20.31	19.95	19.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.95	0.84	0.63	0.46	0.51	0.8	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	443.21	471.67	504.28	535.43	508.25	378.92	259.11	270.36	382.62	422.79	420.63	427.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1012.52	977.87	885.06	739.65	572.61	387.22	259.98	272.2	418.01	627.98	834.24	1008.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	423.56	340.17	283.29	147.04	47.88	0	0	0	0	152.66	297.79	432.27	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2124.67 | (98)

Space heating requirement in kWh/m²/year | 27.96 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	423.56	340.17	283.29	147.04	47.88	0	0	0	0	152.66	297.79	432.27		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	453.01	363.82	302.99	157.26	51.21	0	0	0	0	163.27	318.5	462.32		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2272.37	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)
Water heating														
Output from water heater (calculated above)	199.02	175.52	184.59	165.81	162.74	145.77	140.33	153.52	153.1	171.92	181.36	194.35		
Efficiency of water heater													79.8	(216)
(217)m=	86.78	86.55	85.95	84.5	82	79.8	79.8	79.8	79.8	84.5	86.13	86.89		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	229.34	202.8	214.75	196.24	198.45	182.67	175.86	192.38	191.86	203.46	210.57	223.68		
Total = Sum(219a)$_{1...12}$ =													2422.05	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2272.37	
Water heating fuel used			2422.05	
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			359.22	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	490.83	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	523.16	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1014	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	186.44	(268)
Total CO2, kg/year		sum of (265)…(271) =		1239.36	(272)

TER =	23.65	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:44:46

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 102.3m²

Site Reference : Tottenham Mews **Plot Reference:** 2_04 - 3B5P

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 (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	21.14 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	8.59 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	39.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	35.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	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 using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump	
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.61	
Maximum	1.5	**OK**
MVHR efficiency:	79%	
Minimum	70%	**OK**
9 Summertime temperature		
Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	6.58m²	
Windows facing: South West	2.1m²	
Windows facing: North East	3.17m²	
Windows facing: South West	6.58m²	
Ventilation rate:	6.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	
10 Key features		
Air permeablility	3.0 m³/m²h	
Windows U-value	1.1 W/m²K	
Community heating, heat from electric heat pump		
Photovoltaic array		

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_04 - 3B5P

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	102.3	(1a)	x	2.65	(2a)	=	271.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	102.3	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	271.1	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(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

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) =	67.15	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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	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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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			6.58	x1/[1/(1.1)+ 0.04] =	6.93			(27)
Windows Type 2			1.05	x1/[1/(1.1)+ 0.04] =	1.11			(27)
Windows Type 3			3.17	x1/[1/(1.1)+ 0.04] =	3.34			(27)
Windows Type 4			3.29	x1/[1/(1.1)+ 0.04] =	3.47			(27)
Walls Type1	58.8	18.43	40.37	x 0.2 =	8.07			(29)
Walls Type2	20.1	0	20.1	x 0.19 =	3.72			(29)
Total area of elements, m²			78.9					(31)

** 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) =	31.21	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		11.84	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	43.05	(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=	26.67	26.44	26.2	25.03	24.79	23.62	23.62	23.38	24.09	24.79	25.26	25.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.72	69.49	69.25	68.08	67.84	66.67	66.67	66.43	67.14	67.84	68.31	68.78	

Average = Sum(39)$_{1…12}$ /12= 68.02 (39)

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Heat loss parameter (HLP), W/m²K   (40)m = (39)m ÷ (4)

(40)m=	0.68	0.68	0.68	0.67	0.66	0.65	0.65	0.65	0.66	0.66	0.67	0.67

Average = Sum(40)$_{1...12}$ /12= 0.66 (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 2.76 (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 99.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	109.72	105.73	101.74	97.75	93.76	89.77	89.77	93.76	97.75	101.74	105.73	109.72

Total = Sum(44)$_{1...12}$ = 1196.95 (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=	162.71	142.31	146.85	128.03	122.85	106.01	98.23	112.72	114.07	132.93	145.11	157.58

Total = Sum(45)$_{1...12}$ = 1569.39 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.41	21.35	22.03	19.2	18.43	15.9	14.73	16.91	17.11	19.94	21.77	23.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	227.64	200.95	211.78	190.86	187.77	168.84	163.16	177.65	176.9	197.86	207.94	222.5	(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=	227.64	200.95	211.78	190.86	187.77	168.84	163.16	177.65	176.9	197.86	207.94	222.5	

Output from water heater (annual)$_{1...12}$ 2333.85 (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=	106.04	94.23	100.77	92.83	92.79	85.51	84.6	89.42	88.19	96.14	98.51	104.34	(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=	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.01	21.32	17.34	13.13	9.81	8.28	8.95	11.64	15.62	19.83	23.14	24.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	259.99	262.69	255.89	241.42	223.15	205.98	194.51	191.81	198.61	213.08	231.35	248.52	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	(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=	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	(71)

Water heating gains (Table 5)

(72)m=	142.53	140.23	135.44	128.94	124.71	118.77	113.71	120.19	122.49	129.22	136.83	140.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	490.93	488.64	473.07	447.88	422.07	397.43	381.57	388.03	401.11	426.53	455.72	477.83	(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	0.54	x	6.58	x	11.28	x	0.44	x	0.8	=	12.7	(75)
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.44	x	0.8	=	6.12	(75)
Northeast 0.9x	0.54	x	6.58	x	22.97	x	0.44	x	0.8	=	25.85	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.44	x	0.8	=	12.45	(75)
Northeast 0.9x	0.54	x	6.58	x	41.38	x	0.44	x	0.8	=	46.58	(75)

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Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.44	x	0.8	=	22.44	(75)
Northeast 0.9x	0.54	x	6.58	x	67.96	x	0.44	x	0.8	=	76.49	(75)
Northeast 0.9x	0.54	x	3.17	x	67.96	x	0.44	x	0.8	=	36.85	(75)
Northeast 0.9x	0.54	x	6.58	x	91.35	x	0.44	x	0.8	=	102.82	(75)
Northeast 0.9x	0.54	x	3.17	x	91.35	x	0.44	x	0.8	=	49.54	(75)
Northeast 0.9x	0.54	x	6.58	x	97.38	x	0.44	x	0.8	=	109.62	(75)
Northeast 0.9x	0.54	x	3.17	x	97.38	x	0.44	x	0.8	=	52.81	(75)
Northeast 0.9x	0.54	x	6.58	x	91.1	x	0.44	x	0.8	=	102.55	(75)
Northeast 0.9x	0.54	x	3.17	x	91.1	x	0.44	x	0.8	=	49.4	(75)
Northeast 0.9x	0.54	x	6.58	x	72.63	x	0.44	x	0.8	=	81.75	(75)
Northeast 0.9x	0.54	x	3.17	x	72.63	x	0.44	x	0.8	=	39.39	(75)
Northeast 0.9x	0.54	x	6.58	x	50.42	x	0.44	x	0.8	=	56.76	(75)
Northeast 0.9x	0.54	x	3.17	x	50.42	x	0.44	x	0.8	=	27.34	(75)
Northeast 0.9x	0.54	x	6.58	x	28.07	x	0.44	x	0.8	=	31.59	(75)
Northeast 0.9x	0.54	x	3.17	x	28.07	x	0.44	x	0.8	=	15.22	(75)
Northeast 0.9x	0.54	x	6.58	x	14.2	x	0.44	x	0.8	=	15.98	(75)
Northeast 0.9x	0.54	x	3.17	x	14.2	x	0.44	x	0.8	=	7.7	(75)
Northeast 0.9x	0.54	x	6.58	x	9.21	x	0.44	x	0.8	=	10.37	(75)
Northeast 0.9x	0.54	x	3.17	x	9.21	x	0.44	x	0.8	=	5	(75)
Southwest0.9x	0.54	x	1.05	x	36.79		0.44	x	0.8	=	13.22	(79)
Southwest0.9x	0.54	x	3.29	x	36.79		0.44	x	0.8	=	41.42	(79)
Southwest0.9x	0.54	x	1.05	x	62.67		0.44	x	0.8	=	22.52	(79)
Southwest0.9x	0.54	x	3.29	x	62.67		0.44	x	0.8	=	70.55	(79)
Southwest0.9x	0.54	x	1.05	x	85.75		0.44	x	0.8	=	30.81	(79)
Southwest0.9x	0.54	x	3.29	x	85.75		0.44	x	0.8	=	96.53	(79)
Southwest0.9x	0.54	x	1.05	x	106.25		0.44	x	0.8	=	38.17	(79)
Southwest0.9x	0.54	x	3.29	x	106.25		0.44	x	0.8	=	119.6	(79)
Southwest0.9x	0.54	x	1.05	x	119.01		0.44	x	0.8	=	42.75	(79)
Southwest0.9x	0.54	x	3.29	x	119.01		0.44	x	0.8	=	133.96	(79)
Southwest0.9x	0.54	x	1.05	x	118.15		0.44	x	0.8	=	42.45	(79)
Southwest0.9x	0.54	x	3.29	x	118.15		0.44	x	0.8	=	133	(79)
Southwest0.9x	0.54	x	1.05	x	113.91		0.44	x	0.8	=	40.92	(79)
Southwest0.9x	0.54	x	3.29	x	113.91		0.44	x	0.8	=	128.22	(79)
Southwest0.9x	0.54	x	1.05	x	104.39		0.44	x	0.8	=	37.5	(79)
Southwest0.9x	0.54	x	3.29	x	104.39		0.44	x	0.8	=	117.51	(79)
Southwest0.9x	0.54	x	1.05	x	92.85		0.44	x	0.8	=	33.36	(79)
Southwest0.9x	0.54	x	3.29	x	92.85		0.44	x	0.8	=	104.52	(79)
Southwest0.9x	0.54	x	1.05	x	69.27		0.44	x	0.8	=	24.88	(79)
Southwest0.9x	0.54	x	3.29	x	69.27		0.44	x	0.8	=	77.97	(79)
Southwest0.9x	0.54	x	1.05	x	44.07		0.44	x	0.8	=	15.83	(79)
Southwest0.9x	0.54	x	3.29	x	44.07		0.44	x	0.8	=	49.61	(79)

Southwest	0.9x	0.54	x	1.05	x	31.49		0.44	x	0.8	=	11.31	(79)
Southwest	0.9x	0.54	x	3.29	x	31.49		0.44	x	0.8	=	35.44	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.45	131.37	196.35	271.12	329.08	337.87	321.1	276.15	221.98	149.67	89.12	62.13	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	564.38	620.01	669.42	719	751.15	735.3	702.66	664.18	623.09	576.2	544.84	539.95	(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=	0.96	0.95	0.91	0.84	0.72	0.55	0.41	0.45	0.66	0.86	0.94	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.89	20.18	20.54	20.81	20.95	20.99	20.98	20.89	20.56	20.09	19.68	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.36	20.36	20.36	20.37	20.37	20.38	20.38	20.39	20.38	20.37	20.37	20.37	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.96	0.94	0.9	0.82	0.69	0.5	0.35	0.39	0.62	0.84	0.94	0.96	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.59	18.86	19.28	19.79	20.15	20.33	20.37	20.37	20.27	19.83	19.15	18.55	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.12	19.35	19.7	20.14	20.46	20.63	20.66	20.66	20.56	20.18	19.6	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.12	19.35	19.7	20.14	20.46	20.63	20.66	20.66	20.56	20.18	19.6	19.09	(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=	0.95	0.93	0.89	0.81	0.69	0.52	0.38	0.42	0.63	0.84	0.92	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	535.68	576.16	596.93	585.95	518.63	382.85	266.66	276.88	393.95	481.69	503.8	515.7	(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=	1033.3	1003.97	914.44	765.51	594.32	401.73	270.98	283.06	434.03	649.66	853.56	1023.87	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	370.23	287.48	236.23	129.28	56.31	0	0	0	0	124.97	251.82	378.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1834.42 (98)

Space heating requirement in kWh/m²/year 17.93 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1834.42	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1926.14	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2333.85	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2450.54	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.77	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		252.19	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	252.19	(331)
Energy for lighting (calculated in Appendix L)		423.94	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-776.42	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	908.6	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	22.71	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	931.31	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			931.31	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	130.88	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	220.03	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-402.96	(380)
Total CO2, kg/year	sum of (376)…(382) =			879.26	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			8.59	(384)
EI rating (section 14)				92	(385)

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User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 2_04 - 3B5P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	102.3	(1a) x	2.65	(2a) =	271.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	102.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	271.1	(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		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.35	0.35	0.34	0.31	0.3	0.26	0.26	0.26	0.28	0.3	0.31	0.33

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=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			6.58	x1/[1/(1.4)+ 0.04]	=	8.72			(27)
Windows Type 2			1.05	x1/[1/(1.4)+ 0.04]	=	1.39			(27)
Windows Type 3			3.17	x1/[1/(1.4)+ 0.04]	=	4.2			(27)
Windows Type 4			3.29	x1/[1/(1.4)+ 0.04]	=	4.36			(27)
Walls Type1	58.8	18.43	40.37	x 0.18	=	7.27			(29)
Walls Type2	20.1	0	20.1	x 0.18	=	3.62			(29)
Total area of elements, m²			78.9						(31)

** 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) =	35.32	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		3.95	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	39.26	(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=	50.36	50.14	49.93	48.92	48.73	47.86	47.86	47.69	48.19	48.73	49.11	49.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.63	89.41	89.19	88.19	88	87.12	87.12	86.96	87.46	88	88.38	88.78	

Average = Sum(39)$_{1…12}$ /12= 88.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.88	0.87	0.87	0.86	0.86	0.85	0.85	0.85	0.85	0.86	0.86	0.87

Average = Sum(40)$_{1…12}$ /12= 0.86 (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 2.76 (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 99.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	109.72	105.73	101.74	97.75	93.76	89.77	89.77	93.76	97.75	101.74	105.73	109.72

Total = Sum(44)$_{1…12}$ = 1196.95 (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=	162.71	142.31	146.85	128.03	122.85	106.01	98.23	112.72	114.07	132.93	145.11	157.58

Total = Sum(45)$_{1…12}$ = 1569.39 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.41	21.35	22.03	19.2	18.43	15.9	14.73	16.91	17.11	19.94	21.77	23.64	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.64	188.31	197.78	177.31	173.77	155.29	149.16	163.65	163.35	183.86	194.39	208.5	(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=	213.64	188.31	197.78	177.31	173.77	155.29	149.16	163.65	163.35	183.86	194.39	208.5	

Output from water heater (annual)$_{1...12}$ 2169 (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=	94.84	84.12	89.57	82	81.59	74.67	73.4	78.22	77.35	84.94	87.68	93.14	(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=	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	137.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.66	21.91	17.81	13.49	10.08	8.51	9.2	11.95	16.05	20.37	23.78	25.35	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	259.99	262.69	255.89	241.42	223.15	205.98	194.51	191.81	198.61	213.08	231.35	248.52	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	(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=	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	-110.39	(71)

Water heating gains (Table 5)

(72)m=	127.48	125.17	120.39	113.88	109.66	103.71	98.66	105.14	107.44	114.17	121.77	125.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	479.53	477.17	461.49	436.19	410.29	385.6	369.76	376.29	389.48	415.02	444.3	466.45	(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	0.54	x	6.58	x	11.28	x	0.63	x	0.7	=	15.91	(75)
Northeast 0.9x	0.54	x	3.17	x	11.28	x	0.63	x	0.7	=	7.67	(75)
Northeast 0.9x	0.54	x	6.58	x	22.97	x	0.63	x	0.7	=	32.39	(75)
Northeast 0.9x	0.54	x	3.17	x	22.97	x	0.63	x	0.7	=	15.6	(75)
Northeast 0.9x	0.54	x	6.58	x	41.38	x	0.63	x	0.7	=	58.36	(75)

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Northeast 0.9x	0.54	x	3.17	x	41.38	x	0.63	x	0.7	=	28.11	(75)
Northeast 0.9x	0.54	x	6.58	x	67.96	x	0.63	x	0.7	=	95.84	(75)
Northeast 0.9x	0.54	x	3.17	x	67.96	x	0.63	x	0.7	=	46.17	(75)
Northeast 0.9x	0.54	x	6.58	x	91.35	x	0.63	x	0.7	=	128.82	(75)
Northeast 0.9x	0.54	x	3.17	x	91.35	x	0.63	x	0.7	=	62.06	(75)
Northeast 0.9x	0.54	x	6.58	x	97.38	x	0.63	x	0.7	=	137.34	(75)
Northeast 0.9x	0.54	x	3.17	x	97.38	x	0.63	x	0.7	=	66.16	(75)
Northeast 0.9x	0.54	x	6.58	x	91.1	x	0.63	x	0.7	=	128.48	(75)
Northeast 0.9x	0.54	x	3.17	x	91.1	x	0.63	x	0.7	=	61.9	(75)
Northeast 0.9x	0.54	x	6.58	x	72.63	x	0.63	x	0.7	=	102.42	(75)
Northeast 0.9x	0.54	x	3.17	x	72.63	x	0.63	x	0.7	=	49.34	(75)
Northeast 0.9x	0.54	x	6.58	x	50.42	x	0.63	x	0.7	=	71.11	(75)
Northeast 0.9x	0.54	x	3.17	x	50.42	x	0.63	x	0.7	=	34.26	(75)
Northeast 0.9x	0.54	x	6.58	x	28.07	x	0.63	x	0.7	=	39.58	(75)
Northeast 0.9x	0.54	x	3.17	x	28.07	x	0.63	x	0.7	=	19.07	(75)
Northeast 0.9x	0.54	x	6.58	x	14.2	x	0.63	x	0.7	=	20.02	(75)
Northeast 0.9x	0.54	x	3.17	x	14.2	x	0.63	x	0.7	=	9.65	(75)
Northeast 0.9x	0.54	x	6.58	x	9.21	x	0.63	x	0.7	=	12.99	(75)
Northeast 0.9x	0.54	x	3.17	x	9.21	x	0.63	x	0.7	=	6.26	(75)
Southwest0.9x	0.54	x	1.05	x	36.79		0.63	x	0.7	=	16.56	(79)
Southwest0.9x	0.54	x	3.29	x	36.79		0.63	x	0.7	=	51.89	(79)
Southwest0.9x	0.54	x	1.05	x	62.67		0.63	x	0.7	=	28.21	(79)
Southwest0.9x	0.54	x	3.29	x	62.67		0.63	x	0.7	=	88.39	(79)
Southwest0.9x	0.54	x	1.05	x	85.75		0.63	x	0.7	=	38.6	(79)
Southwest0.9x	0.54	x	3.29	x	85.75		0.63	x	0.7	=	120.93	(79)
Southwest0.9x	0.54	x	1.05	x	106.25		0.63	x	0.7	=	47.82	(79)
Southwest0.9x	0.54	x	3.29	x	106.25		0.63	x	0.7	=	149.84	(79)
Southwest0.9x	0.54	x	1.05	x	119.01		0.63	x	0.7	=	53.56	(79)
Southwest0.9x	0.54	x	3.29	x	119.01		0.63	x	0.7	=	167.84	(79)
Southwest0.9x	0.54	x	1.05	x	118.15		0.63	x	0.7	=	53.18	(79)
Southwest0.9x	0.54	x	3.29	x	118.15		0.63	x	0.7	=	166.62	(79)
Southwest0.9x	0.54	x	1.05	x	113.91		0.63	x	0.7	=	51.27	(79)
Southwest0.9x	0.54	x	3.29	x	113.91		0.63	x	0.7	=	160.64	(79)
Southwest0.9x	0.54	x	1.05	x	104.39		0.63	x	0.7	=	46.98	(79)
Southwest0.9x	0.54	x	3.29	x	104.39		0.63	x	0.7	=	147.22	(79)
Southwest0.9x	0.54	x	1.05	x	92.85		0.63	x	0.7	=	41.79	(79)
Southwest0.9x	0.54	x	3.29	x	92.85		0.63	x	0.7	=	130.95	(79)
Southwest0.9x	0.54	x	1.05	x	69.27		0.63	x	0.7	=	31.18	(79)
Southwest0.9x	0.54	x	3.29	x	69.27		0.63	x	0.7	=	97.69	(79)
Southwest0.9x	0.54	x	1.05	x	44.07		0.63	x	0.7	=	19.84	(79)
Southwest0.9x	0.54	x	3.29	x	44.07		0.63	x	0.7	=	62.15	(79)

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Southwest 0.9x	0.54	x	1.05	x	31.49		0.63	x	0.7	=	14.17	(79)
Southwest 0.9x	0.54	x	3.29	x	31.49		0.63	x	0.7	=	44.41	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.03	164.59	246	339.67	412.29	423.3	402.28	345.97	278.1	187.51	111.65	77.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	571.56	641.75	707.49	775.86	822.57	808.9	772.04	722.26	667.58	602.53	555.95	544.28	(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	0.86	0.67	0.49	0.55	0.82	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.23	20.43	20.69	20.89	20.98	21	21	20.94	20.68	20.35	20.08	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.2	20.2	20.21	20.21	20.21	20.21	20.2	20.2	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.82	0.59	0.41	0.46	0.75	0.96	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.16	19.45	19.83	20.1	20.2	20.21	20.21	20.16	19.83	19.34	18.95	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.51	19.67	19.91	20.24	20.48	20.57	20.58	20.58	20.53	20.23	19.82	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.51	19.67	19.91	20.24	20.48	20.57	20.58	20.58	20.53	20.23	19.82	19.49	(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=	1	0.99	0.98	0.95	0.84	0.63	0.45	0.5	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	570.15	638.22	696.75	734.98	687.45	508.89	345.84	361.47	521.51	581.07	552.74	543.28	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1363.51	1320.1	1196.34	999.65	772.19	520.14	346.96	363.65	562.56	847.62	1123.98	1357.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	590.26	458.22	371.7	190.56	63.05	0	0	0	0	198.31	411.29	605.59	(98)

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2888.98 (98)

Space heating requirement in kWh/m²/year 28.24 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

TER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	590.26	458.22	371.7	190.56	63.05	0	0	0	0	198.31	411.29	605.59		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	631.29	490.07	397.54	203.81	67.43	0	0	0	0	212.09	439.88	647.69		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3089.81	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	213.64	188.31	197.78	177.31	173.77	155.29	149.16	163.65	163.35	183.86	194.39	208.5		
Efficiency of water heater													79.8	(216)
(217)m=	87.39	87.1	86.47	85.01	82.39	79.8	79.8	79.8	79.8	85.02	86.77	87.5		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	244.48	216.2	228.71	208.59	210.9	194.6	186.91	205.07	204.7	216.27	224.04	238.3		
Total = Sum(219a)$_{1...12}$ =													2578.77	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3089.81	
Water heating fuel used			2578.77	
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			435.56	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	667.4	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	557.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1224.41	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	226.05	(268)

TER WorkSheet: New dwelling design stage

Total CO_2, kg/year	sum of (265)…(271) =	1489.39	(272)
TER =		21.14	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:44:45

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 81.5m²

Site Reference : Tottenham Mews **Plot Reference:** 4_05 - 1B2P

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 (c)		
Fuel factor: 1.55 (electricity (c))		
Target Carbon Dioxide Emission Rate (TER)	26.09 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.77 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	54.4 kWh/m²	
		Fail
Excess energy = 4.66 kg/m² (09.4 %)		

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.23 (max. 0.20)	0.23 (max. 0.35)	Fail
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	$4.7m^2$
Windows facing: South West	$6.58m^2$
Windows facing: South West	$2.1m^2$
Ventilation rate:	6.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	$3.0 m^3/m^2h$
Windows U-value	$1.1 W/m^2K$
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 4_05 - 1B2P

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	81.5	(1a)	x	2.65	(2a)	=	215.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			215.98	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.1	(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

0.13	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.1	0.11	0.12	0.12

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) = 66.3 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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	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=	0.3	0.3	0.3	0.28	0.28	0.27	0.27	0.27	0.27	0.28	0.29	0.29	(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			4.7	x1/[1/(1.1)+ 0.04]		=	4.95			(27)
Windows Type 2			3.29	x1/[1/(1.1)+ 0.04]		=	3.47			(27)
Windows Type 3			1.05	x1/[1/(1.1)+ 0.04]		=	1.11			(27)
Walls Type1	50.4	13.38	37.02	x	0.2	=	7.4			(29)
Walls Type2	20.4	0	20.4	x	0.19	=	3.78			(29)
Roof	81.5	0	81.5	x	0.23	=	18.75			(30)
Total area of elements, m²			152.3							(31)

** 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) = 44.02 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 733.5 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 22.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 66.87 (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=	21.55	21.36	21.18	20.24	20.05	19.12	19.12	18.93	19.49	20.05	20.43	20.8	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.42	88.23	88.05	87.11	86.92	85.99	85.99	85.8	86.36	86.92	87.3	87.67	

Average = $Sum(39)_{1…12}$ /12= 87.06 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.08	1.08	1.07	1.07	1.06	1.06	1.05	1.06	1.07	1.07	1.08

Average = Sum(40)$_{1…12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.49 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.35 (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=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69	
											Total = Sum(44)$_{1…12}$ =	1120.25	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48	
											Total = Sum(45)$_{1…12}$ =	1468.83	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.21	191.83	202.37	182.66	179.9	162.05	156.86	170.42	169.59	189.34	198.64	212.41	(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=	217.21	191.83	202.37	182.66	179.9	162.05	156.86	170.42	169.59	189.34	198.64	212.41	

Output from water heater (annual)$_{1...12}$ 2233.28 (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=	102.58	91.2	97.64	90.11	90.17	83.25	82.51	87.02	85.76	93.31	95.42	100.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	20.93	18.59	15.12	11.45	8.56	7.22	7.81	10.15	13.62	17.29	20.18	21.51	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(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=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)
Water heating gains (Table 5)													
(72)m=	137.87	135.71	131.24	125.15	121.2	115.63	110.9	116.96	119.11	125.42	132.53	135.72	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	441.71	439.52	425.75	403.6	381.12	359.53	345.56	351.65	363.09	385.46	411.1	430.32	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	4.7	x	11.28	x	0.44	x	0.8	=	9.07	(75)
Northeast 0.9x	0.54	x	4.7	x	22.97	x	0.44	x	0.8	=	18.47	(75)
Northeast 0.9x	0.54	x	4.7	x	41.38	x	0.44	x	0.8	=	33.27	(75)
Northeast 0.9x	0.54	x	4.7	x	67.96	x	0.44	x	0.8	=	54.64	(75)
Northeast 0.9x	0.54	x	4.7	x	91.35	x	0.44	x	0.8	=	73.45	(75)

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Northeast	0.9x	0.54	x	4.7	x	97.38	x	0.44	x	0.8	=	78.3	(75)
Northeast	0.9x	0.54	x	4.7	x	91.1	x	0.44	x	0.8	=	73.25	(75)
Northeast	0.9x	0.54	x	4.7	x	72.63	x	0.44	x	0.8	=	58.39	(75)
Northeast	0.9x	0.54	x	4.7	x	50.42	x	0.44	x	0.8	=	40.54	(75)
Northeast	0.9x	0.54	x	4.7	x	28.07	x	0.44	x	0.8	=	22.57	(75)
Northeast	0.9x	0.54	x	4.7	x	14.2	x	0.44	x	0.8	=	11.41	(75)
Northeast	0.9x	0.54	x	4.7	x	9.21	x	0.44	x	0.8	=	7.41	(75)
Southwest	0.9x	0.54	x	3.29	x	36.79		0.44	x	0.8	=	41.42	(79)
Southwest	0.9x	0.54	x	1.05	x	36.79		0.44	x	0.8	=	13.22	(79)
Southwest	0.9x	0.54	x	3.29	x	62.67		0.44	x	0.8	=	70.55	(79)
Southwest	0.9x	0.54	x	1.05	x	62.67		0.44	x	0.8	=	22.52	(79)
Southwest	0.9x	0.54	x	3.29	x	85.75		0.44	x	0.8	=	96.53	(79)
Southwest	0.9x	0.54	x	1.05	x	85.75		0.44	x	0.8	=	30.81	(79)
Southwest	0.9x	0.54	x	3.29	x	106.25		0.44	x	0.8	=	119.6	(79)
Southwest	0.9x	0.54	x	1.05	x	106.25		0.44	x	0.8	=	38.17	(79)
Southwest	0.9x	0.54	x	3.29	x	119.01		0.44	x	0.8	=	133.96	(79)
Southwest	0.9x	0.54	x	1.05	x	119.01		0.44	x	0.8	=	42.75	(79)
Southwest	0.9x	0.54	x	3.29	x	118.15		0.44	x	0.8	=	133	(79)
Southwest	0.9x	0.54	x	1.05	x	118.15		0.44	x	0.8	=	42.45	(79)
Southwest	0.9x	0.54	x	3.29	x	113.91		0.44	x	0.8	=	128.22	(79)
Southwest	0.9x	0.54	x	1.05	x	113.91		0.44	x	0.8	=	40.92	(79)
Southwest	0.9x	0.54	x	3.29	x	104.39		0.44	x	0.8	=	117.51	(79)
Southwest	0.9x	0.54	x	1.05	x	104.39		0.44	x	0.8	=	37.5	(79)
Southwest	0.9x	0.54	x	3.29	x	92.85		0.44	x	0.8	=	104.52	(79)
Southwest	0.9x	0.54	x	1.05	x	92.85		0.44	x	0.8	=	33.36	(79)
Southwest	0.9x	0.54	x	3.29	x	69.27		0.44	x	0.8	=	77.97	(79)
Southwest	0.9x	0.54	x	1.05	x	69.27		0.44	x	0.8	=	24.88	(79)
Southwest	0.9x	0.54	x	3.29	x	44.07		0.44	x	0.8	=	49.61	(79)
Southwest	0.9x	0.54	x	1.05	x	44.07		0.44	x	0.8	=	15.83	(79)
Southwest	0.9x	0.54	x	3.29	x	31.49		0.44	x	0.8	=	35.44	(79)
Southwest	0.9x	0.54	x	1.05	x	31.49		0.44	x	0.8	=	11.31	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	63.71	111.53	160.6	212.41	250.17	253.74	242.39	213.4	178.42	125.42	76.86	54.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	505.42	551.05	586.36	616.02	631.29	613.27	587.95	565.05	541.51	510.88	487.96	484.49	(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=	0.96	0.95	0.93	0.89	0.82	0.69	0.56	0.59	0.77	0.9	0.95	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.78	18.99	19.36	19.86	20.34	20.72	20.89	20.86	20.59	19.99	19.31	18.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.02	20.02	20.03	20.03	20.04	20.04	20.04	20.03	20.03	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.96	0.94	0.92	0.87	0.78	0.63	0.46	0.5	0.71	0.88	0.94	0.96	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.04	17.34	17.88	18.6	19.26	19.76	19.96	19.94	19.61	18.8	17.81	16.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.89	18.15	18.6	19.22	19.79	20.23	20.41	20.39	20.09	19.38	18.55	17.85	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.89	18.15	18.6	19.22	19.79	20.23	20.41	20.39	20.09	19.38	18.55	17.85	(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=	0.94	0.93	0.9	0.85	0.77	0.64	0.5	0.54	0.72	0.86	0.92	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	476.17	510.65	527.89	524.65	486.44	393.87	295.3	302.58	387.96	438.44	450.03	458.98	(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=	1201.97	1169.08	1065.66	898.59	703.24	484.22	328	342.59	517.66	763.55	999.32	1196.44	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	540	442.47	400.1	269.24	161.3	0	0	0	0	241.88	395.49	548.67	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2999.15 (98)

Space heating requirement in kWh/m²/year 36.8 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2999.15	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3149.11	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2233.28	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2344.95	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	54.94	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		158.09	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	158.09	(331)
Energy for lighting (calculated in Appendix L)		369.64	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-618.34	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1140.57	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	28.51	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1169.08	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1169.08	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	82.05	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	191.85	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-320.92	(380)
Total CO2, kg/year	sum of (376)…(382) =				1122.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.77	(384)
EI rating (section 14)					88.11	(385)

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User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 4_05 - 1B2P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	81.5	(1a) x	2.65	(2a) =	215.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		215.98	(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) =	0.14	(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		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.27	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.35	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32

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=	0.56	0.56	0.56	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.56	0.56	0.56	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			4.7	x1/[1/(1.4)+ 0.04]		=	6.23			(27)
Windows Type 2			3.29	x1/[1/(1.4)+ 0.04]		=	4.36			(27)
Windows Type 3			1.05	x1/[1/(1.4)+ 0.04]		=	1.39			(27)
Walls Type1	50.4	13.38	37.02	x	0.18	=	6.66			(29)
Walls Type2	20.4	0	20.4	x	0.18	=	3.67			(29)
Roof	81.5	0	81.5	x	0.13	=	10.59			(30)
Total area of elements, m²			152.3							(31)

** 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) = 38.67 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 733.5 (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 7.62 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.28 (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=	39.93	39.76	39.6	38.83	38.69	38.02	38.02	37.9	38.28	38.69	38.98	39.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	86.21	86.05	85.88	85.12	84.97	84.3	84.3	84.18	84.56	84.97	85.26	85.57	

Average = Sum(39)$_{1…12}$ /12= 85.12 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(40)m=	1.06	1.06	1.05	1.04	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05		
										Average = Sum(40)$_{1...12}$ /12=			1.04	(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 — 2.49 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 93.35 (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=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69		
										Total = Sum(44)$_{1...12}$ =			1120.25	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48		
										Total = Sum(45)$_{1...12}$ =			1468.83	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.65 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.89 (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) — 0.89 (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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.21	179.19	188.37	169.11	165.9	148.5	142.86	156.42	156.04	175.34	185.09	198.41	(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=	203.21	179.19	188.37	169.11	165.9	148.5	142.86	156.42	156.04	175.34	185.09	198.41	

Output from water heater (annual)$_{1…12}$ 2068.44 (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=	91.38	81.08	86.44	79.27	78.97	72.42	71.31	75.82	74.92	82.11	84.58	89.78	(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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.54	19.13	15.56	11.78	8.81	7.43	8.03	10.44	14.02	17.8	20.77	22.14	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(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=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	122.82	120.66	116.18	110.09	106.14	100.58	95.85	101.91	104.06	110.36	117.48	120.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	430.27	428.01	414.14	391.88	369.32	347.68	333.73	339.89	351.44	373.91	399.64	418.9	(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)	
Northeast 0.9x	0.54	x	4.7	x	11.28	x	0.63	x	0.7	=	11.37	(75)
Northeast 0.9x	0.54	x	4.7	x	22.97	x	0.63	x	0.7	=	23.14	(75)
Northeast 0.9x	0.54	x	4.7	x	41.38	x	0.63	x	0.7	=	41.68	(75)
Northeast 0.9x	0.54	x	4.7	x	67.96	x	0.63	x	0.7	=	68.45	(75)
Northeast 0.9x	0.54	x	4.7	x	91.35	x	0.63	x	0.7	=	92.02	(75)

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Northeast 0.9x	0.54	x	4.7	x	97.38	x	0.63	x	0.7	=	98.1	(75)
Northeast 0.9x	0.54	x	4.7	x	91.1	x	0.63	x	0.7	=	91.77	(75)
Northeast 0.9x	0.54	x	4.7	x	72.63	x	0.63	x	0.7	=	73.16	(75)
Northeast 0.9x	0.54	x	4.7	x	50.42	x	0.63	x	0.7	=	50.79	(75)
Northeast 0.9x	0.54	x	4.7	x	28.07	x	0.63	x	0.7	=	28.27	(75)
Northeast 0.9x	0.54	x	4.7	x	14.2	x	0.63	x	0.7	=	14.3	(75)
Northeast 0.9x	0.54	x	4.7	x	9.21	x	0.63	x	0.7	=	9.28	(75)
Southwest0.9x	0.54	x	3.29	x	36.79		0.63	x	0.7	=	51.89	(79)
Southwest0.9x	0.54	x	1.05	x	36.79		0.63	x	0.7	=	16.56	(79)
Southwest0.9x	0.54	x	3.29	x	62.67		0.63	x	0.7	=	88.39	(79)
Southwest0.9x	0.54	x	1.05	x	62.67		0.63	x	0.7	=	28.21	(79)
Southwest0.9x	0.54	x	3.29	x	85.75		0.63	x	0.7	=	120.93	(79)
Southwest0.9x	0.54	x	1.05	x	85.75		0.63	x	0.7	=	38.6	(79)
Southwest0.9x	0.54	x	3.29	x	106.25		0.63	x	0.7	=	149.84	(79)
Southwest0.9x	0.54	x	1.05	x	106.25		0.63	x	0.7	=	47.82	(79)
Southwest0.9x	0.54	x	3.29	x	119.01		0.63	x	0.7	=	167.84	(79)
Southwest0.9x	0.54	x	1.05	x	119.01		0.63	x	0.7	=	53.56	(79)
Southwest0.9x	0.54	x	3.29	x	118.15		0.63	x	0.7	=	166.62	(79)
Southwest0.9x	0.54	x	1.05	x	118.15		0.63	x	0.7	=	53.18	(79)
Southwest0.9x	0.54	x	3.29	x	113.91		0.63	x	0.7	=	160.64	(79)
Southwest0.9x	0.54	x	1.05	x	113.91		0.63	x	0.7	=	51.27	(79)
Southwest0.9x	0.54	x	3.29	x	104.39		0.63	x	0.7	=	147.22	(79)
Southwest0.9x	0.54	x	1.05	x	104.39		0.63	x	0.7	=	46.98	(79)
Southwest0.9x	0.54	x	3.29	x	92.85		0.63	x	0.7	=	130.95	(79)
Southwest0.9x	0.54	x	1.05	x	92.85		0.63	x	0.7	=	41.79	(79)
Southwest0.9x	0.54	x	3.29	x	69.27		0.63	x	0.7	=	97.69	(79)
Southwest0.9x	0.54	x	1.05	x	69.27		0.63	x	0.7	=	31.18	(79)
Southwest0.9x	0.54	x	3.29	x	44.07		0.63	x	0.7	=	62.15	(79)
Southwest0.9x	0.54	x	1.05	x	44.07		0.63	x	0.7	=	19.84	(79)
Southwest0.9x	0.54	x	3.29	x	31.49		0.63	x	0.7	=	44.41	(79)
Southwest0.9x	0.54	x	1.05	x	31.49		0.63	x	0.7	=	14.17	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	79.82	139.73	201.21	266.12	313.42	317.9	303.68	267.36	223.53	157.13	96.29	67.86	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	510.08	567.74	615.35	658	682.73	665.58	637.41	607.25	574.97	531.04	495.92	486.76	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.75	0.57	0.62	0.85	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.04	20.25	20.54	20.79	20.95	20.99	20.99	20.89	20.57	20.19	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.05	20.05	20.05	20.05	20.06	20.05	20.05	20.05	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.95	0.86	0.66	0.45	0.5	0.78	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.77	19.08	19.49	19.84	20.02	20.05	20.05	19.96	19.55	18.99	18.55	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.39	19.66	20.01	20.31	20.48	20.51	20.51	20.42	20.05	19.58	19.2	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.23	19.39	19.66	20.01	20.31	20.48	20.51	20.51	20.42	20.05	19.58	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=	1	0.99	0.98	0.95	0.87	0.7	0.51	0.56	0.81	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	507.95	563.24	604.56	627.06	595.51	465.84	325.42	338.89	467.18	510.64	491.68	485.16	(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=	1287.33	1246.98	1129.94	945.28	731.33	495.32	329.8	345.88	534.17	802.79	1064.02	1283.7	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	579.86	459.47	390.88	229.12	101.05	0	0	0	0	217.36	412.09	594.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2983.94 (98)

Space heating requirement in kWh/m²/year 36.61 (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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	579.86	459.47	390.88	229.12	101.05	0	0	0	0	217.36	412.09	594.11	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	620.17	491.41	418.05	245.05	108.08	0	0	0	0	232.47	440.73	635.41	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3191.38 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

203.21	179.19	188.37	169.11	165.9	148.5	142.86	156.42	156.04	175.34	185.09	198.41

Efficiency of water heater | 79.8 | (216)

(217)m=	87.46	87.22	86.72	85.62	83.54	79.8	79.8	79.8	79.8	85.39	86.89	87.56	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.36	205.45	217.22	197.5	198.59	186.09	179.03	196.02	195.54	205.35	213.02	226.59

Total = Sum(219a)$_{1...12}$ = | 2452.74 | (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3191.38	
Water heating fuel used		2452.74	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		75	(231)
Electricity for lighting		380.45	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	689.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	529.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1219.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.45	(268)
Total CO2, kg/year		sum of (265)…(271) =		1455.51	(272)

TER = | 26.09 | (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:44:45

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 55.3m²
Site Reference : Tottenham Mews **Plot Reference:** 5_01 - 1B2P
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 (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	28.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.82 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	51.5 kWh/m²	
		Fail

Excess energy = 0.91 kg/m² (01.8 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - Heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Medium	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	3.3m²	
Windows facing: South West	2.12m²	
Windows facing: North West	7.28m²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_01 - 1B2P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	55.3	(1a) x	2.65	(2a) =	146.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	146.55	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.12	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14

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) = 66.3 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.32	0.31	0.31	0.3	0.29	0.28	0.28	0.28	0.28	0.29	0.3	0.31	(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	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=	0.32	0.31	0.31	0.3	0.29	0.28	0.28	0.28	0.28	0.29	0.3	0.31	(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			1.65	x1/[1/(1.1)+ 0.04]		=	1.74			(27)
Windows Type 2			2.12	x1/[1/(1.1)+ 0.04]		=	2.23			(27)
Windows Type 3			3.64	x1/[1/(1.1)+ 0.04]		=	3.84			(27)
Walls Type1	43.5	12.7	30.8	x	0.2	=	6.16			(29)
Walls Type2	12.2	0	12.2	x	0.19	=	2.26			(29)
Roof	55.3	0	55.3	x	0.14	=	7.74			(30)
Total area of elements, m²			111							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 497.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.19 (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=	15.32	15.18	15.04	14.33	14.19	13.49	13.49	13.35	13.77	14.19	14.47	14.75	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	61.51	61.37	61.23	60.53	60.38	59.68	59.68	59.54	59.96	60.38	60.67	60.95	

Average = Sum(39)$_{1…12}$ /12= 60.49 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.11	1.11	1.09	1.09	1.08	1.08	1.08	1.08	1.09	1.1	1.1

Average = Sum(40)$_{1…12}$ /12= 1.09 (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 1.85 (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 78.05 (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=	85.85	82.73	79.61	76.49	73.36	70.24	70.24	73.36	76.49	79.61	82.73	85.85

Total = Sum(44)$_{1…12}$ = 936.55 (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=	127.31	111.35	114.9	100.17	96.12	82.94	76.86	88.2	89.25	104.01	113.54	123.3

Total = Sum(45)$_{1…12}$ = 1227.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.1	16.7	17.24	15.03	14.42	12.44	11.53	13.23	13.39	15.6	17.03	18.49

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66

(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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=	192.24	169.99	179.83	163.01	161.05	145.78	141.79	153.12	152.08	168.94	176.37	188.22	(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=	192.24	169.99	179.83	163.01	161.05	145.78	141.79	153.12	152.08	168.94	176.37	188.22

Output from water heater (annual)$_{1...12}$ 1992.42 (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=	94.27	83.94	90.15	83.57	83.9	77.84	77.5	81.27	79.94	86.53	88.02	92.94	(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=	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.35	12.75	10.37	7.85	5.87	4.95	5.35	6.96	9.34	11.85	13.83	14.75	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	160.96	162.63	158.42	149.46	138.15	127.52	120.42	118.75	122.95	131.92	143.23	153.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	(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=	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	(71)

Water heating gains (Table 5)

(72)m=	126.71	124.91	121.16	116.07	112.77	108.12	104.16	109.23	111.03	116.3	122.25	124.92	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	352.71	350.97	340.64	324.07	307.48	291.28	280.62	285.62	294.01	310.76	330	344.21	(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)	
Southwest	0.9x	0.77	x	1.65	x	36.79	0.44	x	0.8	=	29.62	(79)
Southwest	0.9x	0.77	x	2.12	x	36.79	0.44	x	0.8	=	19.03	(79)
Southwest	0.9x	0.77	x	1.65	x	62.67	0.44	x	0.8	=	50.45	(79)
Southwest	0.9x	0.77	x	2.12	x	62.67	0.44	x	0.8	=	32.41	(79)
Southwest	0.9x	0.77	x	1.65	x	85.75	0.44	x	0.8	=	69.03	(79)

Southwest0.9x	0.77	x	2.12	x	85.75		0.44	x	0.8	=	44.35	(79)
Southwest0.9x	0.77	x	1.65	x	106.25		0.44	x	0.8	=	85.53	(79)
Southwest0.9x	0.77	x	2.12	x	106.25		0.44	x	0.8	=	54.95	(79)
Southwest0.9x	0.77	x	1.65	x	119.01		0.44	x	0.8	=	95.8	(79)
Southwest0.9x	0.77	x	2.12	x	119.01		0.44	x	0.8	=	61.55	(79)
Southwest0.9x	0.77	x	1.65	x	118.15		0.44	x	0.8	=	95.11	(79)
Southwest0.9x	0.77	x	2.12	x	118.15		0.44	x	0.8	=	61.1	(79)
Southwest0.9x	0.77	x	1.65	x	113.91		0.44	x	0.8	=	91.7	(79)
Southwest0.9x	0.77	x	2.12	x	113.91		0.44	x	0.8	=	58.91	(79)
Southwest0.9x	0.77	x	1.65	x	104.39		0.44	x	0.8	=	84.03	(79)
Southwest0.9x	0.77	x	2.12	x	104.39		0.44	x	0.8	=	53.98	(79)
Southwest0.9x	0.77	x	1.65	x	92.85		0.44	x	0.8	=	74.74	(79)
Southwest0.9x	0.77	x	2.12	x	92.85		0.44	x	0.8	=	48.02	(79)
Southwest0.9x	0.77	x	1.65	x	69.27		0.44	x	0.8	=	55.76	(79)
Southwest0.9x	0.77	x	2.12	x	69.27		0.44	x	0.8	=	35.82	(79)
Southwest0.9x	0.77	x	1.65	x	44.07		0.44	x	0.8	=	35.48	(79)
Southwest0.9x	0.77	x	2.12	x	44.07		0.44	x	0.8	=	22.79	(79)
Southwest0.9x	0.77	x	1.65	x	31.49		0.44	x	0.8	=	25.35	(79)
Southwest0.9x	0.77	x	2.12	x	31.49		0.44	x	0.8	=	16.28	(79)
Northwest 0.9x	0.77	x	3.64	x	11.28	x	0.44	x	0.8	=	20.04	(81)
Northwest 0.9x	0.77	x	3.64	x	22.97	x	0.44	x	0.8	=	40.79	(81)
Northwest 0.9x	0.77	x	3.64	x	41.38	x	0.44	x	0.8	=	73.48	(81)
Northwest 0.9x	0.77	x	3.64	x	67.96	x	0.44	x	0.8	=	120.68	(81)
Northwest 0.9x	0.77	x	3.64	x	91.35	x	0.44	x	0.8	=	162.22	(81)
Northwest 0.9x	0.77	x	3.64	x	97.38	x	0.44	x	0.8	=	172.94	(81)
Northwest 0.9x	0.77	x	3.64	x	91.1	x	0.44	x	0.8	=	161.78	(81)
Northwest 0.9x	0.77	x	3.64	x	72.63	x	0.44	x	0.8	=	128.97	(81)
Northwest 0.9x	0.77	x	3.64	x	50.42	x	0.44	x	0.8	=	89.54	(81)
Northwest 0.9x	0.77	x	3.64	x	28.07	x	0.44	x	0.8	=	49.84	(81)
Northwest 0.9x	0.77	x	3.64	x	14.2	x	0.44	x	0.8	=	25.21	(81)
Northwest 0.9x	0.77	x	3.64	x	9.21	x	0.44	x	0.8	=	16.36	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.68	123.65	186.86	261.16	319.57	329.15	312.39	266.99	212.3	141.42	83.48	57.99	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	421.39	474.62	527.5	585.23	627.04	620.43	593.01	552.62	506.31	452.18	413.48	402.21	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.94	0.92	0.88	0.8	0.69	0.54	0.41	0.46	0.65	0.84	0.92	0.95	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.94	19.2	19.61	20.14	20.57	20.84	20.94	20.93	20.73	20.18	19.48	18.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	20.01	20.01	20.02	20.02	20.02	20.01	20.01	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.93	0.91	0.87	0.78	0.64	0.47	0.33	0.37	0.59	0.81	0.91	0.94	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.25	17.62	18.22	18.96	19.53	19.88	19.98	19.97	19.75	19.03	18.04	17.19	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.13	18.44	18.94	19.57	20.07	20.38	20.48	20.47	20.25	19.62	18.78	18.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.13	18.44	18.94	19.57	20.07	20.38	20.48	20.47	20.25	19.62	18.78	18.07	(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=	0.92	0.89	0.84	0.76	0.65	0.5	0.37	0.41	0.61	0.79	0.89	0.92	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	385.97	422.24	445.48	447.12	405.7	309.86	220.3	226.99	307.49	358.73	366.59	371.41	(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=	850.51	830.83	761.82	645.86	505.57	344.91	231.63	242.1	369.03	544.8	708.77	845.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	345.61	274.57	235.35	143.09	74.31	0	0	0	0	138.43	246.37	352.65	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1810.39 (98)

Space heating requirement in kWh/m²/year 32.74 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1810.39	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1900.91	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1992.42	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2092.04	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	39.93	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		107.27	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	107.27	(331)
Energy for lighting (calculated in Appendix L)		253.42	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-419.08	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	828.94	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.72	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	849.66	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				849.66	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	55.67	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	131.52	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-217.51	(380)
Total CO2, kg/year	sum of (376)…(382) =				819.35	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.82	(384)
EI rating (section 14)					89.05	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_01 - 1B2P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	55.3	(1a) x	2.65	(2a) =	146.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.3	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		146.55	(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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.37	0.37	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.34	0.35

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=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(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			1.65	x1/[1/(1.4)+ 0.04] =	2.19			(27)
Windows Type 2			2.12	x1/[1/(1.4)+ 0.04] =	2.81			(27)
Windows Type 3			3.64	x1/[1/(1.4)+ 0.04] =	4.83			(27)
Walls Type1	43.5	12.7	30.8	x 0.18 =	5.54			(29)
Walls Type2	12.2	0	12.2	x 0.18 =	2.2			(29)
Roof	55.3	0	55.3	x 0.13 =	7.19			(30)
Total area of elements, m²			111					(31)

** 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) = 31.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 497.7 (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 5.55 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.32 (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=	27.71	27.57	27.44	26.8	26.69	26.14	26.14	26.04	26.35	26.69	26.93	27.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.02	64.89	64.75	64.12	64	63.45	63.45	63.35	63.67	64	64.24	64.49	

Average = Sum(39)$_{1…12}$ /12= 64.12 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.18	1.17	1.17	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.16	1.17

Average = Sum(40)$_{1…12}$ /12= 1.16 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.85 (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 78.05 (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=	85.85	82.73	79.61	76.49	73.36	70.24	70.24	73.36	76.49	79.61	82.73	85.85	
										Total = Sum(44)$_{1…12}$ =		936.55	(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=	127.31	111.35	114.9	100.17	96.12	82.94	76.86	88.2	89.25	104.01	113.54	123.3	
										Total = Sum(45)$_{1…12}$ =		1227.97	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	19.1	16.7	17.24	15.03	14.42	12.44	11.53	13.23	13.39	15.6	17.03	18.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	178.24	157.35	165.83	149.46	147.05	132.23	127.79	139.12	138.53	154.94	162.82	174.22	(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=	178.24	157.35	165.83	149.46	147.05	132.23	127.79	139.12	138.53	154.94	162.82	174.22	

Output from water heater (annual)$_{1...12}$ 1827.58 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	83.07	73.82	78.95	72.73	72.7	67.01	66.3	70.07	69.1	75.33	77.18	81.74	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.35	12.75	10.37	7.85	5.87	4.95	5.35	6.96	9.34	11.85	13.83	14.75	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	160.96	162.63	158.42	149.46	138.15	127.52	120.42	118.75	122.95	131.92	143.23	153.86	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	(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=	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	(71)
Water heating gains (Table 5)													
(72)m=	111.66	109.85	106.11	101.02	97.72	93.06	89.11	94.18	95.98	101.24	107.19	109.86	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	340.66	338.92	328.59	312.02	295.42	279.23	268.57	273.57	281.96	298.7	317.95	332.16	(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	1.65	x	36.79	0.63	x	0.7	=	37.11	(79)
Southwest 0.9x	0.77	x	2.12	x	36.79	0.63	x	0.7	=	23.84	(79)
Southwest 0.9x	0.77	x	1.65	x	62.67	0.63	x	0.7	=	63.21	(79)
Southwest 0.9x	0.77	x	2.12	x	62.67	0.63	x	0.7	=	40.61	(79)
Southwest 0.9x	0.77	x	1.65	x	85.75	0.63	x	0.7	=	86.48	(79)

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Southwest	0.9x	0.77	x	2.12	x	85.75		0.63	x	0.7	=	55.56	(79)
Southwest	0.9x	0.77	x	1.65	x	106.25		0.63	x	0.7	=	107.16	(79)
Southwest	0.9x	0.77	x	2.12	x	106.25		0.63	x	0.7	=	68.84	(79)
Southwest	0.9x	0.77	x	1.65	x	119.01		0.63	x	0.7	=	120.02	(79)
Southwest	0.9x	0.77	x	2.12	x	119.01		0.63	x	0.7	=	77.11	(79)
Southwest	0.9x	0.77	x	1.65	x	118.15		0.63	x	0.7	=	119.16	(79)
Southwest	0.9x	0.77	x	2.12	x	118.15		0.63	x	0.7	=	76.55	(79)
Southwest	0.9x	0.77	x	1.65	x	113.91		0.63	x	0.7	=	114.88	(79)
Southwest	0.9x	0.77	x	2.12	x	113.91		0.63	x	0.7	=	73.8	(79)
Southwest	0.9x	0.77	x	1.65	x	104.39		0.63	x	0.7	=	105.28	(79)
Southwest	0.9x	0.77	x	2.12	x	104.39		0.63	x	0.7	=	67.63	(79)
Southwest	0.9x	0.77	x	1.65	x	92.85		0.63	x	0.7	=	93.64	(79)
Southwest	0.9x	0.77	x	2.12	x	92.85		0.63	x	0.7	=	60.16	(79)
Southwest	0.9x	0.77	x	1.65	x	69.27		0.63	x	0.7	=	69.86	(79)
Southwest	0.9x	0.77	x	2.12	x	69.27		0.63	x	0.7	=	44.88	(79)
Southwest	0.9x	0.77	x	1.65	x	44.07		0.63	x	0.7	=	44.45	(79)
Southwest	0.9x	0.77	x	2.12	x	44.07		0.63	x	0.7	=	28.55	(79)
Southwest	0.9x	0.77	x	1.65	x	31.49		0.63	x	0.7	=	31.76	(79)
Southwest	0.9x	0.77	x	2.12	x	31.49		0.63	x	0.7	=	20.4	(79)
Northwest	0.9x	0.77	x	3.64	x	11.28	x	0.63	x	0.7	=	25.1	(81)
Northwest	0.9x	0.77	x	3.64	x	22.97	x	0.63	x	0.7	=	51.1	(81)
Northwest	0.9x	0.77	x	3.64	x	41.38	x	0.63	x	0.7	=	92.06	(81)
Northwest	0.9x	0.77	x	3.64	x	67.96	x	0.63	x	0.7	=	151.19	(81)
Northwest	0.9x	0.77	x	3.64	x	91.35	x	0.63	x	0.7	=	203.23	(81)
Northwest	0.9x	0.77	x	3.64	x	97.38	x	0.63	x	0.7	=	216.67	(81)
Northwest	0.9x	0.77	x	3.64	x	91.1	x	0.63	x	0.7	=	202.69	(81)
Northwest	0.9x	0.77	x	3.64	x	72.63	x	0.63	x	0.7	=	161.58	(81)
Northwest	0.9x	0.77	x	3.64	x	50.42	x	0.63	x	0.7	=	112.18	(81)
Northwest	0.9x	0.77	x	3.64	x	28.07	x	0.63	x	0.7	=	62.45	(81)
Northwest	0.9x	0.77	x	3.64	x	14.2	x	0.63	x	0.7	=	31.59	(81)
Northwest	0.9x	0.77	x	3.64	x	9.21	x	0.63	x	0.7	=	20.5	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.05	154.91	234.1	327.19	400.36	412.37	391.37	334.5	265.98	177.18	104.59	72.66	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	426.71	493.83	562.69	639.21	695.79	691.6	659.94	608.07	547.94	475.89	422.53	404.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.9	0.76	0.57	0.42	0.47	0.73	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.88	20.06	20.33	20.66	20.89	20.98	21	20.99	20.93	20.63	20.19	19.85	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.94	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.95	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.87	0.7	0.48	0.32	0.37	0.65	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.47	18.73	19.12	19.58	19.86	19.95	19.96	19.96	19.91	19.55	18.93	18.43	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.2	19.42	19.75	20.14	20.39	20.48	20.5	20.5	20.44	20.11	19.59	19.16	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.2	19.42	19.75	20.14	20.39	20.48	20.5	20.5	20.44	20.11	19.59	19.16	(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	0.73	0.53	0.37	0.42	0.69	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	422.51	483.98	536.61	561.81	507.01	365.48	246.26	257.51	376.5	436.55	414.16	401.67	(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=	968.99	941.95	857.86	720.79	556.34	373.39	247.37	259.56	403.77	608.54	802.17	965.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	406.58	307.75	239.02	114.46	36.7	0	0	0	0	127.96	279.36	419.15	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1930.98 (98)

Space heating requirement in kWh/m²/year 34.92 (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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	406.58	307.75	239.02	114.46	36.7	0	0	0	0	127.96	279.36	419.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	434.84	329.15	255.63	122.42	39.26	0	0	0	0	136.85	298.78	448.29	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2065.22 (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)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

178.24	157.35	165.83	149.46	147.05	132.23	127.79	139.12	138.53	154.94	162.82	174.22

Efficiency of water heater 79.8 (216)

(217)m=	86.95	86.57	85.79	84.11	81.73	79.8	79.8	79.8	79.8	84.31	86.24	87.07	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	205	181.75	193.3	177.69	179.92	165.7	160.13	174.34	173.6	183.78	188.8	200.09

Total = Sum(219a)$_{1...12}$ = 2184.1 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2065.22	
Water heating fuel used		2184.1	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		75	(231)
Electricity for lighting		253.42	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	446.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	471.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =			917.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	131.52	(268)
Total CO2, kg/year		sum of (265)…(271) =		1088.3	(272)

TER = 28.81 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:44:44

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 64.7m²

Site Reference : Tottenham Mews **Plot Reference:** 5_02 - 2B3P

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 (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	29.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.25 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	56.9 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**OK**
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	**OK**
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	6.82m²
Windows facing: North East	9.51m²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_02 - 2B3P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	64.7	(1a) x	2.65	(2a) =	171.45	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.45	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.12	(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

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14

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) = 66.3 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.32	0.31	0.31	0.3	0.29	0.28	0.28	0.28	0.28	0.29	0.3	0.31	(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	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=	0.32	0.31	0.31	0.3	0.29	0.28	0.28	0.28	0.28	0.29	0.3	0.31	(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			6.82	x1/[1/(1.1)+ 0.04]		=	7.19			(27)
Windows Type 2			3.17	x1/[1/(1.1)+ 0.04]		=	3.34			(27)
Walls Type1	57.5	16.33	41.17	x	0.2	=	8.23			(29)
Walls Type2	14.8	0	14.8	x	0.19	=	2.74			(29)
Roof	64.7	0	64.7	x	0.14	=	9.06			(30)
Total area of elements, m²			137							(31)

** 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) = 37.24 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 582.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 20.55 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.79 (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=	17.92	17.76	17.59	16.77	16.6	15.78	15.78	15.62	16.11	16.6	16.93	17.26	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	75.71	75.54	75.38	74.56	74.39	73.57	73.57	73.41	73.9	74.39	74.72	75.05	

Average = Sum(39)$_{1…12}$ /12= 74.52 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.13	1.14	1.15	1.15	1.16

Average = Sum(40)$_{1...12}$ /12= 1.15 (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 2.11 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 84.33 (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=	92.77	89.39	86.02	82.65	79.27	75.9	75.9	79.27	82.65	86.02	89.39	92.77

Total = Sum(44)$_{1...12}$ = 1012.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	137.57	120.32	124.16	108.25	103.87	89.63	83.05	95.31	96.44	112.4	122.69	133.23

Total = Sum(45)$_{1...12}$ = 1326.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.64	18.05	18.62	16.24	15.58	13.44	12.46	14.3	14.47	16.86	18.4	19.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.5	178.97	189.09	171.08	168.79	152.46	147.98	160.23	159.28	177.32	185.52	198.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.5	178.97	189.09	171.08	168.79	152.46	147.98	160.23	159.28	177.32	185.52	198.16	

Output from water heater (annual)$_{1...12}$ 2091.37 (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=	97.68	86.92	93.22	86.26	86.48	80.07	79.56	83.63	82.33	89.31	91.06	96.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.46	14.62	11.89	9	6.73	5.68	6.14	7.98	10.71	13.6	15.87	16.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	184.63	186.54	181.71	171.44	158.46	146.27	138.12	136.21	141.03	151.31	164.29	176.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	(71)

Water heating gains (Table 5)

(72)m=	131.3	129.35	125.3	119.8	116.23	111.2	106.93	112.41	114.35	120.04	126.47	129.36	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	387.05	385.17	373.57	354.9	336.09	317.82	305.85	311.25	320.76	339.62	361.29	377.42	(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	6.82	x	11.28	x	0.44	x	0.8	=	18.77	(75)
Northeast 0.9x	0.77	x	3.17	x	11.28	x	0.44	x	0.8	=	26.17	(75)
Northeast 0.9x	0.77	x	6.82	x	22.97	x	0.44	x	0.8	=	38.21	(75)
Northeast 0.9x	0.77	x	3.17	x	22.97	x	0.44	x	0.8	=	53.28	(75)
Northeast 0.9x	0.77	x	6.82	x	41.38	x	0.44	x	0.8	=	68.84	(75)

Northeast	0.9x	0.77	x	3.17	x	41.38	x	0.44	x	0.8	=	95.99	(75)
Northeast	0.9x	0.77	x	6.82	x	67.96	x	0.44	x	0.8	=	113.05	(75)
Northeast	0.9x	0.77	x	3.17	x	67.96	x	0.44	x	0.8	=	157.65	(75)
Northeast	0.9x	0.77	x	6.82	x	91.35	x	0.44	x	0.8	=	151.97	(75)
Northeast	0.9x	0.77	x	3.17	x	91.35	x	0.44	x	0.8	=	211.91	(75)
Northeast	0.9x	0.77	x	6.82	x	97.38	x	0.44	x	0.8	=	162.01	(75)
Northeast	0.9x	0.77	x	3.17	x	97.38	x	0.44	x	0.8	=	225.92	(75)
Northeast	0.9x	0.77	x	6.82	x	91.1	x	0.44	x	0.8	=	151.56	(75)
Northeast	0.9x	0.77	x	3.17	x	91.1	x	0.44	x	0.8	=	211.34	(75)
Northeast	0.9x	0.77	x	6.82	x	72.63	x	0.44	x	0.8	=	120.83	(75)
Northeast	0.9x	0.77	x	3.17	x	72.63	x	0.44	x	0.8	=	168.48	(75)
Northeast	0.9x	0.77	x	6.82	x	50.42	x	0.44	x	0.8	=	83.88	(75)
Northeast	0.9x	0.77	x	3.17	x	50.42	x	0.44	x	0.8	=	116.97	(75)
Northeast	0.9x	0.77	x	6.82	x	28.07	x	0.44	x	0.8	=	46.69	(75)
Northeast	0.9x	0.77	x	3.17	x	28.07	x	0.44	x	0.8	=	65.11	(75)
Northeast	0.9x	0.77	x	6.82	x	14.2	x	0.44	x	0.8	=	23.62	(75)
Northeast	0.9x	0.77	x	3.17	x	14.2	x	0.44	x	0.8	=	32.93	(75)
Northeast	0.9x	0.77	x	6.82	x	9.21	x	0.44	x	0.8	=	15.33	(75)
Northeast	0.9x	0.77	x	3.17	x	9.21	x	0.44	x	0.8	=	21.38	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	44.95	91.49	164.83	270.7	363.87	387.93	362.9	289.31	200.85	111.8	56.55	36.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	431.99	476.66	538.4	625.6	699.96	705.75	668.75	600.56	521.61	451.42	417.84	414.12	(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=	0.96	0.94	0.91	0.84	0.72	0.57	0.44	0.5	0.72	0.88	0.94	0.96	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.67	18.9	19.35	19.96	20.48	20.81	20.93	20.9	20.62	19.96	19.22	18.63	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.95	0.94	0.9	0.81	0.67	0.5	0.35	0.41	0.65	0.86	0.93	0.96	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.84	17.17	17.82	18.68	19.38	19.8	19.92	19.9	19.59	18.71	17.65	16.78	(90)

fLA = Living area ÷ (4) = 0.56 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.86	18.13	18.67	19.4	20	20.36	20.48	20.46	20.17	19.41	18.53	17.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	17.86	18.13	18.67	19.4	20	20.36	20.48	20.46	20.17	19.41	18.53	17.81	(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=	0.94	0.92	0.88	0.8	0.68	0.53	0.4	0.45	0.67	0.84	0.91	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	403.97	437.15	472.75	499.23	473.25	371.15	267.31	272.1	347.97	379.63	381.91	389.55	(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=	1026.54	999.72	917.35	782.5	617.1	423.68	285.63	297.81	448.31	655.21	853.85	1021.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	463.19	378.04	330.79	203.95	107.02	0	0	0	0	205.03	339.79	470.24	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2498.06	(98)
Space heating requirement in kWh/m²/year		38.61	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2498.06	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2622.96	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement		2091.37	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2195.94	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.19	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		125.51	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			125.51	(331)
Energy for lighting (calculated in Appendix L)				290.68	(332)
Electricity generated by PVs (Appendix M) (negative quantity)				-490.72	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)				0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1000.4	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.01	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1025.41	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1025.41	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	65.14	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	150.86	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-254.68	(380)
Total CO2, kg/year	sum of (376)…(382) =				986.73	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.25	(384)
EI rating (section 14)					87.95	(385)

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User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_02 - 2B3P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	64.7	(1a) x	2.65	(2a) =	171.45	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		171.45	(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) =	0.12	(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			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.28	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

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=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(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			6.76	x1/[1/(1.4)+ 0.04] =	8.96			(27)
Windows Type 2			3.14	x1/[1/(1.4)+ 0.04] =	4.16			(27)
Walls Type1	57.5	16.18	41.32	x 0.18 =	7.44			(29)
Walls Type2	14.8	0	14.8	x 0.18 =	2.66			(29)
Roof	64.7	0	64.7	x 0.13 =	8.41			(30)
Total area of elements, m²			137					(31)

** 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) = 39.96 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 582.3 (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 6.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.81 (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=	32	31.86	31.72	31.05	30.93	30.35	30.35	30.24	30.57	30.93	31.18	31.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.82	78.67	78.53	77.87	77.74	77.16	77.16	77.06	77.39	77.74	77.99	78.26	

Average = $Sum(39)_{1\ldots12}$ /12= 77.87 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.22	1.22	1.21	1.2	1.2	1.19	1.19	1.19	1.2	1.2	1.21	1.21

Average = Sum(40)$_{1…12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.11 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 84.33 (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=	92.77	89.39	86.02	82.65	79.27	75.9	75.9	79.27	82.65	86.02	89.39	92.77

Total = Sum(44)$_{1…12}$ = 1012.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	137.57	120.32	124.16	108.25	103.87	89.63	83.05	95.31	96.44	112.4	122.69	133.23

Total = Sum(45)$_{1…12}$ = 1326.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.64	18.05	18.62	16.24	15.58	13.44	12.46	14.3	14.47	16.86	18.4	19.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.5	166.32	175.09	157.53	154.79	138.91	133.98	146.23	145.73	163.32	171.97	184.16	(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=	188.5	166.32	175.09	157.53	154.79	138.91	133.98	146.23	145.73	163.32	171.97	184.16

Output from water heater (annual)$_{1...12}$ 1926.53 (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=	86.48	76.81	82.02	75.42	75.28	69.23	68.36	72.43	71.49	78.11	80.22	85.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	16.46	14.62	11.89	9	6.73	5.68	6.14	7.98	10.71	13.6	15.87	16.92	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	184.63	186.54	181.71	171.44	158.46	146.27	138.12	136.21	141.03	151.31	164.29	176.48	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	-84.44	(71)
Water heating gains (Table 5)													
(72)m=	116.24	114.29	110.25	104.75	101.18	96.15	91.88	97.35	99.3	104.99	111.42	114.3	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	374.99	373.12	361.52	342.85	324.03	305.76	293.8	299.2	308.7	327.56	349.24	365.36	(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	6.76	x	11.28	x	0.63	x	0.7	=	23.31	(75)
Northeast 0.9x	0.77	x	3.14	x	11.28	x	0.63	x	0.7	=	32.48	(75)
Northeast 0.9x	0.77	x	6.76	x	22.97	x	0.63	x	0.7	=	47.45	(75)
Northeast 0.9x	0.77	x	3.14	x	22.97	x	0.63	x	0.7	=	66.12	(75)
Northeast 0.9x	0.77	x	6.76	x	41.38	x	0.63	x	0.7	=	85.49	(75)

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Northeast 0.9x	0.77	x	3.14	x	41.38	x	0.63	x	0.7	=	119.12	(75)
Northeast 0.9x	0.77	x	6.76	x	67.96	x	0.63	x	0.7	=	140.39	(75)
Northeast 0.9x	0.77	x	3.14	x	67.96	x	0.63	x	0.7	=	195.64	(75)
Northeast 0.9x	0.77	x	6.76	x	91.35	x	0.63	x	0.7	=	188.72	(75)
Northeast 0.9x	0.77	x	3.14	x	91.35	x	0.63	x	0.7	=	262.97	(75)
Northeast 0.9x	0.77	x	6.76	x	97.38	x	0.63	x	0.7	=	201.19	(75)
Northeast 0.9x	0.77	x	3.14	x	97.38	x	0.63	x	0.7	=	280.36	(75)
Northeast 0.9x	0.77	x	6.76	x	91.1	x	0.63	x	0.7	=	188.21	(75)
Northeast 0.9x	0.77	x	3.14	x	91.1	x	0.63	x	0.7	=	262.27	(75)
Northeast 0.9x	0.77	x	6.76	x	72.63	x	0.63	x	0.7	=	150.04	(75)
Northeast 0.9x	0.77	x	3.14	x	72.63	x	0.63	x	0.7	=	209.08	(75)
Northeast 0.9x	0.77	x	6.76	x	50.42	x	0.63	x	0.7	=	104.17	(75)
Northeast 0.9x	0.77	x	3.14	x	50.42	x	0.63	x	0.7	=	145.15	(75)
Northeast 0.9x	0.77	x	6.76	x	28.07	x	0.63	x	0.7	=	57.99	(75)
Northeast 0.9x	0.77	x	3.14	x	28.07	x	0.63	x	0.7	=	80.8	(75)
Northeast 0.9x	0.77	x	6.76	x	14.2	x	0.63	x	0.7	=	29.33	(75)
Northeast 0.9x	0.77	x	3.14	x	14.2	x	0.63	x	0.7	=	40.87	(75)
Northeast 0.9x	0.77	x	6.76	x	9.21	x	0.63	x	0.7	=	19.04	(75)
Northeast 0.9x	0.77	x	3.14	x	9.21	x	0.63	x	0.7	=	26.53	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.79	113.57	204.61	336.03	451.69	481.55	450.48	359.13	249.32	138.79	70.2	45.56	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	430.78	486.69	566.13	678.88	775.72	787.31	744.28	658.33	558.02	466.35	419.44	410.93	(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	0.8	0.6	0.45	0.53	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.73	19.88	20.16	20.56	20.85	20.97	20.99	20.99	20.88	20.49	20.04	19.7	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.91	19.91	19.92	19.92	19.93	19.93	19.93	19.92	19.92	19.92	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.74	0.51	0.34	0.41	0.73	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=	18.22	18.44	18.86	19.41	19.78	19.91	19.92	19.92	19.83	19.33	18.69	18.19	(90)

fLA = Living area ÷ (4) = | 0.56 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.06	19.24	19.59	20.05	20.38	20.5	20.52	20.52	20.42	19.98	19.44	19.03	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.06	19.24	19.59	20.05	20.38	20.5	20.52	20.52	20.42	19.98	19.44	19.03	(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	0.77	0.56	0.4	0.47	0.77	0.96	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	428.48	481.79	551.25	619.96	594.71	441.55	300.34	312.56	430.04	445.6	415.16	409.16		(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=	1163.59	1128.33	1027.69	868.24	674.71	455.36	302.57	317.27	488.98	728.92	962.65	1160.7		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	546.92	434.48	354.47	178.76	59.52	0	0	0	0	210.79	394.19	559.15		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				2738.27	(98)
Space heating requirement in kWh/m²/year													42.32	(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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	546.92	434.48	354.47	178.76	59.52	0	0	0	0	210.79	394.19	559.15		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	584.94	464.68	379.11	191.18	63.66	0	0	0	0	225.44	421.59	598.02		
									Total (kWh/year) =Sum(211)$_{1...5,10...12}$=				2928.63	(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)														
	188.5	166.32	175.09	157.53	154.79	138.91	133.98	146.23	145.73	163.32	171.97	184.16		
Efficiency of water heater													79.8	(216)
(217)m=	87.49	87.26	86.66	85.15	82.51	79.8	79.8	79.8	79.8	85.5	86.96	87.59		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	215.44	190.6	202.04	185	187.61	174.07	167.89	183.25	182.61	191.03	197.76	210.25		
									Total = Sum(219a)$_{1...12}$ =				2287.57	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2928.63

TER WorkSheet: New dwelling design stage

Water heating fuel used			2287.57	
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			290.68	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	632.58	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	494.11	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1126.7	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	150.86	(268)
Total CO2, kg/year			sum of (265)…(271) =		1316.49	(272)

TER = 29.93 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 24 November 2020 at 17:44:44

Project Information:

Assessed By: Vitaliy Troyan (STRO018096) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 63.8m²

Site Reference : Tottenham Mews **Plot Reference:** 5_03 - 2B3P

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 (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	30.48 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.32 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	61.1 kWh/m²	
		Fail

Excess energy = 1.15 kg/m² (01.9 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - Heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.24 kWh/day	
	Permitted by DBSCG: 2.24 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.48	
Maximum	1.5	**OK**
MVHR efficiency:	78%	
Minimum	70%	**OK**

9 Summertime temperature		
Overheating risk (Thames valley):	Medium	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	9.51m²	
Windows facing: South East	6.82m²	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

10 Key features	
Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_03 - 2B3P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	63.8	(1a) x	2.65	(2a) =	169.07	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.8	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		169.07	(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	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) = 66.3 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.33	0.33	0.32	0.31	0.31	0.29	0.29	0.29	0.3	0.31	0.31	0.32	(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	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=	0.33	0.33	0.32	0.31	0.31	0.29	0.29	0.29	0.3	0.31	0.31	0.32	(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			3.17	x1/[1/(1.1)+ 0.04]		=	3.34			(27)
Windows Type 2			6.82	x1/[1/(1.1)+ 0.04]		=	7.19			(27)
Walls Type1	81.6	16.33	65.27	x	0.2	=	13.05			(29)
Walls Type2	15.6	0	15.6	x	0.19	=	2.89			(29)
Roof	62	0	62	x	0.14	=	8.68			(30)
Total area of elements, m²			159.2							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 41.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 558 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 23.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 65.71 (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=	18.47	18.29	18.12	17.23	17.05	16.16	16.16	15.98	16.51	17.05	17.4	17.76	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.18	84	83.82	82.93	82.76	81.87	81.87	81.69	82.22	82.76	83.11	83.47	

Average = $Sum(39)_{1…12}$ /12= 82.89 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.32	1.32	1.31	1.3	1.3	1.28	1.28	1.28	1.29	1.3	1.3	1.31

Average = Sum(40)$_{1…12}$ /12= 1.3 (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 2.09 (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 83.76 (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=	92.14	88.79	85.44	82.09	78.74	75.39	75.39	78.74	82.09	85.44	88.79	92.14	
										Total = Sum(44)$_{1…12}$ =		1005.13	(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=	136.64	119.5	123.32	107.51	103.16	89.02	82.49	94.66	95.79	111.63	121.85	132.33	
										Total = Sum(45)$_{1…12}$ =		1317.89	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	20.5	17.93	18.5	16.13	15.47	13.35	12.37	14.2	14.37	16.74	18.28	19.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.56	178.15	188.24	170.34	168.09	151.85	147.42	159.58	158.62	176.56	184.69	197.25	(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=	201.56	178.15	188.24	170.34	168.09	151.85	147.42	159.58	158.62	176.56	184.69	197.25	

Output from water heater (annual)$_{1...12}$ 2082.35 (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=	97.37	86.65	92.94	86.01	86.24	79.86	79.37	83.41	82.11	89.06	90.78	95.94	(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=	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.26	14.44	11.75	8.89	6.65	5.61	6.06	7.88	10.58	13.43	15.68	16.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	182.42	184.31	179.54	169.39	156.57	144.52	136.47	134.58	139.35	149.5	162.32	174.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	(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=	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	(71)

Water heating gains (Table 5)

(72)m=	130.88	128.94	124.92	119.46	115.92	110.92	106.68	112.12	114.05	119.7	126.09	128.95	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	383.86	382	370.52	352.04	333.43	315.36	303.52	308.88	318.28	336.94	358.39	374.34	(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	3.17	x	11.28	x	0.44	x	0.8	=	26.17	(75)
Northeast 0.9x	0.77	x	3.17	x	22.97	x	0.44	x	0.8	=	53.28	(75)
Northeast 0.9x	0.77	x	3.17	x	41.38	x	0.44	x	0.8	=	95.99	(75)
Northeast 0.9x	0.77	x	3.17	x	67.96	x	0.44	x	0.8	=	157.65	(75)
Northeast 0.9x	0.77	x	3.17	x	91.35	x	0.44	x	0.8	=	211.91	(75)

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Northeast 0.9x	0.77	x	3.17	x	97.38	x	0.44	x	0.8	=	225.92	(75)
Northeast 0.9x	0.77	x	3.17	x	91.1	x	0.44	x	0.8	=	211.34	(75)
Northeast 0.9x	0.77	x	3.17	x	72.63	x	0.44	x	0.8	=	168.48	(75)
Northeast 0.9x	0.77	x	3.17	x	50.42	x	0.44	x	0.8	=	116.97	(75)
Northeast 0.9x	0.77	x	3.17	x	28.07	x	0.44	x	0.8	=	65.11	(75)
Northeast 0.9x	0.77	x	3.17	x	14.2	x	0.44	x	0.8	=	32.93	(75)
Northeast 0.9x	0.77	x	3.17	x	9.21	x	0.44	x	0.8	=	21.38	(75)
Southeast 0.9x	0.77	x	6.82	x	36.79	x	0.44	x	0.8	=	61.21	(77)
Southeast 0.9x	0.77	x	6.82	x	62.67	x	0.44	x	0.8	=	104.27	(77)
Southeast 0.9x	0.77	x	6.82	x	85.75	x	0.44	x	0.8	=	142.66	(77)
Southeast 0.9x	0.77	x	6.82	x	106.25	x	0.44	x	0.8	=	176.76	(77)
Southeast 0.9x	0.77	x	6.82	x	119.01	x	0.44	x	0.8	=	197.99	(77)
Southeast 0.9x	0.77	x	6.82	x	118.15	x	0.44	x	0.8	=	196.56	(77)
Southeast 0.9x	0.77	x	6.82	x	113.91	x	0.44	x	0.8	=	189.5	(77)
Southeast 0.9x	0.77	x	6.82	x	104.39	x	0.44	x	0.8	=	173.67	(77)
Southeast 0.9x	0.77	x	6.82	x	92.85	x	0.44	x	0.8	=	154.47	(77)
Southeast 0.9x	0.77	x	6.82	x	69.27	x	0.44	x	0.8	=	115.24	(77)
Southeast 0.9x	0.77	x	6.82	x	44.07	x	0.44	x	0.8	=	73.32	(77)
Southeast 0.9x	0.77	x	6.82	x	31.49	x	0.44	x	0.8	=	52.38	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	87.39	157.55	238.65	334.41	409.9	422.48	400.84	342.15	271.44	180.35	106.25	73.76	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	471.25	539.55	609.17	686.46	743.33	737.83	704.36	651.03	589.72	517.29	464.64	448.1	(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=	0.95	0.93	0.9	0.83	0.72	0.58	0.46	0.5	0.7	0.86	0.93	0.96	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.47	18.75	19.23	19.84	20.38	20.75	20.9	20.87	20.58	19.89	19.08	18.41	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.83	19.83	19.83	19.84	19.84	19.85	19.85	19.86	19.85	19.84	19.84	19.83	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.94	0.92	0.88	0.8	0.67	0.51	0.36	0.4	0.63	0.83	0.92	0.95	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.48	16.89	17.57	18.44	19.16	19.63	19.79	19.77	19.45	18.53	17.38	16.41	(90)

fLA = Living area ÷ (4) = 0.55 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.58	17.92	18.49	19.22	19.84	20.25	20.41	20.38	20.08	19.29	18.32	17.52	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.58	17.92	18.49	19.22	19.84	20.25	20.41	20.38	20.08	19.29	18.32	17.52	(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=	0.92	0.9	0.86	0.78	0.67	0.53	0.41	0.45	0.64	0.81	0.9	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	435.18	484.7	521.44	536.27	499.9	393.57	286.36	292.36	378.58	420.82	417.12	416.93	(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=	1118.27	1093.92	1004.99	855.67	673.4	462.51	311.56	325.13	491.33	718.94	932.61	1112.13	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	508.22	409.39	359.76	229.96	129.08	0	0	0	0	221.8	371.16	517.23	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ =	2746.61	(98)
Space heating requirement in kWh/m²/year	43.05	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2746.61	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2883.94	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2082.35	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2186.46	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		123.76	(330a)

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warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		123.76	(331)
Energy for lighting (calculated in Appendix L)			287.21	(332)
Electricity generated by PVs (Appendix M) (negative quantity)			-484.13	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)			0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1052.61	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.32	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1078.93	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1078.93	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	64.23	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	149.06	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1		0.52		x 0.01 =	-251.26	(380)
Total CO2, kg/year	sum of (376)…(382) =				1040.96	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.32	(384)
EI rating (section 14)					87.18	(385)

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User Details:

Assessor Name:	Vitaliy Troyan	**Stroma Number:**	STRO018096
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: 5_03 - 2B3P

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	63.8	(1a) x	2.65	(2a) =	169.07	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	169.07	(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) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.37	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			3.1	x1/[1/(1.4)+ 0.04]		=	4.11			(27)
Windows Type 2			6.66	x1/[1/(1.4)+ 0.04]		=	8.83			(27)
Walls Type1	81.6	15.96	65.64	x	0.18	=	11.82			(29)
Walls Type2	15.6	0	15.6	x	0.18	=	2.81			(29)
Roof	62	0	62	x	0.13	=	8.06			(30)
Total area of elements, m²			159.2							(31)

** 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) = 43.84 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 558 (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 7.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.8 (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=	32.34	32.17	32	31.2	31.06	30.36	30.36	30.24	30.63	31.06	31.36	31.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.14	83.97	83.8	83.01	82.86	82.17	82.17	82.04	82.43	82.86	83.16	83.47	

Average = Sum(39)$_{1…12}$ /12= 83.01 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.32	1.32	1.31	1.3	1.3	1.29	1.29	1.29	1.29	1.3	1.3	1.31

Average = Sum(40)$_{1…12}$ /12= 1.3 (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 — 2.09 (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 — 83.76 (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=	92.14	88.79	85.44	82.09	78.74	75.39	75.39	78.74	82.09	85.44	88.79	92.14

Total = Sum(44)$_{1…12}$ = 1005.13 (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=	136.64	119.5	123.32	107.51	103.16	89.02	82.49	94.66	95.79	111.63	121.85	132.33

Total = Sum(45)$_{1…12}$ = 1317.89 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.5	17.93	18.5	16.13	15.47	13.35	12.37	14.2	14.37	16.74	18.28	19.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.65 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.89 (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) — 0.89 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

TER 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=	187.56	165.5	174.24	156.79	154.09	138.3	133.41	145.58	145.07	162.56	171.14	183.25	(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=	187.56	165.5	174.24	156.79	154.09	138.3	133.41	145.58	145.07	162.56	171.14	183.25	

Output from water heater (annual)$_{1...12}$ 1917.5 (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=	86.17	76.53	81.74	75.17	75.04	69.03	68.17	72.21	71.28	77.86	79.94	84.74	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	104.34	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.26	14.44	11.75	8.89	6.65	5.61	6.06	7.88	10.58	13.43	15.68	16.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	182.42	184.31	179.54	169.39	156.57	144.52	136.47	134.58	139.35	149.5	162.32	174.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	33.43	(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=	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	-83.47	(71)

Water heating gains (Table 5)

(72)m=	115.82	113.89	109.87	104.41	100.86	95.87	91.62	97.06	98.99	104.65	111.03	113.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	371.81	369.95	358.46	339.99	321.38	303.3	291.46	296.82	306.22	324.89	346.34	362.28	(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	3.1	x	11.28	x	0.63	x	0.7	=	32.07	(75)
Northeast 0.9x	0.77	x	3.1	x	22.97	x	0.63	x	0.7	=	65.28	(75)
Northeast 0.9x	0.77	x	3.1	x	41.38	x	0.63	x	0.7	=	117.61	(75)
Northeast 0.9x	0.77	x	3.1	x	67.96	x	0.63	x	0.7	=	193.14	(75)
Northeast 0.9x	0.77	x	3.1	x	91.35	x	0.63	x	0.7	=	259.62	(75)

Northeast	0.9x	0.77	x	3.1	x	97.38	x	0.63	x	0.7	=	276.79	(75)
Northeast	0.9x	0.77	x	3.1	x	91.1	x	0.63	x	0.7	=	258.93	(75)
Northeast	0.9x	0.77	x	3.1	x	72.63	x	0.63	x	0.7	=	206.42	(75)
Northeast	0.9x	0.77	x	3.1	x	50.42	x	0.63	x	0.7	=	143.31	(75)
Northeast	0.9x	0.77	x	3.1	x	28.07	x	0.63	x	0.7	=	79.77	(75)
Northeast	0.9x	0.77	x	3.1	x	14.2	x	0.63	x	0.7	=	40.35	(75)
Northeast	0.9x	0.77	x	3.1	x	9.21	x	0.63	x	0.7	=	26.19	(75)
Southeast	0.9x	0.77	x	6.66	x	36.79	x	0.63	x	0.7	=	74.89	(77)
Southeast	0.9x	0.77	x	6.66	x	62.67	x	0.63	x	0.7	=	127.56	(77)
Southeast	0.9x	0.77	x	6.66	x	85.75	x	0.63	x	0.7	=	174.54	(77)
Southeast	0.9x	0.77	x	6.66	x	106.25	x	0.63	x	0.7	=	216.26	(77)
Southeast	0.9x	0.77	x	6.66	x	119.01	x	0.63	x	0.7	=	242.23	(77)
Southeast	0.9x	0.77	x	6.66	x	118.15	x	0.63	x	0.7	=	240.48	(77)
Southeast	0.9x	0.77	x	6.66	x	113.91	x	0.63	x	0.7	=	231.85	(77)
Southeast	0.9x	0.77	x	6.66	x	104.39	x	0.63	x	0.7	=	212.47	(77)
Southeast	0.9x	0.77	x	6.66	x	92.85	x	0.63	x	0.7	=	188.99	(77)
Southeast	0.9x	0.77	x	6.66	x	69.27	x	0.63	x	0.7	=	140.99	(77)
Southeast	0.9x	0.77	x	6.66	x	44.07	x	0.63	x	0.7	=	89.7	(77)
Southeast	0.9x	0.77	x	6.66	x	31.49	x	0.63	x	0.7	=	64.09	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.96	192.84	292.15	409.41	501.86	517.27	490.78	418.89	332.29	220.76	130.05	90.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	478.76	562.79	650.61	749.4	823.24	820.57	782.24	715.72	638.52	545.65	476.39	452.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.79	0.61	0.45	0.51	0.77	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.67	19.86	20.17	20.55	20.83	20.96	20.99	20.99	20.89	20.51	20.02	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.83	19.83	19.83	19.84	19.84	19.85	19.85	19.85	19.85	19.84	19.84	19.83	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.89	0.73	0.51	0.34	0.39	0.68	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=	18.09	18.37	18.8	19.33	19.69	19.83	19.85	19.85	19.77	19.3	18.6	18.04	(90)

fLA = Living area ÷ (4) = 0.55 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.2	19.56	20.01	20.32	20.46	20.48	20.48	20.39	19.97	19.39	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.97	19.2	19.56	20.01	20.32	20.46	20.48	20.48	20.39	19.97	19.39	18.93	(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	0.56	0.4	0.46	0.73	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	474.65	552.88	624.02	669.63	623.8	463.18	315.93	329.16	463.88	507.92	468.39	449.48	(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=	1234.19	1200.48	1094.37	921.84	714.39	481.23	319.01	334.63	518.48	776.31	1021.87	1229.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	565.1	435.19	349.94	181.59	67.4	0	0	0	0	199.69	398.51	580.26	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2777.66 (98)

Space heating requirement in kWh/m²/year 43.54 (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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	565.1	435.19	349.94	181.59	67.4	0	0	0	0	199.69	398.51	580.26	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	604.38	465.44	374.27	194.21	72.08	0	0	0	0	213.57	426.21	620.6	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2970.76 (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)													
	187.56	165.5	174.24	156.79	154.09	138.3	133.41	145.58	145.07	162.56	171.14	183.25	
Efficiency of water heater												79.8	(216)
(217)m=	87.57	87.28	86.64	85.21	82.78	79.8	79.8	79.8	79.8	85.36	87	87.68	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	214.18	189.63	201.12	184.02	186.14	173.31	167.19	182.43	181.79	190.43	196.72	209	

Total = Sum(219a)$_{1...12}$ = 2275.96 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2970.76

Water heating fuel used		2275.96	
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		287.21	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	641.69	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	491.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1133.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	149.06	(268)
Total CO2, kg/year		sum of (265)…(271) =		1321.28	(272)

TER = 30.48 (273)

APPENDIX C
BRUKL REPORT – “BE LEAN” STAGE

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Tottenham Mews - Office (Lean)

As designed

Date: Wed Nov 04 12:30:57 2020

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	26
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	26
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	19.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	BF000009:Surf[0]
Floor	0.25	0.12	0.12	BF000009:Surf[4]
Roof	0.25	0.18	0.18	BF000009:Surf[5]
Windows***, roof windows, and rooflights	2.2	1.4	1.4	GF00000A:Surf[1]
Personnel doors	2.2	2.2	2.2	GF00000A:Surf[5]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- VRF

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	4	0	0	0.8
Standard value	0.91*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- Electric Rads

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

1- DHW based on Multipoint 80V

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	0.91	0.01
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	**System type in Non-domestic Building Services Compliance Guide**
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
BF - Office	-	-	-	1.2	-	-	-	-	-	-	N/A
GF - Office WC	0.5	-	-	-	-	-	-	-	-	-	N/A
GF - Office	-	-	-	1.2	-	-	-	-	-	-	N/A
BF - WC	0.5	-	-	-	-	-	-	-	-	-	N/A
BF - Shower	0.5	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
BF - Office	100	-	-	1120

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
GF - Cycle Store	100	-	-	10
GF - Office WC	-	100	-	27
GF - Office	100	-	-	447
BF - WC	-	100	-	31
BF - Shower	-	100	-	17

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
BF - Office	N/A	N/A
GF - Office	NO (-86.7%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	278.5	278.5
External area [m^2]	458.5	458.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	106.2	153.25
Average U-value [W/m^{2}K]	0.23	0.33
Alpha value* [%]	10.03	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	7.22	10.91
Cooling	2.87	4.74
Auxiliary	4.39	2.26
Lighting	14.13	25.89
Hot water	33.68	32.5
Equipment*	39.56	39.56
TOTAL**	**62.3**	**76.3**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	61.22	98.57
Primary energy* [kWh/m^2]	113.94	151.42
Total emissions [kg/m^2]	19.7	26

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	21	42.1	6.5	3.1	4.5	0.89	3.74	0.91	5
	Notional	32	70.7	10.3	5.2	2.1	0.86	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Room heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	59.1	0	21.4	0	5.1	0.77	0	0.91	0
	Notional	79.8	0	25.7	0	6.1	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	BF000009:Surf[0]
Floor	0.2	0.12	BF000009:Surf[4]
Roof	0.15	0.18	BF000009:Surf[5]
Windows, roof windows, and rooflights	1.5	1.4	GF00000A:Surf[1]
Personnel doors	1.5	2.2	GF00000A:Surf[5]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	5

APPENDIX D
BRUKL REPORT – “BE GREEN” STAGE

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Tottenham Mews - Office (Green)

As designed

Date: Wed Nov 04 12:24:28 2020

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	29.1
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	29.1
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	27.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	BF000009:Surf[0]
Floor	0.25	0.12	0.12	BF000009:Surf[4]
Roof	0.25	0.18	0.18	BF000009:Surf[5]
Windows***, roof windows, and rooflights	2.2	1.4	1.4	GF00000A:Surf[1]
Personnel doors	2.2	2.2	2.2	GF00000A:Surf[5]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	4	0	0	0.8
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

2- Electric Rads

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

1- DHW based on Multipoint 80V

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.01
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
BF - Office	-	-	-	1.2	-	-	-	-	-	-	N/A
GF - Office WC	0.5	-	-	-	-	-	-	-	-	-	N/A
GF - Office	-	-	-	1.2	-	-	-	-	-	-	N/A
BF - WC	0.5	-	-	-	-	-	-	-	-	-	N/A
BF - Shower	0.5	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W] Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
BF - Office	100	-	-	1120

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
GF - Cycle Store	100	-	-	10
GF - Office WC	-	100	-	27
GF - Office	100	-	-	447
BF - WC	-	100	-	31
BF - Shower	-	100	-	17

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
BF - Office	N/A	N/A
GF - Office	NO (-86.7%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	278.5	278.5
External area [m²]	458.5	458.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	106.2	153.25
Average U-value [W/m²K]	0.23	0.33
Alpha value* [%]	10.03	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.67	4.65
Cooling	2.87	4.74
Auxiliary	4.39	2.26
Lighting	14.13	25.89
Hot water	30.65	32.5
Equipment*	39.56	39.56
TOTAL**	**54.72**	**70.04**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	61.22	98.57
Primary energy* [kWh/m²]	163.79	145.35
Total emissions [kg/m²]	27.7	29.1

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	21	42.1	1.7	3.1	4.5	3.43	3.74	3.5	5
	Notional	32	70.7	3.5	5.2	2.1	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	59.1	0	19.5	0	5.1	0.84	0	1	0
	Notional	79.8	0	25.7	0	6.1	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
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CFT	= Cooling fuel type

Key Features

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Building fabric

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Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
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$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	5

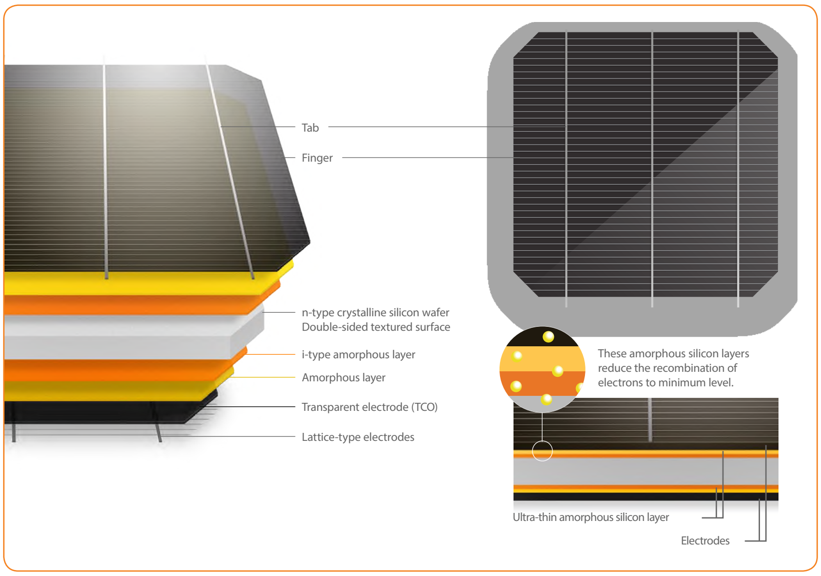
APPENDIX E
PV DATA SHEET

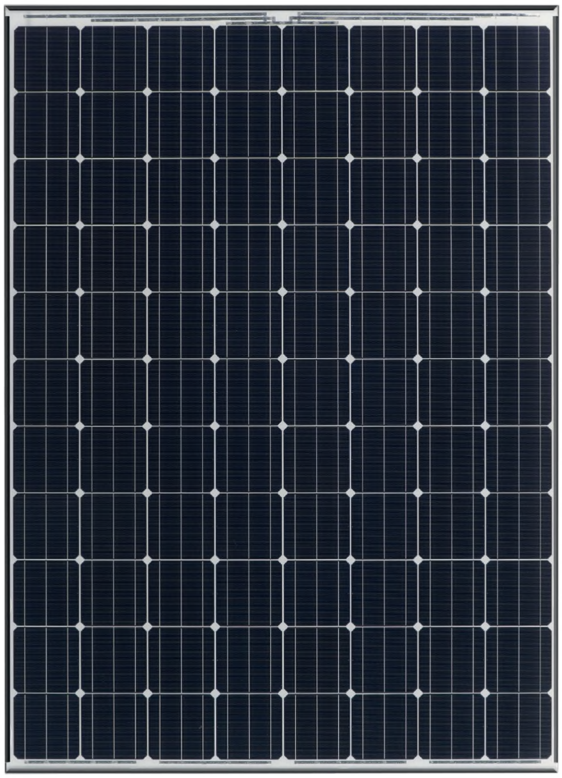
HIT®
Photovoltaic Module

Panasonic

Photovoltaic module HIT® N300

Panasonic's unique heterojunction technology uses ultra-thin amorphous silicon layers. These thin dual layers reduce losses, resulting in higher energy output than conventional panels.





Our slim Panasonic HIT® N300 features a high module efficiency of 19.5%, an industry leading temperature coefficient of -0.258% /°C and a sleek design. Powerful and efficient, designed to get the most out of your roof!

Our competitive advantages

High Performance at High Temperatures

As temperature increases, HIT® continues to perform at high levels due to the industry leading temperature coefficient of -0.258% /°C. No other module even comes close to our temperature characteristics. That means more energy throughout the day and particularly in summer.

25 Year Product and Performance Guarantee**

Industry leading 25 year product workmanship and performance guarantee is backed by a century old company - Panasonic.
Power output is guaranteed to 86.2% after 25 years.

Quality and Reliability

Panasonic's vertical integration, over 20 years of experience manufacturing HIT® and 20 internal tests 3-times beyond those mandated by current standards provide extreme quality assurance.

Higher Efficiency of 19.5% and compact size

Enables higher power output and greater energy yields. HIT® provides maximum production for your limited roof space.

Low Degradation

HIT "N-type" cells result in extremely Low Light Induced Degradation (LID) and zero Potential Induced Degradation (PID) which supports reliability and longevity. This technology reduces annual degradation, guaranteeing more power for the long haul.

Unique water drainage

The water drainage system gives rain, water and snow melt a place to go, reducing water stains and soiling on the panel.
Less dirt on the panel means more sunlight getting through to generate power.

HIT®
Photovoltaic Module

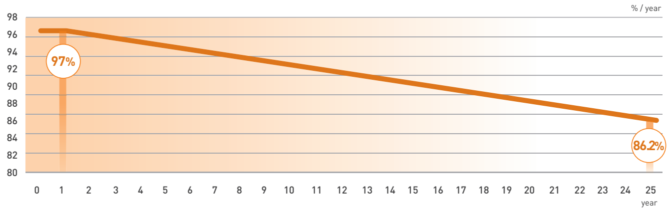
Panasonic

Photovoltaic module HIT® N300

ELECTRICAL SPECIFICATIONS

Model	VBHN300SJ46
Maximum Power (Pmax)[1]	300 W
Maximum Power Voltage (Vpm)	53.1 V
Maximum Power Current (Ipm)	5.65 A
Open Circuit Voltage (Voc)	63.8 V
Short Circuit Current (Isc)	6.04 A
Max. Power at NOCT (Normal Operating Conditions: air mass 1.5; irradiance = 800W/m²; air temperature 20°C; wind speed 1 m/s)	229.5 W
Temperature Coefficient (Pmax)	-0.258 %/°C
Temperature Coefficient (Voc)	-0.235 %/°C
Temperature Coefficient (Isc)	0.055 %/°C
NOCT	44.0 °C
Module Efficiency	19.5 %
Maximum System Voltage	1000 V
Series Fuse Rating	15 A
Power Tolerance (-/+)	+10%/ 0%*

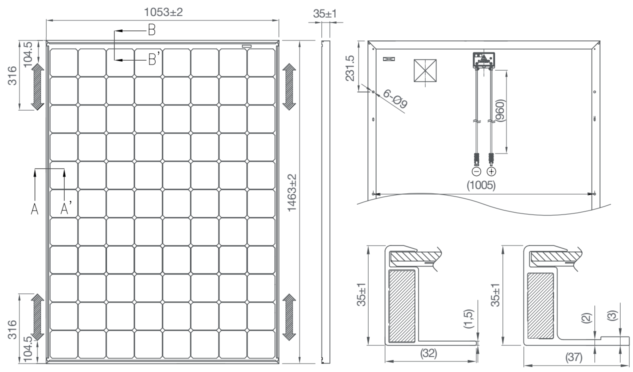
LINEAR PERFORMANCE GUARANTEE



MECHANICAL SPECIFICATIONS

Model	VBHN300SJ46
Internal Bypass Diodes	4 Bypass Diodes
Module Area	1.54 m²
Weight	18 kg
Dimensions LxWxH	1053 mm x 1463 mm x 35 mm
Cable Length +Male/-Female	960 mm / 960 mm
Cable Size / Type	No. 12 AWG / PV Cable
Connector Type	SMK
Static Wind / Snow Load	2400 Pa
Pallet Dimensions LxWxH	1491mm x 1071mm x 1590mm
Quantity per Pallet / Pallet Weight	40 pcs. (760 kg)
Quantity per 40' Container	600 pcs.

DIMENSIONS



Unit: mm

CERTIFICATES

CLASS UNO
UNI 8457
UNI 9174
UNI 9177

JET www.jet.or.jp
IEC61215
IEC61730-1
IEC61730-2

RoHS COMPLIANT

Electrical Protectio n Class II

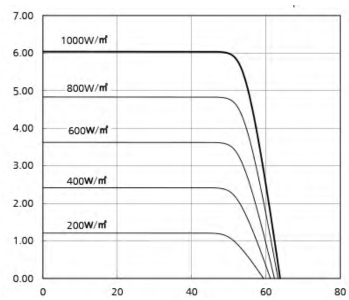
APPROVED PRODUCT
Certificate No. MCS PV0034 Photovoltaic System

CE

OPERATING CONDITIONS & SAFETY RATINGS

Model	VBHN300SJ46
Operating Temperature	-40°C to 85°C
Safety & Rating Certifications	IEC61215, IEC61730-1, IEC1730-2
Fire Classification	Class Uno
Limited Guarantee	25** years workmanship and power output (linear)***

DEPENDENCE ON IRRADIANCE



Reference data for model VBHN300SJ46
(Cell temperature: 25°C)

NOTE: Standard Test Conditions: Air mass 1.5; irradiance = 1000W/m²; cell temp. 25°C
* Maximum power at delivery. For guarantee conditions, please check our guarantee document.
** Registration necessary on www.eu-solar.panasonic.net, otherwise 15 years apply based on guarantee document.

*** 1st year 97 %, from 2nd year -0.45 %/year, in 25th year 86.2%.
[1] STC: Cell temp. 25°C, AM1.5, 1000W/m²

NOTE: Specifications and information above may change without notice.

⚠CAUTION! Please read the installation manual carefully before using the products.

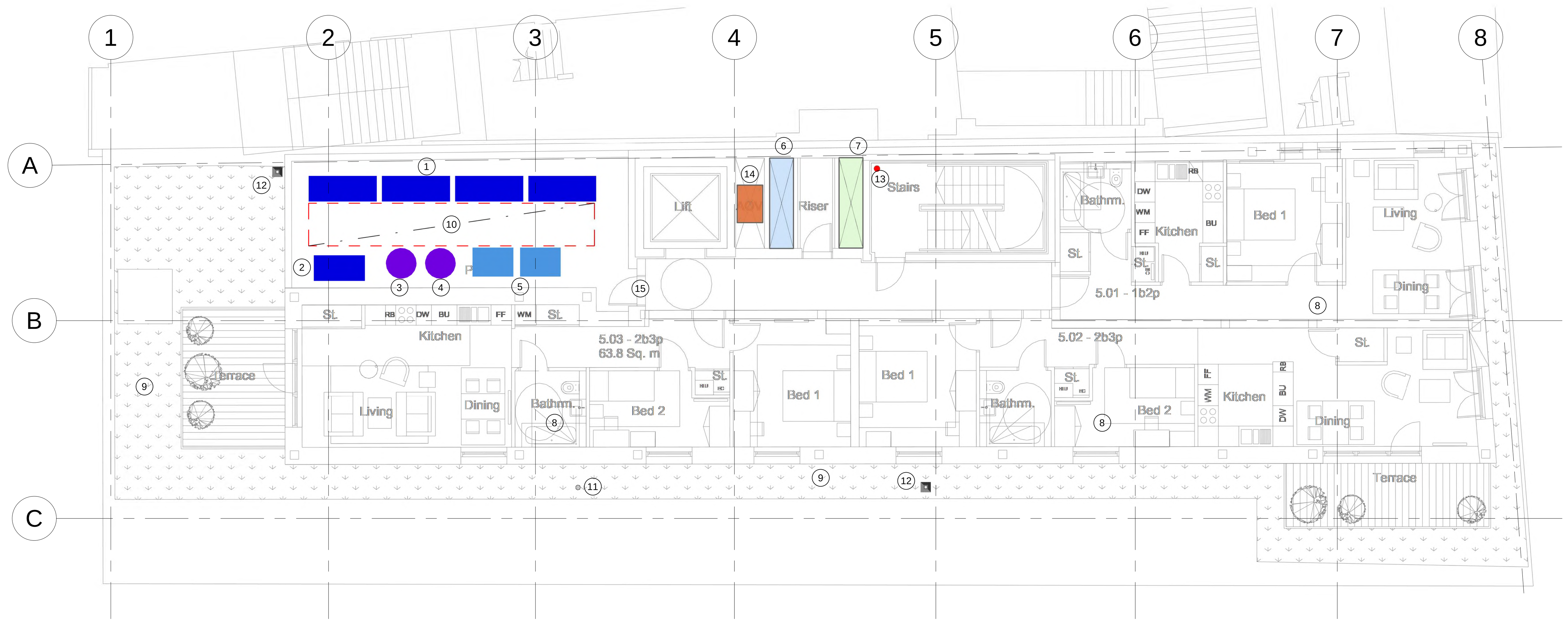
Used electrical and electronic products must not be mixed with general household waste. For proper treatment, recovery and recycling of old products, please take them to applicable collection points in accordance with your national legislation.

Panasonic

Panasonic Eco Solutions Europe, Panasonic Electric Works Europe AG
Robert-Koch-Straße 100, 85521 Ottobrunn, Germany
Tel. +49-89 45354-1000, Fax +49-89 45354-2111
info.solar@eu.panasonic.com www.eu-solar.panasonic.net

APPENDIX F
ASHP LAYOUT

No.	DESCRIPTION
1	4 NO. HOT WATER HEAT PUMPS (AIR SOURCE)
2	HOT WATER CIRCULATING PUMPS
3	BUFFER VESSEL
4	PRESSURISATION UNIT
5	2 NO. VRF CONDENSER UNITS FOR B1 OFFICE
6	MECHANICAL, PUBLIC HEALTH AND FIRE SPRINKLER RISER
7	ELECTRICAL, COMMUNICATIONS AND FIRE DETECTION RISER
8	REFER TO LEVEL 3 COMBINED SERVICES LAYOUT FOR TYPICAL SERVICES CONNECTIONS TO APARTMENTS
9	LEVEL 5 TERRACE TO BE BLUE ROOF. TWO BLUE ROOF OUTLETS AND TWO OVERFLOW ROOF OUTLETS ARE PROPOSED FOR RAINWATER DRAINAGE AND ATTENUATION. REFER TO CIVIL ENGINEER'S AND BLUE ROOF SPECIALIST'S DOCUMENTS FOR ATTENUATION REQUIREMENTS AND DETAILS
10	ACCESS ZONE
11	INDICATIVE LOCATION OF OVERFLOW ROOF OUTLET, AS COORDINATED WITH ARCHITECT
12	INDICATIVE LOCATION OF BLUE ROOF OUTLET, AS COORDINATED WITH ARCHITECT
13	DRY RISER MAIN
14	FIRE RATED SMOKE EXTRACT DUCTWORK RISER - MINIMUM 0.6SQM CROSS SECTIONAL AREA REQUIRED (APPROX DUCT SIZE 750mm X 1100mm). EACH OFFICE FLOOR TO HAVE A SMOKE EXTRACT GRILLE AND MOTORISED FIRE AND SMOKE DAMPER CONNECTED TO THE SMOKE EXTRACT SHAFT, SERVING THE PROTECTED LOBBY
15	THE LOBBY ON LEVEL 5 IS TO BE VENTILATED VIA AN ACTUATED DOOR TO THE EXTERNAL LEVEL 5 PLANT ENCLOSURE



Rev	Description	Date	Rev	Description	Date	Rev	Description	Date
P01	STAGE 2 DRAFT ISSUE	15.09.20						
P02	STAGE 2 DRAFT ISSUE	04.11.20						

A1 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 When reproduced at correct scale this line measures 150mm

CDM NOTES

DURING THE DESIGN PHASE, CONSIDERATION HAS BEEN GIVEN TO SITE SPECIFIC HAZARD IDENTIFICATION. A SCHEDULE OF CDM RISK ITEMS IS INCLUDED WITHIN THESE DOCUMENTS HOWEVER IT SHOULD BE NOTED THAT ONLY SIGNIFICANT AND UNUSUAL RISKS HAVE BEEN IDENTIFIED. THE CONTRACTOR MUST CARRY OUT THEIR OWN RISK ASSESSMENT AS OTHER UNIDENTIFIED RISKS MAY EXIST. WHERE RISK(S) HAVE BEEN IDENTIFIED ON THIS DRAWING PLEASE REFER TO THE CDM SCHEDULE LOCATED ON THE LEGEND SHEET FOR DETAILS

NDY QA SYSTEM
Reason For issue
STAGE 2
Authorisation
By GS : 04 NOV 2020
Verification Of Latest Amendment
By AM : 04 NOV 2020

Norman Disney & Young
A TETRA TECH COMPANY
CONSULTING ENGINEERS
4 CHISWELL STREET
LONDON EC1Y 4UP
UNITED KINGDOM
T +44 207 553 9494
F +44 207 553 9499
www.ndy.com
NDY Consulting Ltd
A registered company in England & Wales
Company Registration No. 3890617

Project
TOTTENHAM MEWS
14-19 Tottenham Mews, London

Title
COMBINED SERVICES
LEVEL 05
RISER & PLANT LAYOUT

Revit Version 2019
DRAWING IN COLOUR

Drawing No. 1419TM-NDY-XX-05-DR-N-5001

Scale	Drawn	Design	Revision
1 : 100 @ A1	ICE	GE	P02
Project No.	Project Commencement		
U14072-001	JUL. 2020		

APPENDIX G
GLA REPORTING 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.

SAP 2012 CO_2 PERFORMANCE | SAP 10.0 CO_2 PERFORMANCE

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 ($kgCO_2/m^2$)	VALIDATION CHECK: TER Worksheet TER 2012 ($kgCO_2/m^2$)	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
0_02 - 2B4P	85.3	2	162.3	18.5	18.5	3637.13	Natural Gas	2473.92	Natural Gas	421.71	75	
2_01 - 3B5P	91.6	4	361.2	15.5	15.5	2946.67	Natural Gas	2530.95	Natural Gas	385.9	75	
2_02 - 2B4P	83.2	4	289.8	15.3	15.3	2336.42	Natural Gas	2485.38	Natural Gas	369.33	75	
2_03 - 2B4P	76	6	361.3	16.3	16.3	2272.37	Natural Gas	2422.05	Natural Gas	359.22	75	
2_04 - 3B5P	102.3	3	285.9	14.6	14.6	3089.81	Natural Gas	2578.77	Natural Gas	435.56	75	
4_05 - 1B2P	81.5	1	81.5	17.9	17.9	3191.38	Natural Gas	2452.74	Natural Gas	380.45	75	
5_01 - 1B2P	55.3	1	55.3	19.7	19.7	2065.22	Natural Gas	2184.1	Natural Gas	253.42	75	
5_02 - 2B3P	64.7	1	64.7	20.3	20.4	2928.63	Natural Gas	2287.57	Natural Gas	290.68	75	
5_03 - 2B3P	63.8	1	63.8	20.8	20.8	2990.28	Natural Gas	2275.62	Natural Gas	287.21	75	
Sum	1,898	23	1,726	16.4	-	57,291	N/A	51,266	N/A	7,747	1,566	0

Unit identifier	REGULATED CO_2 EMISSIONS PER UNIT ($kgCO_2$ p.a.): Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED CO_2 EMISSIONS PER UNIT: Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated TER SAP 10.0 ($kgCO_2/m^2$)	DEMAND: Fabric Energy Efficiency (FEE) Target Fabric Energy Efficiency (TFEE) (kWh/m²)
0_02 - 2B4P	786	534	219	39		1,578	764	520	98	17		1,399	16.4	53
2_01 - 3B5P	636	547	200	39		1,422	619	531	90	17		1,258	13.7	42.3
2_02 - 2B4P	505	537	192	39		1,272	491	522	86	17		1,116	13.4	37.9
2_03 - 2B4P	491	523	186	39		1,239	477	509	84	17		1,087	14.3	40
2_04 - 3B5P	667	557	226	39		1,489	649	542	101	17		1,309	12.8	39.2
4_05 - 1B2P	689	530	197	39		1,456	670	515	89	17		1,291	15.8	49.7
5_01 - 1B2P	446	472	132	39		1,088	434	459	59	17		969	17.5	50.6
5_02 - 2B3P	633	494	151	39		1,316	615	480	68	17		1,181	18.2	58.4
5_03 - 2B3P	646	492	149	39		1,325	628	478	67	17		1,190	18.7	60.3
Sum	12,375	11,073	4,021	813	0	28,282	12,031	10,766	1,805	365	0	24,967	14.5	43.15

NON-DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

Building Use	Model Area (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK: Calculated TER 2012 ($kgCO_2/m^2$)	BRUKL TER 2012 ($kgCO_2/m^2$)	REGULATED ENERGY CONSUMPTION BY END USE (kWh/m² p.a.) TER - 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.)
Office	278.5	1	270.2	26.0	26.0	10.9143	Natural Gas	32.4952	Natural Gas	25.8943	2.25792	4.7421
Sum	279	1	270	25.2	-	2,949	N/A	8,780	N/A	6,997	610	1,281

Building Use	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) TER - SOURCE: BRUKL.INP or *SIM.CSV FILE: Natural Gas (0.216 $kgCO_2$/kWh)	Grid Electricity (0.519 $kgCO_2$/kWh)	Equipment (0.519 $kgCO_2$/kWh)			2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) - TER BRUKL: Natural Gas (0.210 $kgCO_2$/kWh)	Grid Electricity (0.233 $kgCO_2$/kWh)	Unregulated Grid Electricity (0.233 $kgCO_2$/kWh)			REGULATED CO_2 EMISSIONS: SAP10.0 CO_2 emissions ($kgCO_2$ p.a.)	BRUKL TER SAP10.0 ($kgCO_2/m^2$)
Office	43	32	40			7,247	43	32	40			4,620	16.6
Sum	11,729	8,665	10,690	N/A	N/A	7,031	11,729	8,665	10,690	N/A	N/A	4,482	16.6

SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS

Use	Total Area (m²)	Calculated TER 2012 ($kgCO_2/m^2$)	-	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 CO_2 EMISSIONS: 2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED CO_2 EMISSIONS PER UNIT: SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated TER SAP 10.0 ($kgCO_2/m^2$)
Sum	1,996	17.7	-	60,240		60,046		14,744	2,176	1,281	35,312	29,449	14.8

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.

SAP 2012 CO_2 PERFORMANCE | SAP 10.0 CO_2 PERFORMANCE | FEES

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 ($kgCO_2 / m^2$)	VALIDATION CHECK: DER Worksheet DER 2012 ($kgCO_2 / m^2$)	REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE LEAN' SAP DER WORKSHEET: Space Heating	Fuel type Space Heating	Domestic Hot Water (Heat Source 1)	Fuel type Domestic Hot Water	Secondary Heating system	Fuel type Space Heating	Lighting	Auxiliary	Cooling	
					DER Sheet (Row 384)	DER Sheet [(Row 307a) ÷ (Row 367a x 0.01)]	Select fuel type	DER Sheet [Row 310b ÷ (Row 367b x 0.01)]	Select fuel type	DER Sheet [Row 309]	Select fuel type	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315	
0_02 - 2B4P	85.3	2	162.3	18.3	18.3	3057.731844	Natural Gas	2648.581006	Natural Gas			409.9	216.5315		
2_01 - 3B5P	91.6	4	361.2	15.1	15.1	2155.631285	Natural Gas	2688.569832	Natural Gas			381.27	269.1656		
2_02 - 2B4P	83.2	4	289.8	14.2	14.2	1479.083799	Natural Gas	2633.240223	Natural Gas			361.13	198.1953		
2_03 - 2B4P	76	6	361.3	15.4	15.4	1557.709497	Natural Gas	2572.648045	Natural Gas			349.1	184.3867		
2_04 - 3B5P	102.3	3	285.9	14.0	14.0	2152.111732	Natural Gas	2738.03352	Natural Gas			423.94	295.9568		
4_05 - 1B2P	81.5	1	81.5	20.0	20.0	3518.558659	Natural Gas	2620.055866	Natural Gas			369.64	213.0306		
5_01 - 1B2P	55.3	1	55.3	21.2	21.2	2123.921788	Natural Gas	2337.47486	Natural Gas			253.42	147.1995		
5_02 - 2B3P	64.7	1	64.7	21.7	21.7	2930.681564	Natural Gas	2453.564246	Natural Gas			290.68	173.699		
5_03 - 2B3P	63.8	1	63.8	23.0	23.0	3250.73743	Natural Gas	2442.972067	Natural Gas			287.21	174.7187		
Sum	1,898	23	1,726	16.1	-	44,714	N/A	54,549	N/A	0	N/A	7,587	4,576	0	N/A

Unit identifier	REGULATED CO_2 EMISSIONS PER UNIT ($kgCO_2$ p.a.): Space Heating CO_2 emissions ($kgCO_2$ p.a.)	Domestic Hot Water CO_2 emissions ($kgCO_2$ p.a.)	Lighting CO_2 emissions ($kgCO_2$ p.a.)	Auxiliary CO_2 emissions ($kgCO_2$ p.a.)	Cooling CO_2 emissions ($kgCO_2$ p.a.)	2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED CO_2 EMISSIONS PER UNIT: Space Heating CO_2 emissions ($kgCO_2$ p.a.)	Domestic Hot Water CO_2 emissions ($kgCO_2$ p.a.)	Lighting CO_2 emissions ($kgCO_2$ p.a.)	Auxiliary CO_2 emissions ($kgCO_2$ p.a.)	Cooling CO_2 emissions ($kgCO_2$ p.a.)	Unregulated ($kgCO_2$ p.a.)	SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated DER SAP 10.0 ($kgCO_2 / m^2$)	Fabric Energy Efficiency (FEE): Dwelling Fabric Energy Efficiency (DFEE) (kWh/m²)
0_02 - 2B4P	660	572	213	112		1,558	642	556	96	50		655	1,344	15.8	48
2_01 - 3B5P	466	581	198	140		1,384	453	565	89	63		687	1,169	12.8	37.5
2_02 - 2B4P	319	569	187	103		1,179	311	553	84	46		644	994	11.9	32.7
2_03 - 2B4P	336	556	181	96		1,169	327	540	81	43		603	992	13.0	35.4
2_04 - 3B5P	465	591	220	154		1,430	452	575	99	69		735	1,195	11.7	35.1
4_05 - 1B2P	760	566	192	111		1,628	739	550	86	50		634	1,425	17.5	54.4
5_01 - 1B2P	459	505	132	76		1,172	446	491	59	34		467	1,030	18.6	51.5
5_02 - 2B3P	633	530	151	90		1,404	615	515	68	40		531	1,239	19.1	56.9
5_03 - 2B3P	702	528	149	91		1,470	683	513	67	41		525	1,303	20.4	61.5
Sum	9,658	11,783	3,937	2,375	0	27,753	9,390	11,455	1,768	1,066	0	13,273	23,679	13.7	39.31

NON-DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS

Building Use	Model Area (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK: Calculated BER 2012 ($kgCO_2 / m^2$)	VALIDATION CHECK: BRUKL BER 2012 ($kgCO_2 / m^2$)	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.)
Office	278.5	1	270.2	19.7	19.7	7.21756	Natural Gas	33.6815	Natural Gas			14.1339	4.39497	2.86795
Sum	279	1	270	19.7	-	1,950	N/A	9,101	N/A	N/A	N/A	3,819	1,188	775

Building Use	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) 'BE LEAN' BER - SOURCE: BRUKL.INP or *SIM.CSV FILE: Natural Gas (0.216 $kgCO_2$/kWh)	Grid Electricity (0.519 $kgCO_2$/kWh)	Equipment (0.519 $kgCO_2$/kWh)				2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED CO_2 EMISSIONS PER UNIT: Natural Gas (0.210 $kgCO_2$/kWh)	Grid Electricity (0.233 $kgCO_2$/kWh)	Equipment (0.233 $kgCO_2$/kWh)		SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	BRUKL BER SAP 10.0 ($kgCO_2 / m^2$)	FEE
Office	41	21	40				5,476	41	21	40		3,746	13.4	N/A
Sum	11,051	5,637	10,690	N/A	N/A	N/A	5,312	11,051	5,637	10,690		3,634	13.4	

SITE-WIDE ENERGY CONSUMPTION AND CO2 ANALYSIS

Use	Total Area (m²)	Calculated BER 2012 ($kgCO_2 / m^2$)	-	REGULATED ENERGY CONSUMPTION: Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Secondary Heating System (kWh p.a.)	N/A	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)		REGULATED CO_2 EMISSIONS: 2012 CO_2 emissions ($kgCO_2$ p.a.)		REGULATED CO_2 EMISSIONS: SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated BER SAP 10.0 ($kgCO_2 / m^2$)	N/A
Sum	1,996	16.6	-	46,664		63,650		0		11,406	5,764	775		33,066		27,313	13.7	

The applicant should complete all the light blue cells including information on the 'be clean' energy consumption figures and the 'be clean' DER.

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 ($kgCO_2/m^2$)	VALIDATION CHECK: DER Worksheet DER 2012 ($kgCO_2/m^2$)	REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE CLEAN' SAP DER WORKSHEET: Space Heating (Heat Source 1)	Fuel type Space Heating	Domestic Hot Water (Heat Source 1)	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)	Secondary Heating system	Fuel type Secondary Heating	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 307a + 310a) ÷ (Row 362 x 0.01)]	Select fuel type	DER Sheet [(Row 307a + 310a) × (Row 361 ÷ 362)]	DER Sheet [Row 309]	Select fuel type	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315
0_02 - 2B4P	85.3	2	162.3	18.3	18.3	3057.731844	Natural Gas	2648.581006	Natural Gas						409.9	216.5315	
2_01 - 3B5P	91.6	4	361.2	15.1	15.1	2155.631285	Natural Gas	2688.569832	Natural Gas						381.27	269.1656	
2_02 - 2B4P	83.2	4	289.8	14.2	14.2	1479.083799	Natural Gas	2633.240223	Natural Gas						361.13	198.1953	
2_03 - 2B4P	76	6	361.3	15.4	15.4	1557.709497	Natural Gas	2572.648045	Natural Gas						349.1	184.3867	
2_04 - 3B5P	102.3	3	285.9	14.0	14.0	2152.111732	Natural Gas	2738.03352	Natural Gas						423.94	295.9568	
4_05 - 1B2P	81.5	1	81.5	20.0	20.0	3518.558659	Natural Gas	2620.055866	Natural Gas						369.64	213.0306	
5_01 - 1B2P	55.3	1	55.3	21.2	21.2	2123.921788	Natural Gas	2337.47486	Natural Gas						253.42	147.1995	
5_02 - 2B3P	64.7	1	64.7	21.7	21.7	2930.681564	Natural Gas	2453.564246	Natural Gas						290.68	173.699	
5_03 - 2B3P	63.8	1	63.8	23.0	23.0	3250.73743	Natural Gas	2442.972067	Natural Gas						287.21	174.7187	
Sum	1,898	23	1,726	16.1	-	44,714	N/A	54,549	N/A	0	N/A	0	0	N/A	7,587	4,576	0

Unit identifier	SAP 2012 CO_2 PERFORMANCE – REGULATED CO_2 EMISSIONS PER UNIT ($kgCO_2$ p.a.): Space Heating	Domestic Hot Water	Space Heating and DHW from CHP (if applicable)	Electricity generated by CHP (if applicable)	Lighting	Auxiliary	Cooling	2012 CO_2 emissions ($kgCO_2$ p.a.)	SAP 10.0 CO_2 PERFORMANCE – REGULATED CO_2 EMISSIONS PER UNIT ($kgCO_2$ p.a.): Space Heating	Domestic Hot Water	Space Heating and DHW from CHP (if applicable)	Electricity generated by CHP (if applicable)	Lighting	Auxiliary	Cooling	SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated DER SAP 10.0 ($kgCO_2/m^2$)
0_02 - 2B4P	660	572			213	112		1,558	642	556			96	50		1,344	15.8
2_01 - 3B5P	466	581			198	140		1,384	453	565			89	63		1,169	12.8
2_02 - 2B4P	319	569			187	103		1,179	311	553			84	46		994	11.9
2_03 - 2B4P	336	556			181	96		1,169	327	540			81	43		992	13.0
2_04 - 3B5P	465	591			220	154		1,430	452	575			99	69		1,195	11.7
4_05 - 1B2P	760	566			192	111		1,628	739	550			86	50		1,425	17.5
5_01 - 1B2P	459	505			132	76		1,172	446	491			59	34		1,030	18.6
5_02 - 2B3P	633	530			151	90		1,404	615	515			68	40		1,239	19.1
5_03 - 2B3P	702	528			149	91		1,470	683	513			67	41		1,303	20.4
Sum	9,658	11,783	0	0	3,937	2,375	0	27,753	9,390	11,455	0	0	1,768	1,066	0	23,679	13.7

NON-DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

Building Use	Model Area (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK: Calculated BER 2012 ($kgCO_2/m^2$)	VALIDATION CHECK: BRUKL BER 2012 ($kgCO_2/m^2$)	REGULATED ENERGY CONSUMPTION BY END USE (kWh/m² p.a.) 'BE CLEAN' 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			Electricity generated by CHP (-) (if applicable)			Lighting (kWh/m² p.a.)	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)
Office	278.5	1	270.2	19.7	19.7	7.21756	Natural Gas	33.6815	Natural Gas	N/A	N/A		N/A	N/A	14.1339	4.39497	2.86795
Sum	279	1	270	19.7	-	1,950	N/A	9,101	N/A			0			3,819	1,188	775

Building Use	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) 'BE CLEAN' BER - SOURCE: BRUKL.INP or *SIM.CSV FILE: Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-) (if applicable)	Equipment			2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED CO_2 EMISSIONS PER UNIT: Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-) if applicable	Equipment		SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	BRUKL BER SAP10.0 ($kgCO_2/m^2$)
	0.216 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh				0.210 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh			
Office	41	21			40	N/A	N/A	5,476	41	21			40		3,746	13.4
Sum	11,051	5,637	0	0	10,690			5,312	11,051	5,637	0	0	10,690		3,634	13.4

SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS

Use	Total Area (m²)	Calculated BER 2012 ($kgCO_2/m^2$)	-	REGULATED ENERGY CONSUMPTION: 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	Secondary Heating System (kWh p.a.)	N/A	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)	REGULATED CO_2 EMISSIONS: 2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED CO_2 EMISSIONS PER UNIT: SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated BER SAP 10.0 ($kgCO_2/m^2$)
Sum	1,996	16.6	-	46,664		63,650		0		0	0		11,406	5,764	775	33,066	27,313	13.7

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

VALIDATION CHECK / 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)	Calculated DER 2012 ($kgCO_2/m^2$)	DER Worksheet DER 2012 ($kgCO_2/m^2$)	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	Secondary Heating system	Fuel type Secondary Heating	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 ...)]	Select fuel type	DER Sheet [(Row 307a + 310a) × (Row 361 ÷ 362)]	DER Sheet Row 309	Select fuel type	DER Sheet Row 333	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315
0_02 - 2B4P	85.3	2	162.3	12.3	12.3	1094.668	Grid Electricity	948.192	Grid Electricity		Grid Electricity		Grid Electricity						-647.15	409.9	216.5315	
2_01 - 3B5P	91.6	4	361.2	9.6	9.6	771.716	Grid Electricity	962.508	Grid Electricity										-694.91	381.27	269.1656	
2_02 - 2B4P	83.2	4	289.8	8.7	8.7	529.512	Grid Electricity	942.7	Grid Electricity										-631.51	361.13	198.1953	
2_03 - 2B4P	76	6	361.3	9.8	9.8	557.66	Grid Electricity	921.008	Grid Electricity										-576.34	349.1	184.3867	
2_04 - 3B5P	102.3	3	285.9	8.6	8.6	770.456	Grid Electricity	980.216	Grid Electricity										-776.42	423.94	295.9568	
4_05 - 1B2P	81.5	1	81.5	13.8	13.8	1259.644	Grid Electricity	937.98	Grid Electricity										-618.34	369.64	213.0306	
5_01 - 1B2P	55.3	1	55.3	14.8	14.8	760.364	Grid Electricity	836.816	Grid Electricity										-419.08	253.42	147.1995	
5_02 - 2B3P	64.7	1	64.7	15.3	15.3	1049.184	Grid Electricity	878.376	Grid Electricity										-490.72	290.68	173.699	
5_03 - 2B3P	63.8	1	63.8	16.3	16.3	1153.576	Grid Electricity	874.584	Grid Electricity										-484.13	287.21	174.464	
Sum	1,898	23	1,726	10.4	-	15,997	N/A	19,529	N/A	0	N/A	0	N/A	0	N/A	0	0	N/A	-13,093	7,587	4,576	0

SAP 2012 CO_2 PERFORMANCE — REGULATED CO_2 EMISSIONS PER UNIT ($kgCO_2$ p.a.) / SAP 10.0 CO_2 PERFORMANCE — REGULATED CO_2 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 CO_2 emissions ($kgCO_2$ p.a.)	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		SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated DER SAP 10.0 ($kgCO_2/m^2$)
0_02 - 2B4P	568	492			-336	213	112			1,049	255	221			-151	96	50			471	5.5
2_01 - 3B5P	401	500			-361	198	140			877	180	224			-162	89	63			394	4.3
2_02 - 2B4P	275	489			-328	187	103			727	123	220			-147	84	46			326	3.9
2_03 - 2B4P	289	478			-299	181	96			745	130	215			-134	81	43			335	4.4
2_04 - 3B5P	400	509			-403	220	154			879	180	228			-181	99	69			395	3.9
4_05 - 1B2P	654	487			-321	192	111			1,122	293	219			-144	86	50			504	6.2
5_01 - 1B2P	395	434			-218	132	76			819	177	195			-98	59	34			368	6.7
5_02 - 2B3P	545	456			-255	151	90			987	244	205			-114	68	40			443	6.8
5_03 - 2B3P	599	454			-251	149	91			1,041	269	204			-113	67	41			467	7.3
Sum	8,303	10,135	0	0	-6,795	3,937	2,375	0	NA	17,955	3,727	4,550	0	0	-3,051	1,768	1,066	0	NA	8,061	4.7

NON-DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

VALIDATION CHECK / 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)	Calculated BER 2012 ($kgCO_2/m^2$)	BRUKL BER 2012 ($kgCO_2/m^2$)	Space Heating (kWh/m² p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water							Electricity generated by CHP (-) if applicable			Electricity generated by renewable technology (-) if applicable	Lighting (kWh/m² p.a.)	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)
Office	278.5	1	270.2	27.7	27.7	2.672	Grid Electricity	30.6521	Grid Electricity	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A		14.1339	4.39497	2.86795
Sum	279	1	270	27.7	-	722	N/A	8,282	N/A							0			0	3,819	1,188	775

REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) 'BE GREEN' BER - SOURCE: BRUKL.INP or *SIM.CSV FILE / REGULATED CO_2 EMISSIONS PER UNIT

Use	Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-) if applicable	Electricity generated by renewable technology (-)	Enter Carbon Factor 1	Enter Carbon Factor 2	Enter Carbon Factor 3	Equipment	2012 CO_2 emissions ($kgCO_2$ p.a.)	Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-) if applicable	Electricity generated by renewable technology (-)	Enter Carbon Factor 1	Enter Carbon Factor 2	Enter Carbon Factor 3	Equipment	SAP 10.0 CO_2 emissions	BRUKL BER SAP 10.0 ($kgCO_2/m^2$)
	0.216 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh		0.210 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh		
Office		53							40	7,711		53							40	3,462	12.4
Sum	0	14,414	0	0	0	0	0	0	10,690	7,481	0	14,414	0	0	0	0	0	0	10,690	3,359	12.4

SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS

REGULATED ENERGY CONSUMPTION

Use	Total Area (m²)	Calculated BER 2012 ($kgCO_2/m^2$)	-	Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Space Heating (Heat source 2) (kWh p.a.)	N/A	Domestic Hot Water (Heat source 2) (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	Secondary Heating system (kWh p.a.)	N/A	Electricity generated by renewable (kWh p.a.) if applicable	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)	REGULATED CO_2 EMISSIONS: 2012 CO_2 emissions	N/A	REGULATED CO_2 EMISSIONS: SAP 10.0 CO_2 emissions	Calculated BER SAP 10.0 ($kgCO_2/m^2$)
Sum	1,996	12.7	-	16,719		27,811		0		0		0		0	0		-13,093	11,406	5,763	775	25,436		11,419	5.7

SAP 2012 Performance	SAP 10.0 Performance

Domestic

SAP 2012 Performance

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	28.3	29.8
After energy demand reduction (be lean)	27.8	29.8
After heat network connection (be clean)	27.8	29.8
After renewable energy (be green)	18.0	29.8

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	0.5	2%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	9.8	35%
Cumulative on site savings	**10.3**	**37%**
Annual savings from off-set payment	18.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**539**	-
Cash in-lieu contribution (£)	**51,171**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SAP 10.0 Performance

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	25.0	13.4
After energy demand reduction (be lean)	23.7	13.4
After heat network connection (be clean)	23.7	13.4
After renewable energy (be green)	8.1	13.4

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: Savings from energy demand reduction	1.3	5%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	15.6	63%
Cumulative on site savings	**16.9**	**68%**
Annual savings from off-set payment	8.1	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**242**	-
Cash in-lieu contribution (£)	**22,973**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

Non-domestic

SAP 2012 Performance

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	7.0	5.5
After energy demand reduction (be lean)	5.3	5.5
After heat network connection (be clean)	5.3	5.5
After renewable energy (be green)	7.5	5.5

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	1.7	24%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	-2.2	-31%
Total Cumulative Savings	**-0.5**	**-6%**
Annual savings from off-set payment	7.5	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**224**	-
Cash in-lieu contribution (£)	**21,321**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SAP 10.0 Performance

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	4.5	2.5
After energy demand reduction (be lean)	3.6	2.5
After heat network connection (be clean)	3.6	2.5
After renewable energy (be green)	3.4	2.5

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	0.8	19%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.3	6%
Total Cumulative Savings	**1.1**	**25%**
Annual savings from off-set payment	3.4	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**101**	-
Cash in-lieu contribution (£)*	**9,572**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SITE-WIDE

SAP 2012 Performance

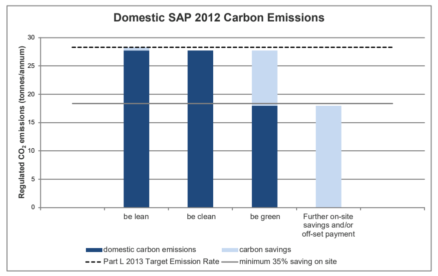
	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2013 baseline	35.3		
Be lean	33.1	2.2	6%
Be clean	33.1	0.0	0%
Be green	25.4	7.6	22%
Total Savings	-	9.9	28%
	-	CO_2 savings off-set (Tonnes CO_2)	-
Off-set	-	**763.1**	-

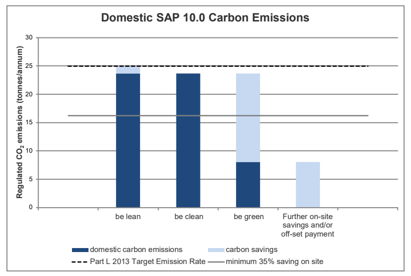
SAP 10.0 Performance

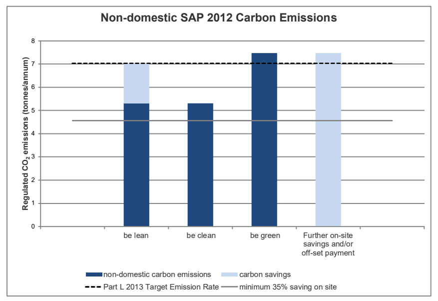
	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2013 baseline	29.4		
Be lean	27.3	2.1	7%
Be clean	27.3	0.0	0%
Be green	11.4	15.9	54%
Total Savings	-	18.0	61%
	-	CO_2 savings off-set (Tonnes CO_2)	-
Off-set	-	**342.6**	-

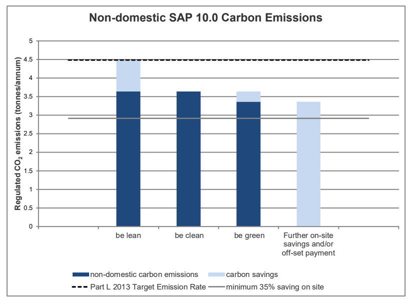
	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	43.15	39.31	9%

	Area weighted non-domestic cooling demand (MJ/m²)	Total area weighted non-domestic cooling demand (MJ/year)
Actual	42.1	11375.42
Notional	70.7	19103.14









OUR SERVICE LINES

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- DILAPIDATIONS
- PROJECT CONSULTANCY
- COST CONSULTANCY
- M+E CONSULTANCY
- DEVELOPMENT CONSULTANCY
- PRINCIPAL DESIGNER
- INSURANCE ASSESSMENT
- DISASTER RESPONSE
- PARTY WALLS
- EXPERT WITNESS
- DESIGN
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