

Energy Strategy

FOR

Mixed Use Redevelopment

AT

101 CAMLEY STREET

LONDON BOROUGH OF CAMDEN



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Issue: 04



DOCUMENT ISSUE RECORD

ISSUE	PREPARED BY			CHECKED BY	, ,	
	PREPARED	DATE	SIGNATURE	CHECKED	DATE	SIGNATURE
01	D.Vardill	26.06.14	Tholith	P.Bushell	26.06.14	
02	D.Vardill	27.06.14	Tholith	P.Bushell	27.06.14	
03	D.Vardill	09.09.14	Tholith	P.Bushell	09.09.14	
04	D.Vardill	11.09.14	Tholith	P.Bushell	11.09.14	

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1. EXECUTIVE SUMMARY

This Energy Statement has been prepared for the proposed mixed use development at 101 Camley Street, London. This document forms part of a series of documents issued in support of the planning application to the London Borough of Camden for 101 Camley Street London. This document shall be read in conjunction with all related information submitted for the application. This document relates to the energy use and carbon emissions reduction required under Local, regional and national policy.

Policy and guidance includes:

The London Plan 2011 (Draft Further Alterations to the London Plan 2014) The Mayor's Supplementary Planning Guidance – Revised Sustainable design and Construction (2014) UK National sustainable development policy Camden Council's Core Strategy (2010) Camden Council's Development Policies (2010-2015) Planning Guidance 3 – Sustainability (April 2011)

The proposed development has been assessed and a site wide energy strategy produced in accordance with the Mayor's Energy Hierarchy:

- 1. **Be lean**: minimise energy use
- 2. Be clean: supply energy efficiently
- 3. **Be green**: use of renewable energy

The methodology detailed herein is In accordance with the Greater London Authority guidance which states that applications received by the Mayor before the 6 July 2014 may demonstrate compliance with the 40% reduction target beyond 2010 Building Regulations.

This document demonstrates that the London Borough of Camden Planning policies relevant to sustainable energy have been addressed in a structured and comprehensive manner by the proposals in the Planning Application.

The energy strategy demonstrates that regulated carbon dioxide emissions for the proposed scheme have been reduced by more than 40% over Part L 2010 compliant baseline requirements by maximising the contribution of each step of the energy hierarchy.

A CHP (combined heat and power unit) will be specified to meet the minimised energy demand plus a combination of heat pump and photovoltaic array that will meet a significant amount of both the residential and commercial energy and thermal requirements of the development.

Be lean:

- Improved building fabric, better than the limiting standards of the Building Regulations
- Ventilation systems with low specific fan powers, including EC motors on the fan coil units
 High efficiency boilers

- Low energy lighting and, where appropriate, automatic lighting control systems
- Measures to reduce the space cooling demand



These energy efficiency measures result in the building's carbon emissions being **11.87%** better than the Building Regulations 2010 target emissions rate.

Be clean: By optimising the CHP selection to ensure efficient running. The CHP has been selected to meet approx. 60% of the domestic hot water and space heating load of both the residential and employment units. The CHP will also generate electricity which will be fully utilised by the onsite demand reducing the overall consumption on the utilities infrastructure required. As the electricity generated will only meet a proportion of the site demand no electricity will be exported back to the grid.

The carbon emissions reductions from the 'be clean' stage are an additional **28.28%** reduction.

Be green: an assessment has been carried out of current low and zero carbon technologies. The most suitable options are photovoltaic panel arrays to supplement the CHP energy provision and use of heat pumps to contribute to the cooling demand for the proposed business units. The PV array will be approx. 110-350m². The heat pump selection will be based on approx. 25kW

The carbon emissions reductions from the 'be green' stage are an additional **10.12%**.

The total reduction in regulated carbon emissions for the proposed development will be over 40% over the Part L 2010 compliant baseline values.

1.1. SITE BACKGROUND

This Energy Statement sets out the methodology used in assessing the proposed development and an assessment of the predicted energy targets and renewable proposals to support the planning application for the proposed mixed use redevelopment (employment and residential) at 101 Camley Street, London.

The site is currently being used as a warehouse and delivery depot by DPD, but the company are relocating to larger premises in the Kentish Town Industrial Estate.

It is proposed that existing building located at 101 Camley Street, London, be demolished and the new development be constructed resulting in a total of 121 dwellings including 30 affordable homes along with the commercial employment units comprising a total of circa 2,220m² Gross External Area (GEA). The Site is located at the junction of Camley Street and Granary Street in the London Borough of Camden.

It is the intention of the Client for the proposed building to achieve both a compliance with Part L 2010 Building Regulations and a Code for Sustainable Homes Level 4 certification for the residential dwellings. The employment units are to target BREEAM 'Excellent' but currently achieve 'Very Good'.

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2. ENERGY STRATEGY

Methodology

A thorough review has been undertaken of the energy technology options for the site to ensure the most appropriate energy strategy is implemented. This energy strategy has been developed in accordance with requirements of the London Plan and specifically the GLA Energy Team's Guidance Note 'Guidance on Planning Energy Assessments October 2010.

Accordingly, the Mayor's Energy Hierarchy (Use Less Energy - 'Be Lean', Supply Energy Efficiently -'Be Clean' and Use Renewable Energy - 'Be Green') has been applied to energy considerations for the site, starting with a robust 'baseline' energy demand assessment. A final energy strategy consisting of the introduction of a combined heat and power (CHP) has been evaluated as the most appropriate to serve the energy demand profile of the site whilst ensuring optimal energy efficiency and CO_2 emission reductions.

Baseline Energy Demand Assessment

The 101 Camley Street development is assessed under Building Regulations Part L 2010 as requested by the London Borough of Camden. The results in the report are assessed based on a thermal model using Designbuilder V3 with Energy Plus.

In establishing the energy profile of the building, consideration has been given to the various ways in which the building in use will consume energy, and means of making reasonable estimates or calculations of the likely energy use. Appropriate non-regulated loads (small power, equipment, external and common areas lighting, cooking and appliances etc.) have also been established and incorporated in the assessment.

2.1. Energy Hierarchy Step 1 - 'Be Lean' - Reduce Energy Demand

A range of measures have been adopted in the building fabric and services design to reduce the energy demand of the scheme, relative to what would be permissible solely to satisfy the Building Regulations.

- Improved building fabric, better than the limiting standards of the Building Regulations
- Ventilation systems with low specific fan powers, including EC motors on the fan coil units
- High efficiency boilers
- Low energy lighting and, where appropriate, automatic lighting control systems
- Measures to reduce the space cooling demand

These energy efficiency measures result in the building's carbon emissions being **11.87%** better than the Building Regulations 2010 target emissions rate.

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2.2. Energy Hierarchy Step 2 - 'Be Clean' - Supply Energy Efficiently

No existing district heating and/or cooling networks have been identified in the immediate area but there is a proposal for a future network (2017-18) in the Phoenix Court area which we have discussed with London Borough of Camden, see separate correspondence.

The proposed building services strategy offers a flexible energy scope to connect to a district heating main in the future without substantial changes to the systems and allowance will be made for further review with the London Borough of Camden during the detailed design phase for possible future connection to their proposed Phoenix Court network due to be constructed in 2017-18.

The site is located a short distance from the Kings Cross Energy centre on the opposite side of the Canal and main rail lines.

Enquiries were made at an early stage to Kings Cross energy centre for a supply to meet the proposed loads of the Development. Following discussions with their Technical team they advised that they did not consider it to be a feasible option due to the location of the development which is adjacent to the canal and network rail property and the required loads.

The development lends itself to CHP as a consistent heat load for domestic hot water exists year round. The electricity generated by the CHP will be fully utilised by the on-site demand. Calculations using FSAP 2009 and SBEM that by providing a gas fired CHP meeting 60% of the total annual heat and domestic hot water demand will result in a **28.28%** reduction in regulated carbon emissions.

2.3. Energy Hierarchy Step 3 - 'Be Green' - Renewable Energy

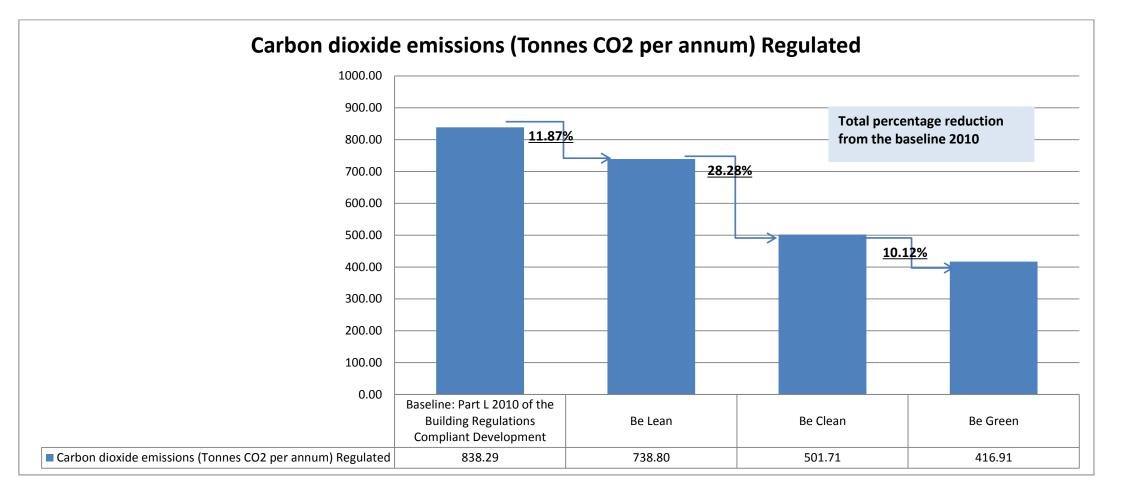
The use of renewable energy technologies has been considered. The provision of CHP to meet 60% of the site heat demand, heat pump technology and also an array of photovoltaic collectors will result in a further reduction of **10.12%** reduction in regulated carbon emissions for this final step.

2.4. Summarised Results following the 3 Steps

It is estimated that the project as a whole (both residential and commercial units) will achieve **50.27%** reduction in carbon dioxide emissions from a Part L 2010 compliant baseline.



2.5. Summary Graph and Tables





	Carbon dioxide emi	ssions	
	(Tonnes CO2 per annum)		
	Regulated	Unregulated ¹	
Baseline: Part L 2010 of the Building Regulations Compliant Development	838.29	377.23	
After energy demand reduction	738.80	332.46	
After CHP	501.71	332.46	
After renewable energy	416.91	332.46	

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

Table 2: Regulated carbon dioxide savings from each stage of the Energy Hierarchy

	(Tonnes CO2 per annum)	(%)		
Savings from energy demand reduction	99.49	11.87%		
Savings from CHP	237.09	28.28%		
Savings from renewable energy	84.80	10.12%		
Total Cumulative Savings	421.38	50.27%		
Total Target Savings	335.32	40%		
Annual Surplus	86.07	10%		

Regulated Carbon dioxide savings

¹ Unregulated Energy has been accounted for and is estimated as 40% for commercial spaces and 50% for residential spaces of the total regulated energy. As both space types are nearly equal in energy demand an average of 45% unregulated energy for the Target and 35% has been used after the demand reduction step.



2.6. Carbon Dioxide Emissions savings from each stage of the Energy Hierarchy

The proposed CHP strategy for the development shows CO_2 savings from 'be clean' measures of 99,490kg CO_2 /year (11.87% of regulated emissions), 'be Lean' measures of 237,090kg CO_2 /year (28.28% of regulated emissions) and 'be Green' measures of 84,800kg CO_2 /year (10.12% of regulated emissions).

This is a total saving of 421,380kgCO₂/year (50.27% of regulated emissions), exceeding the London Plan target for a new build development by 10%.

A thorough consideration has been made of the energy technology options for the site to ensure the most appropriate energy strategy is implemented. This report provides an assessment of the issues under consideration, and has demonstrated that the London Borough of Camden's energy policies are generally met or exceeded.



3. OVERVIEW

3.1. Objective

The purpose of this energy strategy is to demonstrate that energy consumption and climate change mitigation measures have been fully considered and appropriately selected and specified as part of the building's design.

In accordance with the guidance note 'Guidance on Planning Energy Assessments' after establishing the baseline energy demand and profile for the site, the strategy for the project follows the Mayor's Energy Hierarchy (Use Less Energy - 'Be Lean', Supply Energy Efficiently - 'Be Clean' and Use Renewable Energy - 'Be Green') in appraising appropriate measures to reduce carbon emissions and other climate impacts from the development.

The following sections provide more details on each of the steps of the Energy Strategy following the London Plan's Energy Hierarchy.²

3.2. General Methodology

The Guidance Note provides further detail on addressing the London Plan's energy hierarchy through the provision of an energy assessment to accompany strategic planning applications. Importantly, the Guidance Note acknowledges its requirements should be adapted for different scales of development.

The Guidance Note has been used to structure the appraisal and reporting of energy strategies for this Energy Statement.

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 $^{^2\,}$ All analysis in this document adopts the Building Regulations Part L 2010 CO_2 fuel factors.



4. BASELINE ENERGY ASSESSMENT

4.1. Objective

Before energy efficiency measures are investigated, it is important to establish the baseline energy consumption of the scheme, for comparison and evaluation of energy proposals.

4.2. Scope

For energy assessments being undertaken under the London Plan, the appropriate baseline case against which to assess potential carbon savings is a new development designed to conform to the current Building Regulations Part L (2010³); effectively the 'do minimum' case. This baseline case represents a typical building arrangement; where electricity for the development is imported from the grid and space and heating water are provided by standard mains gas-fired boilers.

All energy uses, and not just the conventional building services loads (lighting, heating, cooling and ventilation) and energy loads associated with the function of the site should be considered in the establishment of the energy profile, and especially in the selection of a building services strategy and any renewable energy technology.

The following 'regulated' energy uses are considered in the baseline energy analysis:

- Space Heating/Cooling
- Water Heating
- Ventilation
- Fans, Pumps and Controls
- Lighting (internal)

The regulated energy uses can be established using the robust and well-established calculation methodology of Part L of the Building Regulations Part L 2010 (SAP, SBEM and DSM via the NCM)⁴.

4.3. Site Energy Use Estimation

Site energy emissions and consumption figures are based on the data from the sample residential SAP calculations and the business units SBEM.

The data output from the SAP and SBEM is then calculated pro-rata on a square meter basis for the site to give a planning stage estimation of the energy consumption and emissions used within this report.

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 $^{^3}$ 2010 regulations to be adhered to as per the GLA guidance for applications made prior to 06 July 2014

⁴ Standard Assessment Procedure (SAP), Simplified Building Energy Model (SBEM), Dynamic Simulation Modelling (DSM), National Calculation Method (NCM)

5. BE LEAN

5.1. Objective

The first step in pursuing energy efficient and low-carbon design under the energy Hierarchy is to minimise the development's energy demand. This is achieved both by passive measures and the introduction of more energy efficient plant and services. Any measures implemented at this stage will reduce the extent of measures or size of plant needed to address the subsequent 'be clean' and 'be green' stages.

5.2. Scope

The building services strategy has been developed in response to the following drivers for the project:

maximising the potential of the building to satisfy market expectations (balancing of scope of works with value to create the optimal specification) achieving environmental comfort condition and occupant wellbeing and avoiding unnecessary costs of construction

5.3. Methodology

In establishing the proposed energy strategy and servicing strategy for the development, the requirement to minimise energy consumption through improved building fabric and building services measures has been considered a priority.

As part of this assessment the London Plan's 'Cooling Hierarchy' has been considered in the design process, to reduce where possible the extent and installed capacity of cooling plant.

- Passive strategies and measures that have been considered include:
- Improving building (thermal and air leakage) performance.
- Use of thermal mass.
- Use of natural daylighting



5.4. Key Assumptions - Building Services Strategy for the 'Be Lean' Assessment

THERMAL ELEMENTS

The proposed new building's fabric elements shall be in compliance with the Approved Building Regulations Part L1A 2013.

The proposed 'U' values for 101 Camley Street are as below:

Element	Design U-Values (W/m ² K)
External Walls	0.20
Roof	0.16
Floor	0.2
Windows & Doors	1.4

Table 7: Design U-Values

A design air permeability rate has been set at $5 \text{ m}^3/\text{m}^2/\text{hr}$ at 50Pa.

HEATING

The residential units will primarily utilise a communal heating system that combines a lead CHP unit and with sequenced high efficiency gas fired boilers that are to be centrally located. This system will serve all dwellings with space heating utilising underfloor or radiant emitters. It will also serve the domestic hot water demand and part of the electricity usage.

DOMESTIC HOT WATER SERVICES

The hot water generation shall be supplied by the same CHP system that serves the building heating systems. Provisionally heat interface units within the dwellings will transfer the main system heat to provide localised DHW without the need for storage.

COMFORT COOLING

The demand for comfort cooling has been minimised by means of minimising heat gains to the space. This has been achieved by a combination of design considerations. These considerations are such as controlled ventilation and mechanical heat recovery systems with summer bypass and boost, improved performance of the building fabric and high performance glazed elements, openable windows, natural shading from structure, low energy lighting, etc.

No mechanical cooling is to be provided to the units. The Penthouses will have a provision for option to install a comfort cooling system post completion should the future purchasers require it.

ARTIFICIAL LIGHTING

The provision of natural daylight is considered an important factor in the design in order to minimise the use of artificial light within the building. Floors from ground level upward have access to natural light with high specification glazing being specified to maximise day lighting

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levels and minimise associated heat loss. High efficiency lamps will be considered in conjunction with the client's preferences and facilities for automatic switching and dimming systems shall also be incorporated where possible.

Building Energy Management System

The energy throughout the site will be sub-metered for both heating and electricity on a per apartment basis. The metering will provide both historic and live energy use information to the end user and record the same centrally for consumption evaluation.

A dedicated BEMS will be provided for all Landlords areas and plant and will ensure all plant can be operated more efficiently by monitoring and optimising the plant to suit the building profiles and demands. All plant will be selected to suit the energy strategy and include inverter drives for pumps, fans and motors generally. Live and historic energy use can be collated at a central point for consumption evaluation by the Landlord.

SUSTAINABLE CONSIDERATIONS

The 101 Camley Street, London development incorporates rainwater harvesting to minimise mains water consumption. Rainwater shall be collected at the various roof levels and sufficient volume stored for garden irrigations.

	Carbon dioxide emis	Carbon dioxide emissions after 'Be Lean' Demand Reduction	
	(Tonnes CO2 per annum)		
	Regulated	Unregulated ⁵	
Baseline: Part L 2010 of the Building Regulations Compliant Development	838.29	377.23	
After energy demand reduction	738.80	332.46	

The 'Be Lean' demand reduction results in an **11.87%** reduction in regulated carbon emissions.

⁵ Unregulated Energy has been accounted for and is estimated as 40% for commercial spaces and 50% for residential spaces of the total regulated energy. As both space types are nearly equal in energy demand an average of 45% unregulated energy for the Target and 35% has been used after the demand reduction step.



6. BE CLEAN

6.1. Objective

The next step in the Energy Hierarchy, 'be clean', is to investigate the options for the efficient supply of energy to the development. This stage follows the incorporation of all practicable energy efficiency measures.

6.2. Scope

Potential approaches include connecting the scheme to existing CHP-led district energy networks, or if no existing schemes exist investigating whether such networks are planned in the area and designing systems with the flexibility to connect to these in the future. Opportunities to provide a communal heating system across buildings/uses within a multiple building scheme should also be pursued.

With or without a communal system, the feasibility of CHP (combined heat and power), including the provision of cooling using the CHP waste heat should be reviewed.

6.3. Review

The site is located a short distance from the Kings Cross Energy centre, an existing district heat network, on the opposite side of the Canal and main rail lines.

Enquiries were made at an early stage to Kings Cross energy centre for a supply to meet the proposed loads of the Development. Following discussions with their Technical team they advised that they did not consider it to be a feasible option due to the location of the development which is adjacent to the canal and network rail property and the required loads.

Further enquiries have been made with London Borough of Camden and they have advised that they are potentially providing a district heat network centre at Phoenix Court as part of their Phase 3 works. The current date for the construction of this centre is 2017-18. An allowance will be made for further review with the London Borough of Camden during the detailed design phase for possible future connection to their proposed Phoenix Court network due to be constructed in 2017-18.

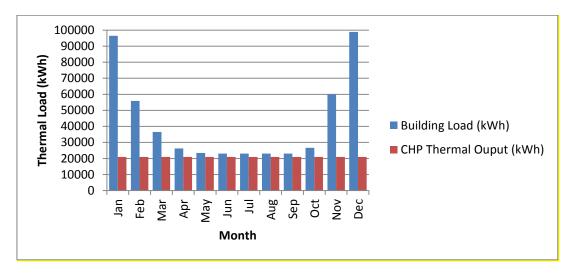
Due to the time scales involved in the development and London Borough of Camden proposed dates for the Phoenix Court project it is unlikely a district heating network connection is viable. On this basis we have proceeded to evaluate the installation of a Combined Heat and Power unit for the site.

The mixed nature of the 101 Camley Street development lends itself to CHP as a consistent year round heat load (ensuring the plant runs at its optimal efficiency) exists. The domestic hot water demand of the building provides a good base load for the operation of the CHP, with the additional benefit of the electricity generated by the CHP being consumed on site for general power usage throughout.

The communal heating system serving the residential spaces via heat interface units will be extended to serve commercial units and communal spaces, providing all zones with the opportunity to benefit from carbon efficient heat. This should ensure a thermal load is provided for the CHP by the residential and business units during the day and an increased residential load in the evenings.



In order to do an initial selection for the CHP the likely full load running hours for the CHP must be established to optimise energy efficiency and ensure excess heat or electricity generation is avoided. Based on this it is assumed the CHP will run at the rated output for approximately 14 hours a day for 300 days per year, this allows down time for maintenance etc. this equates to be approximately 4200 hours per year⁶.



Indicative monthly thermal load for the CHP

Based on the criteria above a $60kW_{th}$ has been selected at this stage. This selection is based solely on the data produced by the SAP calculations carried out at this stage rather than a full energy assessment of the development and as such the size of the CHP unit is subject to change at detailed design stage when a more detailed analysis would typically be carried out.

Calculations using the Designbuilder and SAP software show that by providing a gas fired CHP meeting 60% of the total annual heat and domestic hot water demand results in a **20.28%** reduction in regulated carbon emissions.

To meet the remaining thermal load high efficiency gas boilers will be specified. Any plant specified will be compliant with the Clean Air Act and local air quality requirements. The main heating plant is to be located on the lower ground floor (see KSR drawing No. CML101_P1) and will be naturally ventilated to atmosphere via louvres at ground floor level. The flues have been route to terminate at roof level.

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⁶ Running hour may be adjusted during detailed design stages



	Carbon dioxide emissions after 'Be Clean' CHP (Tonnes CO2 per annum)		
	Regulated	Unregulated ⁷	
Baseline: Part L 2010 of the Building Regulations Compliant Development	838.29	377.23	
After energy demand reduction	738.80	332.46	
After CHP	501.71	332.46	

⁷ Unregulated Energy has been accounted for and is estimated as 40% for commercial spaces and 50% for residential spaces of the total regulated energy. As both space types are nearly equal in energy demand an average of 45% unregulated energy for the Target and 35% has been used after the demand reduction step.



7. BE GREEN - INCORPORATION OF RENEWABLE TECHNOLOGIES

7.1. Objective

The third and final stage of the energy hierarchy is to 'be green'. The potential of a range of renewable energy systems that can contribute on-site generation to serve the energy requirements of the site, and thereby further reductions in CO_2 emissions for the proposed development.

7.2. Methodology

This assessment has been undertaken using the methods laid out in the London Energy Partnership's 'integrating renewable energy into new developments: Toolkit for planners, developers and consultants' - the 'Renewables Toolkit'

7.3. Scope

The following renewable energy technologies have been considered for application at the site as they are identified in the London Plan as being potentially technically feasible for projects in London.

- Ground Source Heat Pump
- Air Source Heat Pump
- Solar Thermal Water Heating
- Photovoltaics
- Wind Turbines
- Biomass

7.4. ON-SITE RENEWABLE ENERGY ASSESSMENT

A number of technologies were appraised in terms of technical, physical and financial feasibility, as potential low carbon system for use on the project.

7.4.1. Ground source heat pumps



illustrative images only

Heat pumps use refrigerant gases and an electrical compressor to take heat from a source and deliver it to an output. In this way they can be used to supply heating or cooling to a building. The ground acts as a huge solar collector and thermal store, which dampens fluctuations in ground temperature. The fluctuations reduce with depth and stabilise at the annual mean by about 12m below the surface; for the UK this is in the range 9–12°C.

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Ground source heat pumps can make use of heat stored in the ground and raise it to a more useful temperature of around 40-50°C. It should be noted that at these temperatures, the heat produced is only useful for low temperature applications such as under floor heating installations; otherwise, a degree of top-up by conventional means is required when used for generating domestic hot water for example.

Ground source heat pumps can also be used to provide cooling by reverse cycle and transferring rejected heat from the building back into the ground. The heat transferred back into the ground is then stored in thermal banks and can be used later in the year when there is a need for heating again.

The viability of such a system and therefore costs rely almost entirely on the sub-structure build-up, the adjacency and restrictions on sub-structural service distributions and transport systems and the structural interface required to achieve thermal piles below the building.

From the evaluation it shows that the site may have the potential for ground source geothermal heat exchange and storage below the new basement levels of the proposed development due to the building having piled foundations. Based on this a closed loop system could be provided to release heat into the ground as well as draw heat from it depending on the requirements of the building subject to a detailed ground condition survey that would be carried out at the detailed design phase.



7.4.2. Air Source Heat Pumps

Air source heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however the initial heat energy is extracted from the external air rather than the ground. These heat pumps can be reversed to provide cooling to an area although this reduces the coefficient of performance of the pumps.

The heat pump connects multiple inside units with a single outside unit. The latter resembles a comfort cooling condenser unit and care must be taken to locate the unit where any noise generation is not obtrusive and the location should ensure the unit is not visually obtrusive.

Air source heat pumps are not considered to be well suited for a multi residential building such as this and with the use of communal heating via CHP this technology is not considered to be viable.

Illustrative images only



7.4.3. Solar Water Heating



Illustrative images only

The hot water load for the development is very high due to the density of occupation and although there is useable space at 11th & 8th floor roof level to accommodate the panels, the building domestic hot water demand is already met by CHP system following the assessment carried out for step 2 of the Hierarchy. Solar hot water heating therefore will not be progressed further.

7.4.4. Photovoltaics



Illustrative images only

Photovoltaic panels (PV) provide clean silent electricity and generate green power during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

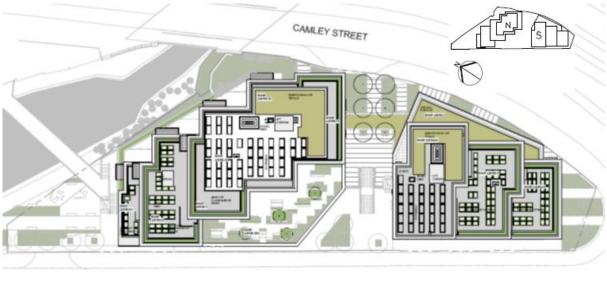
PV panels typically have an electrical warranty of 20 - 25 years and are eligible for the Government's Feed in Tariff (FITS) incentive scheme for the 25 years after the installation.

There is 350m² of space to accommodate PV panels including associated clearances at 11th & 8th floor roof level as shown on the image below, an array of panels is proposed and will add to the electricity produced by the CHP unit and again minimize grid supplied power reliance. In total this equates to a PV installation of approximately 25kW peak. It is assumed that this system will be southeast facing and mounted at a 30 degrees inclination.

Any remaining area not utilised by a PV array could be utilised for extending the proposed green roof.

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GRANARY STREET

Plan showing available area for PV Panels at 11th & 8th Floor Roof Level

7.4.5. Wind turbines



Illustrative images only

Wind power can be used to generate electricity either in parallel with mains supplies or as standalone solutions using battery back-up.

In order to generate worthwhile quantities of electricity, average wind speeds of between 5-6 m/s are necessary (the UK government is currently advising 5.5-6.0m/s as the threshold). However Government wind speed database predicts local wind speed at 101 Camley Street, London to be 4.6 m/s at 10 m above ground level and 4.9 m/s at 25 m above ground level thus rendering the option unviable.



7.4.6. Biomass boilers



Illustrative images only

Energy from biomass is produced by burning organic matter. Organic matter is harvested and processed to create bio-energy which can take the form of liquid or solid fuels.

Although biomass is carbon-based (and hence generates carbon emissions), the carbon that is released during combustion is equal to that carbon that was absorbed during growth and so the fuel is classed as carbon neutral (the fuel generally requires treatment and transport, with associated carbon emissions however, but these effects will be ignored here).

Deliveries of fuel for a communal biomass boiler would be considered unacceptable, suitable space for fuel storage would also prove impractical therefore this shall not be considered further.



7.4.7. Summary of Renewable Energy Feasibility

Technology	Feasible For This Site	Reason	
Photovoltaics YES		Proposed at roof level to reduce site reliance on grid supplied electricity. Approx 25kW peak array.	
Solar Water No		Dismissed since load already supplied by CHP.	
Ground source heat pumps	YES	Ground Loops or Bore holes may be accommodated	
Air Source heat pumps	No	Enough space to accommodate Air source heat pump out door unit (condenser), however not necessary as CHP can accommodate heating load more efficiently.	
Wind Generators	No	Insufficient wind speeds and turbulence at site.	
Biomass Boilers	No	Regular fuel deliveries would be unacceptable and require unavailable fuel storage space.	



Carbon dioxide emissions after 'Be Green' Renewables

(Tonnes CO2 per annum)

	Regulated	Unregulated ⁸
Baseline: Part L 2010 of the Building Regulations Compliant Development	838.29	377.23
After energy demand reduction	738.80	332.46
After CHP	501.71	332.46
After renewable energy	416.91	332.46

From the 'Be Green' step the result is a **10.12%** reduction in regulated carbon emissions.

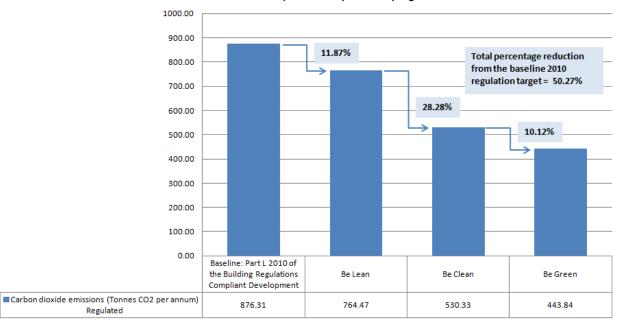
⁸ Unregulated Energy has been accounted for and is estimated as 40% for commercial spaces and 50% for residential spaces of the total regulated energy. As both space types are nearly equal in energy demand an average of 45% unregulated energy for the Target and 35% has been used after the demand reduction step.



8. CONCLUSIONS

This report demonstrates how the London plan methodology has been followed and that the three key steps have been taken allowing a reduction of 50.27% over the targeted Part L 2010 Building Regulations CO_2 emissions rate.

Graph and Tables



Carbon dioxide emissions (Tonnes CO2 per annum) Regulated

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

	Carbon dioxide emis	sions	
	(Tonnes CO2 per anr	num)	
	Regulated	Unregulated ⁹	
Baseline: Part L 2010 of the Building Regulations Compliant Development	838.29	377.23	
After energy demand reduction	738.80	332.46	
After CHP	501.71	332.46	
After renewable energy	416.91	332.46	

⁹ Unregulated Energy has been accounted for and is estimated as 40% for commercial spaces and 50% for residential spaces of the total regulated energy. As both space types are nearly equal in energy demand an average of 45% unregulated energy for the Target and 35% has been used after the demand reduction step.



Table 2: Regulated carbon dioxide savings from each stage of the Energy Hierarchy

	Regulated Carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Savings from energy demand reduction	99.49	11.87%
Savings from CHP	237.09	28.28%
Savings from renewable energy	84.80	10.12%
Total Cumulative Savings	421.38	50.27%
Total Target Savings	335.32	40%
Annual Surplus	86.07	10%



APPENDIX A

Energy Strategy - Calculations and Assumptions



The proposed heating, domestic hot water systems and efficient lighting in conjunction with various low and zero-carbon renewable energy systems have been considered and adopted or dismissed as detailed herein. This proposed building has been specifically assessed in terms of predicted carbon emissions using approved FSAP Software.

The key low carbon technologies deemed as the most viable option for the proposed development is the use of a Combined Heat and Power (CHP) Loads is to be as follows;

- CHP unit sized for approximately 60% of the estimated heating and domestic hot water requirement.
- CHP on site electricity generation is provided in addition to heat output therefore reducing grid electricity reliance.

To further minimise the entire site reliance on grid supplied electricity a suitably sized array of photovoltaic cells will also be installed at roof level serving the commercial and residential units and common parts.



The SAP calculations have been completed for each dwelling layout variation and the average results prepared to determine the energy consumption and CO₂ emission with the new building.

Tables 1 to 3 shows that the results of the Average SAP calculations proposed Dwelling Emission Rate (DER) is considerably lower than both that of the Building Regulations minimum required Target Emissions Rate (TER) and the 40% improvement required.

Core A	
ASSESSMENT	CO ₂ (Kg/m ² /year)
Average Dwelling TER	16.35
TER +40% Improvement	9.81
Average Dwelling DER	8.33

Table 1: Predicted Annual CO₂ Emissions against Limits (average for Core A)

Core B	
ASSESSMENT	CO ₂ (Kg/m ² /year)
Average Dwelling TER	16.38
TER +40% Improvement	9.83
Average Dwelling DER	8.48

Table 2: Predicted Annual CO₂ Emissions against Limits (average for Core B)

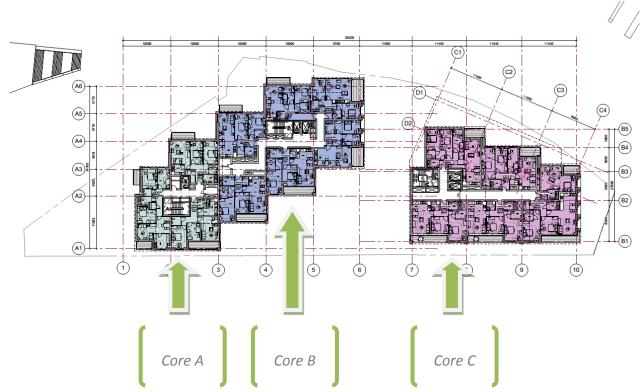
Core C	
ASSESSMENT	CO₂ (Kg/m²/year)
Average Dwelling TER	15.84
TER +40% Improvement	9.50
Average Dwelling DER	7.73

Table 3: Predicted Annual CO₂ Emissions against Limits (average for Core C)



This proposed redevelopment at 101 Camley Street, London is therefore expected to reduce its carbon (CO₂) emissions by **49.05% (Core A)**, **48.23% (Core B)** and **51.20% (Core C)** in accordance with planning policy guidance over Part L 2010 Building Regulations required minimum standards.¹⁰.

The CO_2 compliance has been sub divided into each individual Blocks that correspond to the construction cores of the residential building. This has allowed a more detailed review and a full assessment of all flat layouts.



The non-residential units that are located below the residential cores A, B and C have been analysed using the government approved software Simplified Building Energy Model (SBEM) and as required by planning policy guidance with the same methodology applied as for the residential elements the commercial units also achieve over a 40% reduction in CO_2 emission from the 2010 Part L baseline. Below is the criterion 1 table that shows the reduction estimated within the SBEM¹¹:

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.9
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.9
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	6.9
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

¹⁰ It should also be noted that with weighted averages considering all flats that are not within this sample set the reduction is increased further.

¹¹ Also see Appendix F for the full BRUKL data output.



The baseline energy demand for a notional residential building has been established within FSAP and used for the building regulation compliance checks;

The energy consumption benchmarks used in the assessment shows in the table below:

Benchmark data / (kWh per annum)					
Building Type	Heating	Hot Water	Cooling	Electricity (power)	Electricity (lighting)
Average Dwelling	4598	3610	0	175	570

Table 6: Benchmark Data

From the Notional calculations the total estimated CO₂ level is estimated as 9323.59 kgCO₂/year

The Carbon emissions factors used in the assessment shows in the table below:

Fuel	Carbon Factors /(Kg/kWh)
Natural Gas	0.198
Electricity	0.517
Electricity Displaced	0.529

Table 6a: Carbon Factors



APPENDIX B

Residential Compliance Sheets



	User	Details		
Assessor Name: Software Name:	Stroma FSAP	Stroma Number Software Versio		n: 1.5.0.78
	Calculati	on Details		
Dwelling		DER	TER	TFA
UNIT A002_2B4P		8.65	18.15	73.4
UNIT A003_2B3P		10.68	19.28	69.3
UNIT A101_4B5P		6.91	14.97	86.6
UNIT A102_3B5P		8.65	15.25	86.4
UNIT A103_2B4P		8.68	15.22	72.7
UNIT A104_2B4P		6.75	15.09	73.4
UNIT A501_2B4P		8.57	15.8	80.7
UNIT A502_3B5P		7.34	15.3	86.8
UNIT B001_2B4P		10.34	18.31	72.7
UNIT B002_2B4P		10.05	18.09	72
UNIT B003_S		11.66	24.16	38.9
UNIT B1-B32_1B2P		7.76	17.93	54.7
UNIT B102_2B4P		6.62	14.65	78.4
UNIT B103_2B3P		7.41	14.98	72
UNIT B105_S		9.2	20.84	38.9
UNIT B106_1B2P		7.61	18.33	52.7
UNIT B107_1B2P		7.16	15.87	56.5
UNIT B605_2B3P		8.33	16.47	62.6
UNIT B607_3B5P		7.86	15.06	89.6
UNIT B801_3B5P		7.93	14.85	86
UNIT B802_3B5P		7.4	15.53	86
UNIT B1101_4B6P		9.17	15.09	265.3
UNIT C101_385P		7.73	14.5	93.9
UNIT C102_2B4P		7.05	15.54	81.3
UNIT C103_385P		6.75	13.89	87
UNIT C104_2B4P		6.45	14.41	82.5

Block Compliance WorkSheet: Be Green_All Blocks

Stroma FSAP 2009 Version: 1.5.0.78 (SAP 9.90) - http://www.stroma.com

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Dwelling	DER	TER	TFA
UNIT C105_1B2P	8.36	18.48	49.8
UNIT C106_2B4P	6.94	15.17	80
UNIT C403_3B5P	7.4	15.24	87
UNIT C404_2B4P	7.12	15.41	81.5
UNIT C701_3B5P	8.06	15.4	93.9
UNIT C702_284P	7.64	16.63	80.3
UNIT C801_3B5P	9.92	17.71	93.9
UNIT C802 2B4P	9.31	18.92	80.3

Block Compliance WorkSheet: Be Green_All BlocksCont...

Calculation Summary

Total Floor Area	2747.00
Average TER	16.11
Average DER	8.15
Compliance	Pass
% Improvement	49.41

Stroma FSAP 2009 Version: 1.5.0.78 (SAP 9.90) - http://www.stroma.com

Page 2 of 2



APPENDIX C

SAP and DER Worksheets for dwellings (typical)

Attached seperately

APPENDIX D

Code for Sustainable Homes Report (typical)

Attached seperately



Code for Sustainable Homes Report

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ctual Case CO2 emissions 27.95 ctual DER 7.61 eduction in CO2 emissions 27.1 redits awarded for Ene 7 = 2 23 April 2009 on the promotion of the use of energy from renewable sources and meet all other ancillary regainments as defined by Directive 2009/28/EC regions chrologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and ementing and subsequently repairments as defined by Directive 2009/28/EC and 2003/30/E a following requirements must also be met: where not provided by accordiate determal renewables there must be a direct supply of energy produced to the dwelling under assessment. where covered by the Microgeneration Certification Scheme (MCS), bechnologies under 50kWe or 300kWith must be certified.	tual Case CO2 emissions 27.95	Standard Case CO2 emissions		38.34	
ctual DER 7.61 eduction in CO2 emissions 27.1 redits awarded for Ene 7 = 2 27.1 chrologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC represen Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amenting and subsequently repealing Directives 2001/77/EC and 2003/08/E e following requirements must also be met: where not provided by accordiate enternation Certification Scheme (MCS), bechnologies under 50kWe or 300kWh must be certified.		Standard DER		18	
eduction in CO2 emissions 27.1 redits awarded for Ene 7 = 2 choologies eights to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other anciliary requirements as defined by Directive 2009/28/EC respen Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/E a following requirements must also be met: Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment. Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300KWth must be certified.	12 DER 7.51	Actual Case CO2 emissions		27.95	
redits awarded for Ene 7 = 2 chrologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancitary requirements as defined by Directive 2009/28/EC ropean Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/E e following requirements must also be met: Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment. Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.		Actual DER		7.61	
chrologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC i ropean Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/E a following requirements must also be met: Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment. Where covered by the Microgeneration Certification Scheme (MCS), technologies under S0KWE or 300KWIh must be certified.	duction in CO2 emissions 27.1	Reduction in CO2 emissions	27.1		
ropean Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/E a following requirements must also be met: Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment. Where covered by the Microgeneration Certification Scheme (MCS), technologies under S0KWE or 300KWIh must be certified.		Credits awarded for Ene 7 = 2			
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Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.		he following requirements must also be met:			
	are not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.	Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.			
AND A REAL PROPERTY AND A REAL PROPERTY AND A REAL PROPERTY AND A REAL PROPERTY.		Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified. Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.			

CHP schemes faulted by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA. It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

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DER WorkSheet: New dwelling design stage

		User Details:				
Assessor Name: Software Name:	Stroma FSAP 2009	Stroma Nu Software N	/ersion:	Versior	n: 1.5.0.78	
		Property Address: UNI	T B106_1B2P			
Address :						
1. Overall dwelling dim	ensions:	2 2 2 2				
C		Area(m ²)	Ave Height(m		Volume(m	-
Ground floor		52.7 (1a)	× 2.5	(2a) =	147.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 52.7 (4)				
Dwelling volume		(3a)+	+(3b)+(3c)+(3d)+(3e)+	(3n) =	147.55	(5)
2. Ventilation rate:						
	main Second heating heating		total		m ³ per hou	ır
Number of chimneys		+ 0 -		40 -	0	(6a)
Number of open flues			· · · ·	20 -	0	(6b)
Number of intermittent f	ans		· · ·	10 -	0	(7a)
Number of passive vent				10 - L	_	(76)
and the second se				40 -	0	-
Number of flueless gas	nres		a		o anges per ho	(7c)
Infiltration due to chimn	eys, flues and fans = (6a)+(6b)+	(7a)+(7b)+(7c) =		+ (5) ~	0	(0)
	been carried out or is intended, proce		e from (9) to (16)			_
Number of storeys in	the dwelling (ns)			[0	(9)
Additional infiltration			and a state of the)-1]x0.1 =	0	(10)
	0.25 for steel or timber frame			L	0	(11)
If both types of wail are deducting areas of open	present, use the value corresponding lings); if equal user 0.35	to the greater wall area (afte	r			
If suspended wooden	floor, enter 0.2 (unsealed) or	0.1 (sealed), else enter	0	Γ	0	(12)
If no draught lobby, e	nter 0.05, else enter 0			Č	0	(13)
Percentage of window	vs 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) =	E	0	(10)
	, q50, expressed in cubic met		e metre of envelop	e area	5	(17)
	ility value, then (10) = [(17) + 20]-			[0.25	(10)
	les if a pressurisation test has been d	one or a degree air permeab	llity is being used		-	-
Number of sides on whi Shelter factor	ch sheltered	(20) = 1 - 10.075	x (194 =	-	2	(19)
		(21) = (16) x (20	Contraction of	F	0.85	=
	ating shelter factor				0.21	124
nfiltration rate incorpora				21.77		(21)
nfiltration rate incorpora nfiltration rate modified	for monthly wind speed		an Oct Nov	Dec	9	(21)
nfiltration rate incorpora Infiltration rate modified Jan Feb	for monthly wind speed Mar Apr May Jun		ep Oct Nov	Dec		(21)
Infiltration rate incorpora Infiltration rate modified Jan Feb Monthly average wind s	for monthly wind speed Mar Apr May Jun peed from Table 7	Jul Aug Se				{21)
Infiltration rate incorpora Infiltration rate modified Jan Feb Monthly average wind s	for monthly wind speed Mar Apr May Jun			Dec 5.1		(21)
Infiltration rate incorpora Infiltration rate modified Jan Feb Monthly average wind s	for monthly wind speed Mar Apr May Jun peed from Table 7 5.1 4.5 4.1 3.9	Jul Aug Se			- 17 18 18 18	(21)

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DER WorkSheet: New dwelling design stage

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	d infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m	
If mechanical ventilation: 0.5 If the and purp using Appendix N, (22b) + (23a) × Fmv (equation (N5)), otherwise (23a) 0.5 If balanced mechanical ventilation with heat recovery (MV/HR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 77.35 24sym 0.4 0.3 <t< td=""><td></td><td></td></t<>		
If exhaust at heat pump using Ageendik N, (23b) * Fmv (equation (N5)), otherwise (23b) * (23a) 0.3 If balanced mechanical vertiliation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 77.3c a) If balanced mechanical vertiliation without heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 77.3c b) If balanced mechanical vertiliation without heat recovery (MV) (24b)m = (22b)m + (23b) (1 - (23c) + 100] 20mm 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(23
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4ft) = T7.3 a) If balanced mechanical ventilation with heat recovery (MV/R) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 24am 0 <td>which have been provided the second to M (23b) a (23b) a feature (MB), alternative (23b) a (23b)</td> <td>=</td>	which have been provided the second to M (23b) a (23b) a feature (MB), alternative (23b) a (23b)	=
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 24aym 0.4 0.30 0.30 0.33 0.32 0.31 0.31 0.34 0.35 0.37 0.30 b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) 24aym 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(23
24am 0.4 0.38 0.35 0.33 0.32 0.31 0.31 0.34 0.35 0.37 0.38 b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) 0 </td <td>1135</td> <td>(23</td>	1135	(23
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) 24bm 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(24
2abim 0 <td></td> <td>(24</td>		(24
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) 24cim 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		10.0
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)		(24
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		
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)m ² x 0.5] 24dpm 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		174
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m ² x 0.5] (24d)m 0		(24
24dgm 0 <td></td> <td></td>		
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) (23) For (24, 0, 30, 0, 30, 0, 30, 0, 31, 0, 31, 0, 31, 0, 34, 0, 35, 0, 37, 0, 36 31 for (05555) area neither ELEMENT Gross area (m?) 0 penings Net Area m? 0, 10, 0, 10, 0, 10, 0, 10, 0, 10, 0, 10, 0, 10, 0, 10, 0, 10, 0, 10, 1		(24
Interval 0.4 0.30 0.35 0.33 0.31 0.31 0.34 0.35 0.37 0.30 3.1 Construction losses and to the loss commenter: Image: Construction losses and losses commenter: Image: Construction lose losses construct		
3. Hind losses au (1 m) (loss term neter) ELEMENT Gross area (m) Openings Net Area (m) Walke Window: A X U (W) (K) (K) (K) (K) (K) (K) (K) (K) (K) (K		(25
ELEMENT Gross area (m ²) Openings Net Area A,m ² U-value Wm2K A X U (W/K) k-value kJ/m ² -K A X kJ/K Windows Type 1 7.04 $x^{1/1/(1.4)+0.04)}$ 9.33 $x^{1/1/(1.4)+0.04)}$ 9.33 Walls Type 1 20 9.9 $x^{1/1/(1.4)+0.04)}$ 9.33 $x^{1/1/(1.4)+0.04)}$ 9.33 Walls Type 2 22.4 9.9 12.5 $x^{-0.2}$ 4.19 4.19 Walls Type 2 22.4 9.9 12.5 $x^{-0.2}$ 2.5 $$		100
area (m²)m²A, m²W/m2K(W/K)kJ/m²-KkJ/KWindows Type 17.04 $x1/1/(1.4) + 0.041 + 0.041 + 0.331 + 0.041 + 13.12$ 9.9 $x1/1/(1.4) + 0.041 + 13.12$ Walls Type 222.49.912.5 x 0.2 4.19 Party wall47.6 x 0 0 0 Party wall47.6 x 0 0 0 Party oeiling 9.7 0.4 0.2 0.4 0.2 * include the areas on both sides of internal walls and partitions $1/(1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/$	losses aud heat loss para neter:	
area (m?)m²A, m²W/m2K(W/K)k.J/m²-Kk.J/m²-KWindows Type 17.04 $x^{1/11}(1,1,4) + 0.041 + 0.341 + 0.041 + 0.341 + 0.041 + 0.312Walls Type 1267.0420.96x0.24.19Walls Type 222.40.912.5x0.24.19Walls Type 222.40.912.5x0.24.19Party wall47.6x00Party wall47.6x00Party foor02.702.702.7Party ceiling02.702.7** include the areas on both sides of internal wals and partitionsFabric heat loss, W/K = S (A x U)(20)(30) + (32) 29.15Heat capacity Cm = S(A x k)(20)(30) + (32) + (32n)(32e) 5109.44Thermal mass parameter (TMP = Cm + TFA) in k.J/m²Kindicative values of TMP in Table 17are bus divide instead of a details of the construction are not known precisely the indicative values of TMP in Table 17Total fabric heat loss(33) + (36) 36.71Ventilation heat loss calculated monthly(33) + (36) 36.71Ventilation heat loss calculated monthly(30) = 0.33 \times (25) m \times (5)JanFebMarAprMayJunJunJunJunJunAugSepOctNovDec36.71Heat transfer coefficient, W/K(39) = $	NT Gross Openings Net Area U-value AXU k-value A	Xk
Number of the construction are not known precisely the indicative values of TMP in Table 17Windows Type 22.49.912.5 x 0.24.19Walls Type 22.2.49.912.5 x 0.22.5Total area of elements, m ² 90.4 x 0 0 0 Party wall47.6 x 0 0 0 Party oeiling92.7 0 0 0 Party ceiling92.7 0 0 0 Heat capacity Cm = S(A x k) $(20)(30) + (32) + (32) and (32) + (32) - (32)(320) + (32) + (32) - (32)(320) + (32) + (32) - (32)(320) + (32) + (32) - (32) - (32) - (32) + (32) - (32) - (32) - (32) + (32) - (32) $		/K
Walls Type1 20 7.04 20.96 \times 0.2 4.19 Walls Type2 22.4 9.9 12.5 \times 0.2 2.5 Total area of elements, m ² 90.4 0.2 2.5 0.2 2.5 Party wall 47.6 x 0 0 0 Party realing 52.7 0 0 0 ** include the areas on both sides of internal walks and partitions 52.7 0.20 0.20 ** include the areas on both sides of internal walks and partitions 52.7 0.20 0.20 ** include the areas on both sides of internal walks and partitions 22.7 28.15 28.15 Fabric heat loss, W/K = S (A x U) $(20)(30) + (32) =$ 28.15 5109.44 Heat capacity Cm = S(A x k) $((20)(30) + (32) + (32)(320) + (32) + (32)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (320)(320) + (32) + (32) + (320)(320) + (32) + (32) + (320) + (32) $	a Type 1 7.04 x1/[1/(1.4)+0.04] = 9.33	(27
Walls Type2 22.4 9.9 12.5 x 0.2 2.5 Total area of elements, m ² 90.4 90.4 90.4 90.4 Party wall 47.6 x 0 0 100.4 Party wall 47.6 x 0 0 100.4 Party floor 92.7 100.4 100.4 100.4 100.4 100.4 Party ceiling 52.7 100.4 <td< td=""><td>s Type 2 9.9 x1/(1/(1.4)+0.04) - 13.12</td><td>(27</td></td<>	s Type 2 9.9 x1/(1/(1.4)+0.04) - 13.12	(27
Total area of elements, m² 30.4 Party wall 47.6 x 0 0 Party floor 52.7 0 0 0 Party ceiling 32.7 0 0 0 * tor 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 walts and partitions Fabric heat loss, $W/K = S (A \times U)$ $(20)(30) + (32) +$ 29.15 Heat capacity Cm = S(A x k) $((20)(30) + (32) + (32) + (32a)(32e) =$ 5109.44 Thermal mass parameter (TMP = Cm + TFA) in kJ/m²K indicative Value: Medium 250 For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f 250 can be used instead of a detailed calculation. 7.56 Total fabric heat loss $(33) + (36) =$ 36.71 Total fabric heat loss calculated monthly $(30) = 0.15 \times (31)$ $(30) = 0.33 \times (25)m \times (5)$ (30)m* 19.40 10.71 17.10 10.12 15.09 10.30 17.10 10.12 (30)m* 19.40 10.71 10.12 <	pe1 26 7.04 20.96 × 0.2 - 4.19	(29
Total area of elements, m² 30.4 Party wall 47.6 x 0 0 Party floor 52.7 0 0 0 Party ceiling 92.7 0 0 0 * tor 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 waits and partitions Fabric heat loss, $W/K = S (A x U)$ $(20)(30) + (32) +$ 29.15 Heat capacity Cm = $S(A x k)$ $((20)(30) + (32) + (32)(32e) =$ 5109.44 Thermal mass parameter (TMP = Cm + TFA) in kJ/m²K indicative Value: Medium 250 For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f 250 can be used instead of a detailed calculation. 7.56 7.56 Total fabric heat loss $(33) + (36) =$ 36.71 Total fabric heat loss calculated monthly $(30) = 0.35 \times (31)$ 36.71 Total fabric heat loss calculated monthly $(30) = 0.33 \times (25)m \times (5)$ 36.71 (30)m* 19.46 10.71 10.12 15.09 15.09 16.36 17.16	/pe2 22.4 9.9 12.5 x 0.2 = 2.5	(29
Party floor 52.7 Party ceiling 52.7 * 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) (28)(30) + (32) = Heat capacity Cm = S(A x k) ((26)(30) + (32) + (32a)(32e) = Thermal mass parameter (TMP = Cm + TFA) in kJ/m²K Indicative Value: Medium 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 '' details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss (33) + (36) = (30)m = 19.48 18.71 (30)m = 19.48 18.71 (30)m = 19.49 19.49 Jun Jul Aug Sep Oct Nov Dec (30)m = 19.41 19.41 19.48 18.71 16.12 15.6 15.09 16.36 17.16 17.93 16.71 Heat transfer coefficient, W/K (39)m = (37) + (36)m (39)m = (37) + (36)m 16.36 17.16 <	ea of elements, m ²	(31
Party floor 52.7 Party ceiling 52.7 * 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) (28)(30) + (32) = Heat capacity Cm = S(A x k) ((26)(30) + (32) + (32a)(32e) = Thermal mass parameter (TMP = Cm + TFA) in kJ/m²K Indicative Value: Medium 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 '' details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss (33) + (36) = (30)m = 19.48 18.71 (30)m = 19.48 18.71 (30)m = 19.49 19.49 Jun Jul Aug Sep Oct Nov Dec (30)m = 19.41 19.41 19.48 18.71 16.12 15.6 15.09 16.36 17.16 17.93 16.71 Heat transfer coefficient, W/K (39)m = (37) + (36)m (39)m = (37) + (36)m 16.36 17.16 <		(32
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Heat capacity Cm = S(A x k) ((20)(30) + (32) + (32a)(32e) = 5109.44 Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² K Indicative Value: Medium 250 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 if details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss (33) + (36) = 36.71 Ventilation heat loss calculated monthly (35) m = 0.33 × (25) m x (5) <u>Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec</u> (36) m= 19.48 16.71 16.71 17.16 16.12 15.6 15.09 15.09 16.38 17.16 17.93 16.71 Heat transfer coefficient, W/K (39) m = (37) + (38)m		
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(38)m= 19.48 18.71 18.71 17.16 16.12 15.09 15.09 16.38 17.16 17.93 18.71 Heat transfer coefficient, W/K (39)m = (37) + (38)m	on heat loss calculated monthly (36)m = 0.33 × (25)m × (5)	
Heat transfer coefficient, W/K (39)m = (37) + (36)m	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
	19.48 15.71 15.71 17.16 16.12 15.6 15.09 15.09 16.38 17.16 17.93 15.71	(38
	nsfer coefficient, W/K (38)m = (37) + (38)m	
Average = Sum(39), p // 2= 53.89		(39



DER WorkSheet: New dwelling design stage

leat lo	ss para	meter (H	HLP), W/	m²K					(40)m	= (39)m +	(4)			
40)m=	1.07	1.05	1.05	1.02	1	0.99	0.98	0.98	1.01	1.02	1.04	1.05		
lumbo	v of day	e in mor	nth (Tabl	0.10)				11 - 12	,	Average -	Sum(40),	u /12=	1.02	(40
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m=	31	26	31	30	31	30	31	31	30	31	30	31		(41
												3348-3		
		10.00	rgy requi	rement								kWh/yea	HT:	
	A > 13.9			[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	013 x (1	TFA -13.		77		(42
	A£ 13.9	1.1		·										
								(25 x N) to achieve		e target o		23		(43
			person per											
1	Jan	Feb	Mar day for ea	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
		100000000												
4)m=	63.65	60.8	77.76	74.71	71.66	65.61	68.61	71.66	74.71	77.76	80.8	63.65		- 1
nergy c	content of	not water	used - cal	culated m	onthly = 4.	190 x Vd,	n x nm x t	Tm / 3600		and in case of the local division of the loc	m(44), u =	internet internet	914.77	(44
-m(2)	124.05	109.02	112.5	55.05	94.11	01.21	75.25	00.35	87.38	101.84	111.16	120.72		
	124.00	TUBLE			-		TURN			10000	m(45),		1202.20	(45
instant	aneous w	ater heatir	g at point	of use (n	hot water	ratorage),	enter 0 in	poxes (46)		OTTAL COM	MASH. S		14.04.4.0	-
-m(8	18.7	16.35	10.07	14.71	14.12	12.18	11.29	12.95	13.11	15.28	16.67	18.11		(4
later i	storage	loss:	1			1		110000			100000			
) If ma	anufactu	rer's de	clared lo	iss facto	or is know	wn (kWh	/day):					0		(4
empe	rature fa	actor fro	m Table	2b		Contraction of the	100			100		0		(4
nergy	lost from	m water	storage	, kWh/y	ear			(47) x (48)	-			0		(4
			ared cylin								_			
10.00		0.000) includir								1	10		(5
			l no tank in t water (thi					enter '0' In	bax (50)					
ot wa	ter stora	ge loss	factor fr	om Tab	le 2 (kW	h/litre/da	iv)				0	02		(5
	e factor i	1000			-22429-22020						1	03		(5)
			m Table	2b								.6		(5)
neray	lost fro	m water	storage	kWh/w	ear			((50) x (51) x (52) x ((53) =		03		(5
	49) or (5				0.000.1)							03		(5)
/ater	storage	loss cal	culated f	or each	month			((56)m = (55) × (41)r	m				
6)m=	32.01	28.92	32.01	30.98	32.01	30.95	32.01	32.01	30.98	32.01	30.98	32.01		(5
												m Appendix	н	17
7)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(5
		2 100	1002											
		10.00	nual) fro culated f			59)m = ((58) ÷ 3(65 × (41)	m		3	50		(5
(mod	dified by	factor fr	om Tabl	e H5 if t	there is a	solar wa	ter heati	ng and a	cylinder	r thermo	stat)			
9)m=	30.55	27.62	30.55	29.59	30.55	29.59	30.55	30.58	29.59	30.55	29.59	30.58		(5
ombi	loss cal	culated	for each	month	(61)m =	(60) ÷ 3	65 × (41)m						
								-			-			
1)m=	0	0	0	0	0	0	0	0	0	0	0	0		(6)



DER WorkSheet: New dwelling design stage

Total h	neat requ	uired for	water he	eating c	alculated	d for eac	h month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)n	n
(62)m=	167.24	165.55	175.09	155.65	156.7	141.78	137.04	148.94	147.96	164.43	171.74	183.31		(62)
Solar Di	HW Input o	alculated	using App	endix G o	Appendb	H (negati	ve quantit	y) (enter 1	0' if no sola	r contribut	lion to wate	er heating)		
add a	dditional	l lines if	FGHRS	and/or !	WWHRS	applies	, see Ap	pendix	G)					
63)m=	0	0	0	0	0.	0	0.	0	0	0	0	0		(63)
Output	t from wa	ater hea	ter											
(64)m=	187.24	165.55	175.09	158.65	156.7	141.78	137.64	148.94	147.96	164.43	171.74	163.31		
								Ou	tput from w	ater heate	r (annual)		1939.22	(64)
Heat g	ains from	m water	heating,	kWh/m	onth 0.2	5 x [0.85	5 × (45)n	n + (61)	m] + 0.8	x [(46)m	+ (57)m	n + (59)m	1	
(65)m=	91.52	01.40	87.48	81.07	61.36	75.46	75.09	78.78	77.51	83.93	85.42	90.21	1	(65)
inclu	de (57)	m in calo	culation	of (65)m	only if o	vlinder i	s in the	dwelling	or hot w	ater is f	rom com	munity h	eating	
1.111			a Table 5										-	
	Sec. 16	1.1.201	B 610-000		P									
vietab	Jan	Feb	5), Wat Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
-m(80	00.49	68.49	85.49	88.49	88.49	58.49	55.49	88.49	88.49	88.49	88.49	88.49		(66)
										00.45	00.40	00.45		1
-			ted in Ap				-	-	-		1			-
67)m-	13.75	12.21	9.93	7.62	0.02	4.75	5.13	6.00	5.95	11.36	13.20	14,13		(67)
Applia	nces gai	-	ulated in	and the second se	dix L, eq	uation L		3a), als	o see Ta			_		_
-m(60	154.24	155.64	151.01	143.22	132.38	122.2	115.39	113.79	117.82	126.41	137.25	147.44		(68)
Cookir	ng gains	(calcula	ited in A	ppendix	L, equa	tion L15	or L15a), also s	ee Table	5	-	1		
=m(60)	31.65	31.85	31.00	31.00	31.05	31.85	31.00	31.55	31.55	31.05	31.05	31.85		(69)
Pumps	s and far	ns gains	(Table	5a)			1		100					
70)m=	0	0	0	0	0	0	9	0	0	0	0	0		(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	ole 5)				_				
(71)m=	-70.79	-70.79	-70.79	-70.79	-70.79	-70.79	-70.79	-70.79	~70.79	-70.79	-70.79	-70.79		(71)
Water	heating	gains (1	(able 5)									<u> </u>		
(72)m=	123.01	121.24	117.58	112.59	109.35	104.8	100.93	105.89	107.66	112.81	118.64	121.25		(72)
Total i	internal	nains =				(00)m + (67)n	n + (65)m	+ (69)m +	(70)m + (7	1)m + (72)	len l		
(73)m=	340.55	338.84	328.86	312.00	296.91	261.29	271	275.89	283.97	300.13	318.69	332.36		(73)
-	lar gains		540.00		200.01									1
		alculated	using sola	r flux from	Table 6a	and assoc	lated equa	tions to c	onvert to th	ne apolical	ble orientat	tion.		
	ation: A			Area		Flu			g_		FF		Gains	
/		able 6d		m²			ble 6a		Table 6b	T	able 6c		(W)	
Southe	asto.ex	0.77	×	9		x 🗔	37.39	1 × [0.72	¬ * Г	0.6	1	147.75	(77)
	ast o.ex	-	۳,	-	_	-	-			╡┊╞	-	= .		=
	asto.sx	0.77		9.	_	-	53.74		0.72	=	0.8	= : :	251.87	(77)
		0.77	×	9.	_		54.22		0.72	╡╴┝	0.8	· !	332.8	(77)
	asto.9x	0.77	×	9.	9		03.49	× _	0.72	_ × L	0.8		405.96	(77)
	ast o.9x	0.77	×	9.	9	x 1	13.34	×	0.72	×	0.8	[447.65	(77)
	ast o.sx	0.77	x	9.	9	x 1	15.04	x	0.72	x	0.8	- [454.63	(77)
Southe	ast o.9x	0.77	×	9.	9	x 1	12.79	x	0.72] x [0.8	- [445.72	(77)

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9.9

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(77)

Southeast 0.9x

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42

0.72

×

0.8

x

105.34



outheast o.sx	0.77	x	9.1		X	92.9							
outheast o.ex		۳,	1	_	- F		╡┊╞	0.72		0.8		367.11	(77
outheast o.ex		=	9,1		x	72.36	╡┊╞	0.72	≓	0.8	=	265.96	-
outheast o.ex			9.1	-	F	44.03	=	0.72	╡╴╞	0.8		177.14	(77
outhwesto.ex		_ *	9.1	_	*	31.95	╡╴╞	0.72	╡╴┝	0.8	- ·	126.26	(77
		×	7.0	_	×	37.39	4 4	0.72	⊣ × Ŀ	0.8		105.06	(79
outhwesto.9x	0.0000	×	7.0	×	×Ļ	63.74	_ _	0.72	_ × Ŀ	0.8	ļ	179.11	(79
outhwesto.ex		×	7.0	14	×	84.22	_ L	0.72	_ × L	0.8	!	236.66	(79
outhwesto.ex		×	7.0	14	×	103.49	_	0.72	_ × [0.8	!	290.82	(79
outhwesto.9x		x	7.0	14	×	113.34		0.72	_ ×	0.8	[318.49	(79
outhwesto.sx	0.17	x	7.0	94	x	115.04		0.72	×	0.8	-	323.29	(79
outhwesto, ex	0.77	x	7.0	94	×	112.79		0.72	×	0.8	- [316.96	(79
outhwesto.ex	0.77	×	7.0	04	× [105.34		0.72] × [0.8	[296.02	(78
outhwesto.ex	0.77	x	7.0	54	× [92.9		0.72] × [0.8	[261.05	(79
outhwesto.9x	0.77	×	7.0	14	× [72.36		0.72] × [0.8	- [203.35	(79
outhwesta.sx	0.77	×	7.0	14	× [44.03		0.72] × [0.8	□ - [125,97	(79
outhwesto.sx	0.77	×	7.0	14	×	31.95	ΠĒ	0.72] × [0.8	- T	69.78	(79
4)m= 583.36	-	096.32	1012.66	1003.20	-	3)m , watts 9.21 1033 (-	812.13	769.44	621.79	545.41		(84
4)m= 593.30 741.500 inte Temperatur	internal a 769.62 amal ter e during h	nd solar 095.32 Ceture eating p	1012.60 Inc. ting eriods in	1063.20	ing a	9.21 1033 (rea from T	able 9, 1		789.44	021.79	040.41	21	
4)m= 583.34 A Compension Temperatur Utilisation fa	internal a 769.62 emailter e during h actor for ga	nd solar 098.32 Cature eating p ains for l	1012.66 In ting eriods in iving are	1003 20 n the liv	n (se	9.21 1033 rea from T e Table 9a	able 9, 1	rh1 (°C)				21	(64
4)m- 593.30 A Value Inte Temperatur Utilisation fa Jan	internal a 769.62 emailter e during h actor for ga	nd solar 095.32 Ceture eating p	1012.60 Inc. ting eriods in	1063.20	n (se	9.21 1033 (rea from T	able 9, 1	rh1 (°C)	783.44 Oct	021.79 Nov	548.41 Dec 0.97	21	(05
4)m= 593.30 Temperatur Jtilisation fa Jan 0.95	internal a 769.62 emel ter e during h actor for gi Feb 0.9	nd solar ses.32 eating p ains for Mar 0.78	1012.66 In ting eriods ir iving are Apr 0.63	n the lives 28 n the lives, h1,r May 0.46	100 100 100 100 100 100 100	9.21 1034 c rea from T e Table 9a un Jul 32 0.21	able 9, 1) 0.21	Th1 ("C) 3 Sep 0.39	Oct	Nov	Dec	21	(05
4)m- 593.30 Al Constitution Femperatur Jtilisation fa Jan 5)m- 0.95 Mean interm	internal a 5 769.02 e during h actor for g Feb 0.9 al temper	nd solar ses.32 eating p ains for Mar 0.78	1012.66 In ting eriods ir iving are Apr 0.63	n the lives 28 n the lives, h1,r May 0.46	n (se o J o J o. follov	9.21 1034 c rea from T e Table 9a un Jul 32 0.21	able 9, 1) 0.21	Th1 ("C) 3 Sep 0.39	Oct	Nov	Dec	21	(85
4)m- 593.30 7 Compared to 10 7 Compared to 10	internal a 5 769.62 e during h actor for ga Feb 0.9 al temper	nd solar ses.32 eating p ains for Mar 0.78 ature in 20.85	1012.60 In ting eriods ir iving are 0.63 Iving are 20.96	1063 20 n the liv ea, h1,r May 0.46 ea T1 (20.99	n (se o follov	9.21 1033 c rea from T e Table 9a un Jul 32 0.21 v steps 3 to 21 21	able 9,	Ch1 (°C) 3 Sep 0.39 ble 9c) 21	Oct 0.65	Nov 0.92	Dec 0.97	21	(85
4)m- 593.30 7 Compared to 1 7 Compared	internal a 5 769.52 e during h actor for g Feb 0.9 al tempera 20.64 e during h	nd solar ses.32 eating p ains for Mar 0.78 ature in 20.85	1012.60 In ting eriods ir iving are 0.63 Iving are 20.96	1063 20 n the liv ea, h1,r May 0.46 ea T1 (20.99	f dwe	9.21 1033 c rea from T e Table 9a un Jul 32 0.21 v steps 3 to 21 21	able 9,	Ch1 (°C) 3 Sep 0.39 ble 9c) 21	Oct 0.65	Nov 0.92	Dec 0.97	21	(85
4)m- 593.30 A Control Inte Temperatur Jtilisation fa Jan 8)m- 0.96 Mean interm 7)m- 20.36 Temperatur 8)m- 20.03	internal a 769.62 e during h actor for ga Feb 0.9 al temper 20.64 e during h	nd solar 898.32 ature eating p ains for Mar 0.78 ature in 20.85 eating p 20.04	1012-00 Internet ing eriods in wing are 0.63 Iving are 20.96 eriods in 20.07	1003 20 n the liv ea, h1,r May 0.46 ea T1 (20.99 n rest o 20.08	n (se n (se follow f dwe 20	9.21 1034 c rea from T 1034 c e Table 9a 101 32 0.21 v steps 3 to 21 21 21 viling from 0.09	able 9, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	Th1 (°C) 3 Sep 0.39 ble 9c) 21 Th2 (°C)	Oct 0.66 20.95	Nov 0.92 20.65	Dec 0.97 20.35	21	(85
4)m- 593.30 Temperatur Jtilisation fa 6)m- 0.96 Mean interm 7)m- 20.36 Temperatur 5)m- 20.03 Jtilisation fa	internal a 769.62 e during h actor for g Feb 0.9 al temper 20.64 e during h 20.64 actor for g	nd solar 898.32 ature eating p ains for Mar 0.78 ature in 20.85 eating p 20.04 ains for	1012.00 In ting eriods ir iving are 0.03 Iving are 20.96 eriods ir 20.07 est of de	1003 21 n the liv a, h1,r May 0.46 ea T1 (i 20.99 n rest o 20.06 welling	1 100 1	9.21 1033 c rea from T e Table 9a un Jul 32 0.21 v steps 3 to 21 21 elling from .09 20.1 n (see Tab	able 9, 0 Aug 0,21 0,7 in Ta 21 Table 9, 20,1 le 9a)	Th1 ("C) 3 Sep 0.39 ble 9c) 21 Th2 ("C) 20.08	Oct 0.66 20.95 20.07	Nov 0.92 20.65 20.05	Dec 0.97 20.35 20.04	21	(80
4)m- 593.30 7 Constinue Temperatur Jtilisation fa 5)m- 0.96 Mean interm 7)m- 20.30 Temperatur 5)m- 20.33 Jtilisation fa 9)m- 0.96	e during h construction for ga Feb 0.9 al temper 20.64 e during h 20.64 e during h 20.04 actor for ga 0.88	nd solar sea.32 eating p ains for Mar 0.78 ature in 20.85 eating p 20.04 ains for 0.75	1012.66 in ting eriods in Apr 0.63 iving are 20.96 eriods in 20.97 est of do 0.59	1003 24 n the liv ea, h1,r May 0.46 ea T1 (20.99 n rest o 20.08 welling, 0.41	1 100 1 10 1 10	9.21 1034.4 rea from T 1034.4 e Table 9a 9a un Jul 32 0.21 v steps 3 to 21 21 21 alling from .09 .09 20.1 n (see Tab 27 0.16	able 9, Aug 0,21 0,21 0,21 0,7 in Ta 21 Table 9, 20.1 1 1 1 1 1 1 1 1 1 1 1 1 1	Th1 ("C) 3 Sep 0.39 ble 9c) 21 Th2 ("C) 20.08 0.34	Oct 0.68 20.95 20.07 0.61	Nov 0.92 20.65	Dec 0.97 20.35	21	(80 (80) (80)
4)m= 593.30 7 Compared to 10 7 Compared to 10	e during h construction e during h cotor for g Feb 0.9 construction 20.64 e during h 20.64 e during h 20.64 actor for g 20.64 actor for g 20.64	nd solar sea.32 ature eating p ains for Mar 0.78 ature in 20.85 eating p 20.04 ains for r 0.75 ature in	1012.00 In the eriods in Apr 0.63 Iving are 20.96 eriods in 20.07 rest of do 0.59 the rest	1003 21 n the liv ea, h1,r May 0.45 ea T1 (20.99 n rest o 20.08 welling, 0.41 of dwel	1 100 1	9.21 1033 c rea from T e Table 9a un Jul 32 0.21 v steps 3 to 21 21 elling from .09 20.1 n (see Tab 27 0.16	able 9, ") Aug 0,21 0 7 in Ta 21 Table 9, 20,1 le 9a) 0,17 steps 3 t	Sep 0.39 ble 9c) 21 Th2 (°C) 20.08 0.34	Oct 0.65 20.95 20.07 0.61 e 9c)	Nov 0.92 20.65 20.05	0.97 20.35 20.04	21	(80 (87 (87 (89
	e during h construction e during h cotor for g Feb 0.9 construction 20.64 e during h 20.64 e during h 20.64 actor for g 20.64 actor for g 20.64	nd solar sea.32 eating p ains for Mar 0.78 ature in 20.85 eating p 20.04 ains for 0.75	1012.66 in ting eriods in Apr 0.63 iving are 20.96 eriods in 20.97 est of do 0.59	1003 24 n the liv ea, h1,r May 0.46 ea T1 (20.99 n rest o 20.08 welling, 0.41	1 100 1	9.21 1034.4 rea from T 1034.4 e Table 9a 9a un Jul 32 0.21 v steps 3 to 21 21 21 alling from .09 .09 20.1 n (see Tab 27 0.16	able 9, Aug 0,21 0,21 0,21 0,7 in Ta 21 Table 9, 20.1 1 1 20.1 1 1 1 1 1 1 1 1 1 1 1 1 1	Sep 0.39 ble 9c) 21 Th2 (°C) 20.08 0.34 20.08	Oct 0.65 20.95 20.07 0.61 ie 9c) 20.03	Nov 0.92 20.65 20.05 0.9	Dec 0.97 20.35 20.04 0.96	21	(85 (87 (87) (88) (89)
	e during h construction e during h cotor for g Feb 0.9 construction 20.64 e during h 20.64 e during h 20.64 actor for g 20.64 actor for g 20.64	nd solar sea.32 ature eating p ains for Mar 0.78 ature in 20.85 eating p 20.04 ains for r 0.75 ature in	1012.00 In the eriods in Apr 0.63 Iving are 20.96 eriods in 20.07 rest of do 0.59 the rest	1003 21 n the liv ea, h1,r May 0.45 ea T1 (20.99 n rest o 20.08 welling, 0.41 of dwel	1 100 1	9.21 1033 c rea from T e Table 9a un Jul 32 0.21 v steps 3 to 21 21 elling from .09 20.1 n (see Tab 27 0.16	able 9, ") Aug 0,21 0 7 in Ta 21 Table 9, 20,1 le 9a) 0,17 steps 3 t	Sep 0.39 ble 9c) 21 Th2 (°C) 20.08 0.34 20.08	Oct 0.65 20.95 20.07 0.61 ie 9c) 20.03	Nov 0.92 20.65 20.05	Dec 0.97 20.35 20.04 0.96	21	(85 (87 (87) (88) (89)
4)m- 593.30 4)m- 593.30 4)m- 593.30 4)m- 593.30 4)m- 593.30 4)m- 101 5)m- 0.96 4)m- 20.36 6)m- 20.36 7)m- 20.36 10m- 20.36 10m- 20.36 10m- 20.36 10m- 20.36 0.9m- 0.96 Mean interm 0.96 Mean interm 0.96 Mean interm 0.97 0.90m- 19.22	e during h 20.64 e during h actor for ge 0.9 al temper 20.64 e during h 20.64 actor for ge 0.85 al temper 19.62	nd solar a+0.32 clure eating p ains for 0.78 ature in 20.85 eating p 20.04 ains for 0.75 ature in 19.88	1012.66 in ting eriods ir Normal Apr 0.63 iving are 20.96 eriods ir 20.97 est of de 0.59 the rest 20.03	1003 24 n the liv ea, h1,r May 0.46 ea T1 (20.99 n rest o 20.08 welling. 0.41 of dwel 20.08	1000 1000	9.21 1033.4 rea from T 1034.4 e Table 9a 9a un Jul 32 0.21 v steps 3 to 21 21 21 alling from 20.1 n (see Table 7 0.16 72 0.16 72 40.16 73 20.1	able 9, Aug 0,21 0,21 0,21 0,7 in Ta 20,1 1e 9a) 0,17 teps 3 t 20,1	Sep 0.39 ble 9c) 21 Th2 (°C) 20.08 0.34 27 in Table 20.08	Oct 0.65 20.95 20.07 0.61 ie 9c) 20.03	Nov 0.92 20.65 20.05 0.9	Dec 0.97 20.35 20.04 0.96		
4)m- 593.30 4)m- 593.30 4)m- 593.30 4)m- 593.30 4)m- 593.30 4)m- 101 5)m- 0.96 Mean interm 7)m- 7)m- 20.36 Gemperatur 20.36 Jtilisation fa 9)m- 9)m- 0.96 Mean interm 0.96 Mean interm 19.22 Mean interm 19.22	internal a 769.62 anal tern e during h actor for ga 0.9 al temper 20.64 e during h 20.64 actor for ga 0.85 al temper 19.62	nd solar a+0.32 clure eating p ains for 0.78 ature in 20.85 eating p 20.04 ains for 0.75 ature in 19.88	1012.66 in ting eriods ir Normal Apr 0.63 iving are 20.96 eriods ir 20.97 est of de 0.59 the rest 20.03	1003 24 n the liv ea, h1,r May 0.46 ea T1 (20.99 n rest o 20.08 welling. 0.41 of dwel 20.08	1 10 ² 1 10 ² 1 10 ² 1 10 ² 1 10 ² 1 0. 1	9.21 1033.4 rea from T 1034.4 e Table 9a 9a un Jul 32 0.21 v steps 3 to 21 21 21 alling from 20.1 n (see Table 7 0.16 72 0.16 72 40.16 73 20.1	able 9, able 9, Au 0.21 0.7 in Ta 21 Table 9, 20.1 1e 9a) 0.17 iteps 3 t 20.1 1 + (1 -	Th1 ("C) Sep 0.39 ble 9c) 21 Th2 ("C) 20.08 0.34 0.34 0.34 0.34 0.34 1.034 0.	Oct 0.65 20.95 20.07 0.61 ie 9c) 20.03	Nov 0.92 20.65 20.05 0.9	Dec 0.97 20.35 20.04 0.96		(65 (67 (67 (69 (91
4)m- 593.30 A 0.000 inter- Temperatur Jtilisation fa 5)m- 0.96 Mean interm 7)m- 20.30 Temperatur 5)m- 20.30 Temperatur 9)m- 0.96 Mean interm 9)m- 19.22 Mean interm 2)m- 19.22 Mean interm	internal a 769.02 e during h actor for g 0.9 al temper 20.64 e during h 20.64 e during h 20.64 actor for g 0.85 actor for g 0.85	ature in 19.85 eating p ains for Mar 0.78 ature in 20.85 eating p 20.04 ains for 0.75 ature in 19.88 ature (fo 20.36	1012.60 in ting eriods in Apr 0.63 iving are 20.96 eriods in 20.97 est of do 0.59 the rest 20.03 r the wh 20.46	1003 20 1003 20 1003 20 1003 20 1004 1004 1004 1004 1004 1004 1005	10/10 ing a	9.21 1033.4 rea from T Table 9a un Jul 32 0.21 visteps 3 to 21 visteps 3 to 20.1 n (see Tab 20.1 visteps 20.1 20.1	able 9, able 9, Aug 0.21 0 7 in Ta 21 Table 9, 20.1 1 4 (1 20.5	Th1 ("C) 3 Sep 0.39 ble 9c) 21 Th2 ("C) 20.08 0.34 0.34 0.34 20.08 fLA) × T2 20.53	Oct 0.65 20.95 20.07 0.61 1e 9c) 20.03 1LA = LIVI 20.45	Nov 0.92 20.05 20.05 0.9 19.64 ng area + (-	20.35 20.04 19.22 4) =		(85 (87 (87 (89 (90
A Constinue Temperatur Utilisation fa (a)m* 0.96 Mean interm (7)m* 20.36 Mean interm (8)m* 0.96 Mean interm (9)m* 19.22 Mean interm	actor for galler actor for for galler actor for galler actor for for for galler actor for galler actor for galler actor for for for for for for for for for f	ature in 19.85 eating p ains for Mar 0.78 ature in 20.85 eating p 20.04 ains for 0.75 ature in 19.88 ature (fo 20.36	1012.60 in ting eriods in Apr 0.63 iving are 20.96 eriods in 20.97 est of do 0.59 the rest 20.03 r the wh 20.46	1003 20 1003 20 1003 20 1003 20 1004 1004 1004 1004 1004 1004 1005	10 10	9.21 1033.4 rea from T Table 9a un Jul 32 0.21 visteps 3 to 21 visteps 3 to 20.1 n (see Tab 20.1 visteps 20.1 20.1	able 9, Au 0,21 0,7 in Ta 21 Table 9, 20,1 1e 9a) 0,17 steps 3 t 20,1 1 + (1 - 1) 20,5 4 1 + (1 - 5) 20,5 4 1 + (1 - 5) 20,5 4 20,5	Sep 0.39 ble 9c) 21 Th2 (°C) 20.08 0.34 0.7 in Table 20.08 fLA) × T2 20.53 here approx	Oct 0.65 20.95 20.07 0.61 1e 9c) 20.03 1LA = LIVI 20.45	Nov 0.92 20.05 20.05 0.9 19.64 ng area + (-	20.35 20.04 19.22 4) =		(65 (67 (67 (69 (91
4)m= 593.30 Temperatur Utilisation fr 6)m= 0.96 Mean interm 7)m= 20.36 Temperatur 8)m= 20.03 Utilisation fr 9)m= 0.96 Mean interm 0)m= 19.22 Mean interm 2)m= 19.76 Apply adjus	internal a 769.02 e during h actor for g Feb 0.9 al temper 20.64 e during h 20.64 e during h 20.65 e during h 20.64 e during h 20.64 e during h 20.62 e during h 20.12 e during h 20.12 e during h 20.12 e during h 20.12	and solar abs.32 ature eating p ains for 0.78 ature in 20.85 eating p 20.04 ains for 0.75 ature in 19.85 ature in 19.85 ature (fo 20.36	1012.60 in ting eriods in Apr 0.63 iving are 20.96 eriods in 20.96 eriods in 20.97 est of do 0.59 the rest 20.03 r the wh 20.46 internal	1003 21 1003 21 1003 21 1003 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1005 20 100	10 10	9.21 1033.4 rea from T Table 9a un Jul 32 0.21 visteps 3 to 21 visteps 3 to 20.1 n (see Tab 20.1 visteps 2 to 10 20.1 visteps 2 to 10 20.1 visteps 2 to 2.1 20.1 visteps 2 to 2.1 20.1 visteps 2 to 2.1 20.54 visteps 2 to 54 6 from Tab	able 9, Au 0,21 0,7 in Ta 21 Table 9, 20,1 1e 9a) 0,17 steps 3 t 20,1 1 + (1 - 1) 20,5 4 1 + (1 - 5) 20,5 4 1 + (1 - 5) 20,5 4 20,5	Sep 0.39 ble 9c) 21 Th2 (°C) 20.08 0.34 0.7 in Table 20.08 fLA) × T2 20.53 here approx	Oct 0.65 20.95 20.07 0.61 le 9c) 20.03 tLA = LIVI 20.45 opriate	Nov 0.92 20.65 20.05 0.9 19.64 ng area + (- 20.14	Dec 0.97 20.35 20.04 0.96 19.22 4) =		(8) (8) (8) (8) (8) (9) (9) (9)
4)m- 593.30 A Comparature Jtilisation fa Jilisation fa (Jan 6)m- 0.96 Mean interm 7)m- 20.36 Temperature 7)m- 20.36 Temperature 3)m- 0.96 Mean interm 9)m- 0.96 Mean interm 9)m- 19.22 Mean interm 2)m- 19.76 Apply adjus 3)m- 19.76	actor for generation of the sector for genera	and solar abs.32 ature eating p ains for 0.78 ature in 20.85 eating p 20.04 ains for 0.75 ature in 19.88 ature (fo 20.36 he mean 20.36 he mean	1012.00 in ting eriods in wing are Apr 0.63 iving are 20.96 eriods in 20.97 est of de 0.59 the rest 20.03 r the wh 20.48 internal 20.48	1003 21 1003 21 1003 21 1003 20 1004 20 100	1 192 1	9.21 1034 c rea from T Table 9a un Jul 32 0.21 v steps 3 to 21 21 21 viling from 20.1 0.09 20.1 n (see Tab 27 0.16 72 (follow s) 0.09 20.1) = fLA × T 20.54 e from Tab 20.54	able 9, Aug 0,21 0,7 in Ta 21 Table 9, 20,1 1 = 9a) 0,17 steps 3 t 20,1 1 + (1	Fh1 ("C) 0.39 0.39 ble 9c) 21 Th2 (°C) 20.08 0.34 0.34 0.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34	Oct 0.68 20.95 20.07 0.61 ke 9c) 20.03 1LA = Livi 20.48 opriate 20.45	Nov 0.92 20.65 20.05 0.9 19.64 ng area + (- 20.14	Dec 0.97 20.35 20.04 0.96 19.22 4) = 19.77 19.77	0.49	(8) (8) (8) (8) (8) (9) (9) (9)
4)m- 593.30 4)m- 593.30 4)m- 593.30 4)m- 593.30 4)m- 193.30 4)m- 193.30 5)m- 0.96 Mean interm 0.96 7)m- 20.30 Comperatur 20.33 Jtilisation fa 90m- 90m- 0.96 Mean interm 0.96 Mean interm 19.22 Mean interm 19.78 Apply adjus 19.78 3)m- 19.78 3)m- 19.78	actor for generation of a constraint of a cons	and solar ass.32 ature eating p ains for 0.78 ature in 20.85 eating p 20.04 ains for 0.75 ature in 19.88 ature in 19.88 ature solar 19.88 ature in 20.36 ne mean 20.36 iremant emal ter	1012.00 In ting eriods in wing are Apr 0.63 Iving are 20.96 eriods in 20.07 est of de 0.59 the rest 20.03 r the wh 20.48 internal 20.48	1003 21 1003 21 1003 21 1003 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1005 20 100	1 192 1	9.21 1034 c rea from T Table 9a un Jul 32 0.21 v steps 3 to 21 21 21 viling from 20.1 0.09 20.1 n (see Tab 27 0.16 72 (follow s) 0.09 20.1) = fLA × T 20.54 e from Tab 20.54	able 9, Aug 0,21 0,7 in Ta 21 Table 9, 20,1 1 = 9a) 0,17 steps 3 t 20,1 1 + (1	Fh1 ("C) 0.39 0.39 ble 9c) 21 Th2 (°C) 20.08 0.34 0.34 0.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34 10.34	Oct 0.68 20.95 20.07 0.61 ke 9c) 20.03 1LA = Livi 20.48 opriate 20.45	Nov 0.92 20.65 20.05 0.9 19.64 ng area + (- 20.14	Dec 0.97 20.35 20.04 0.96 19.22 4) = 19.77 19.77	0.49	(5) (5) (5) (5) (9) (9) (9)
)m+ 593.30 emperatur 1112 emperatur Jan jm+ 0.96 lean interm jm+ 20.30 emperatur 20.30 emperatur 20.30 emperatur 20.30 emperatur 10.96 jm+ 0.96 lean interm 19.22 lean interm 19.78 jm+ 19.70 Space he et Ti to the	internal a 769.02 actor for ga Feb 0.9 actor for ga 20.64 e during h 20.64 e during h 20.64 e during h 20.64 actor for ga 0.88 actor for ga actor for for for ga actor for for for for for for for for	and solar ass.32 ature eating p ains for 0.78 ature in 20.85 eating p 20.04 ains for 0.75 ature in 19.88 ature in 19.88 ature solar 19.88 ature in 20.36 ne mean 20.36 iremant emal ter	1012.00 In ting eriods in wing are Apr 0.63 Iving are 20.96 eriods in 20.07 est of de 0.59 the rest 20.03 r the wh 20.48 internal 20.48	1003 21 1003 21 1003 21 1003 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1004 20 1005 20 100	102 ning a η (see J σ follow follow follow follow a follow a follow a a b a a b a	9.21 1034 c rea from T Table 9a un Jul 32 0.21 v steps 3 to 21 21 21 viling from 20.1 0.09 20.1 n (see Tab 27 0.16 72 (follow s) 0.09 20.1) = fLA × T 20.54 e from Tab 20.54	able 9, 7) Aug 0,21 0,7 in Ta 21 Table 9, 20,1 1 + (1 20,54 1 + (1)) 1 + (1))	Th1 ("C) 0.39 0.39 ble 9c) 21 Th2 ("C) 20.08 0.34 0.34 0.34 0.34 20.08 fLA) × T2 20.53 bere approx 9b, so that	Oct 0.68 20.95 20.07 0.61 ke 9c) 20.03 1LA = Livi 20.48 opriate 20.45	Nov 0.92 20.65 20.05 0.9 19.64 ng area + (- 20.14	Dec 0.97 20.35 20.04 0.96 19.22 4) = 19.77 19.77	0.49	3) 3) 3) 3) 3) 2) 2) 2) 2) 2)

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Utilisation factor for gains, hm:						
(94)m= 0.95 0.88 0.76 0.61 0.44 0.29 0.18 0	0.36	0.64	0.9	0.96		(94)
Useful gains, hmGm , W = (94)m x (84)m						
(95)m* 565.2 675.4 662.59 616.01 463.91 310.46 168.72 16	8.71 330.12	502.46	559.05	526.49		(95)
Monthly average external temperature from Table 8						
(90)m ⁺ 4.5 5 6.8 8.7 11.7 14.6 16.9 1	6.9 14.3	10.8	7	4.9		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(9		· ·				1200
	8.73 330.64	521.64	717.82	824.28		(97)
Space heating requirement for each month, kWh/month = 0.024 x		1	1			
(98)m= 218.38 109.37 51.1 13.53 1.91 0 0	0 0	14.27	114.31	221.56		
	Total per yea	r (kWh/yea	r) = Sum(9	(C)1.48.12	744.43	(98)
Space heating requirement in kWh/m²/year					14.13	(99)
9b. Energy requirements - Community heating scheme						
This part is used for space heating, space cooling or water heating			unity scl	neme.		-
Fraction of space heat from secondary/supplementary heating (Tat	ble 11) '0' if i	ione			0	(301)
Fraction of space heat from community system 1 - (301) =				Γ	1	(302)
The community scheme may obtain heat from several sources. The procedure allow	ws for CHP and	up to four	other heat	sources; the	latter	
Includes bollers, heat pumps, geothermal and waste heat from power stations. See	Appendix C.					
Fraction of heat from Community CHP				- T	0.6	(303a)
Fraction of community heat from heat source 2				_ C	0.4	(303b)
Fraction of total space heat from Community CHP		63	(02) x (303	a) -	0.6	(304a)
Fraction of total space heat from community heat source 2		(2	02) x (303	b) - [0.4	(304b)
Factor for control and charging method (Table 4c(3)) for community	y heating sy	stern		Ē	1	(305)
Distribution loss factor (Table 12c) for community heating system				Ē	1.05	(306)
Space heating				100	kWh/yea	
Annual space heating requirement				Г	744.43	٦
Space heat from Community CHP	(98) x (104a) x (30	5) x (306)	- F	465.99	(307a)
Space heat from heat source 2	(96) x (904b) x (30	5) x (306)	- Ē	312.66	(307b)
Efficiency of secondary/supplementary heating system in % (from 7	Table 4a or	Appendix	: E)	Ē	0	(308
Space heating requirement from secondary/supplementary system	(98) x (901) x 100	+ (305) =	Ē	0	(309)
Water heating					1000 00	-
Annual water heating requirement				L	1939.22	
If DHW from community scheme: Water heat from Community CHP	(64) x (903a) x (30	5) x (306)	- F	1221.71	(310a)
Water heat from heat source 2	(64) x (903b) x (30	5) x (306)	· Ē	814.47	(310b)
Electricity used for heat distribution	0.01 × [(307a)(307e)	(310a)	(310e)] =	28.18	(313)
Cooling System Energy Efficiency Ratio				Ē	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 out	tside				119.27	(330a)

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warm air heating system fans					(330b)
				0	100000
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/ye	ar	=(330a) + (33	90b) + (330g) =	119.27	(331)
Energy for lighting (calculated in App	endix L)			242.84	(332)
Electricity generated by PVs (Append	lix M) (negative quantity)			-238.26	(333)
Electricity generated by wind turbine	(Appendix M) (negative q	uantity)		0	(334)
12b. CO2 Emissions - Community he	ating scheme			1216 1216	
Electrical efficiency of CHP unit				31	(361)
Heat efficiency of CHP unit				62	(362)
		Energy kWh/year	Emission facto kg CO2/kWh	r Emissions kg CO2/year	
Space heating from CHP) 0	307a) × 100 + (362) =	756.44 ×	0.2	149.75	(363)
less credit emissions for electricity	(307a) = (361) + (362) =	234.5 ×	0.53	-124.05	(364)
Water heated by CHP 0	310a) × 100 + (362) =	1970.5 ×	0.2	390.16	(365)
less credit emissions for electricity -	(310a) × (361) + (362) =	610.85 ×	0.53	-323,14	(366)
Efficiency of heat source 2 (%)	If there is CHP us	ng two fuels repeat (363)	o (300) for the second fo	BC BC	(367b)
CO2 associated with heat source 2	I(307b)	+(310b)] x 100 + (367b) x	0.2	232.47	(366)
Electrical energy for heat distribution		(813) x	0.52	14.57	(372)
Total CO2 associated with community	y systems	(363)(366) + (368)(3	72)	- 339.75	(373)
CO2 associated with space heating (secondary)	(309) x	0	- 0	(374)
CO2 associated with water from imm	ersion heater or instantar	eous heater (212) x	0.2	- 0	(375)
Total CO2 associated with space and	water heating	(373) + (374) + (375) =		339.75	(376)
CO2 associated with electricity for pu	mps and fans within dwe	lling (331)) x	0.52	- 61.66	(378)
CO2 associated with electricity for lig	hting	(332))) x	0.52	125.55	(379)
Energy saving/generation technologie Item 1	es (333) to (334) as appli	cable	0.53 × 0.01 ·	-126.04	(380)
Total CO2, kg/year	sum of (376)(362) =			400.95	(383)
Dwelling CO2 Emission Rate	(383) + (4) =			7.61	(384)
El rating (section 14)				94.5	(385)

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		User Details:				
Assessor Name: Software Name:	Stroma FSAP 2009		Version:	Version	n: 1.5.0.78	
		Property Address: U	NIT B106_1B2P			
Address :						
1. Overall dwelling dim	ensions:	10 10 10 10 10 10 10 10 10 10 10 10 10 1				
		Area(m ²)	Ave Height		Volume(m	<u> </u>
Ground floor		52.7 (1a) × 2.6	(2a) =	147.55	(3)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+	(1n) 52.7 (4)				
Dwelling volume		(3	a)+(3b)+(3c)+(3d)+(3e)	+(3n) =	147.55	(5)
2. Ventilation rate:						_
	main Secon		total		m ³ per hou	ır
Number of chimneys	heating heatin		- 0	x 40 -	0	1(6)
Number of open flues				x 20 -		
	0 + 0			and the second second	0	1
Number of intermittent f	ans		2	x 10 -	20	(7)
Number of passive vent	5		0	x 10 -	0	(7
Number of flueless gas	fires		a	x 40 =	0	(7
				Air ch	anges per ho	our
Infiltration due to chimne	eys, flues and fans = (0a)+(0b)	+(7a)+(7b)+(7c) =	20	+ (5) -	0.14	(8)
If a pressurisation test has	been carried out or is intended, proc	ceed to (17), otherwise cont	mue from (9) to (16)			
Number of storeys in	the dwelling (ns)				0	(9
Additional infiltration			and the second second	[(9)-1]x0.1 =	0	(1
	0.25 for steel or timber frame present, use the value corresponding			L	0	(1
deducting areas of open		g to the greater wait area (a	HEP .			
If suspended wooden	floor, enter 0.2 (unsealed) or	r 0.1 (sealed), else en	ter 0	ſ	0	(1
If no draught lobby, er	nter 0.05, else enter 0			ĺ	0	(1
Percentage of window	vs and doors draught stripped	д		[0	(1
Window infiltration		0.25 - [0.2 x (14) + 100] =	[0	(1
Infiltration rate		(8) + (10) + (1	1) + (12) + (13) + (15)	- [0	(1
	, q50, expressed in cubic me	accessory of the second of the second of the second second second second second second second second second se		ope area	10	(1
	ility value, then (10) = [(17) + 20			[0.64	(1
	les if a pressurisation test has been	done or a degree air perme	ability is being used		<u>.</u>	_
Number of sides on whi Shelter factor	cn sheltered	(20) = 1 - 10.0	75 x (19)) =	ł	2	(1
	ating shalter factor	(21) = (18) x (and a state of	ł	0.65	(2
Infiltration rate incorpora		10.1 (1.07.01)		1	0.54	{2
	for monthly wind speed		San Ort H			
Jan Feb	Mar Apr May Ju	n Jul Aug	Sep Oct N	ov Dec		
Monthly average wind s				_		
(22)m= 5.4 5.1	5.1 4.5 4.1 3.9	3.7 3.7	4.2 4.5 4.8	5.1		
Wind Factor (22a)m = (2	22)m ÷ 4					
		092 092	05 142 47	1 27		
(22a)m 1.35 1.27	1.27 1.12 1.02 0.98	0.92 0.92	1.05 1.12 1.3	1.27		

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Calcul						a mina a	sheen!	(21a) x	(menuluit					
Calcula	0.73	0.69	0.69	0.61	0.55	0.53	0.5	0.5	0.57	0.61	0.65	0.69		
				rate for t	he appli	cable ca	se	10 10	100 - D	10 10		2		-
		al ventila											0	(23
								45)) , other) = (23a)		8	0	(23)
								n Table 4h					0	(23)
			-		-							1 – (23c)	÷ 100]	
(24a)m=	Ű	0	0	0	0	0	0	0	0	0	0	0		(24)
b) If	balance	d mecha	anical ve	ntilation	without	heat red	covery (M	//V) (24b)m = (22	2b)m + (23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If	whole h	ouse ex	tract ver	tilation (or positiv	e input	ventilatio	on from o	outside					
i	if (22b)n	n < 0.5 ×	(23b), t	hen (24	c) = (23b); other	wise (24	c) = (22t	o) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If	natural	ventilatio	on or wh	ole hous	se positiv	ve input	ventilatio	on from I	oft	S				
i	if (22b)n	n = 1, th	en (24d)	m = (22)	b)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0.77	0.74	0.74	0.65	0.65	0.64	0.62	0.62	0.66	0.65	0.71	0.74		(24
Effe	ctive air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)					
(25)m*.	0.77	0.74	0.74	0.00	0.65	0.64	0.62	0.62	0.66	0.00	0.71	0.74		(25
Walls		50		13.1	7	11.32	100	0.35		20.97	H	3		_
Total a Party f Party c for win	loor eiling dows and le the area	roof winde	, m² ows, use e sides of in	ffective wi		37 2) 50.4 52.7 52.7 stue calcul	x	0.35 formula t	- (/////.vai/	13.03	s given in	paragraph		(29 (31
Total a Party f Party c for wh <i>tor wh</i> Fabric	loor ceiling dows and le the area heat los	roof winds as on both as, W/K :	, m ² ows, use e sides of in = S (A x	ffective wi	indow U-va	37 2) 50.4 52.7 52.7 stue calcul	x	0.35	//(1/U-vaiu (+ (32) =	13.03 e)+0.04] a			3.2	(29 (31 (32 (32
Total a Party f Party c * for win ** includ Fabric	loor ceiling dows and le the area heat los	roof winde	, m ² ows, use e sides of in = S (A x	ffective wi	indow U-va	37 2) 50.4 52.7 52.7 stue calcul	x	0.35 formula t	//(1/U-vaiu (+ (32) =	13.03 e)+0.04] a	us given in 2) + (32a).			(27 (29 (31 (32 (32 (32
Total a Party f Party c <i>for win</i> <i>for win</i> <i>for win</i> Heat c	loor ceiling dows and le the area heat los apacity	roof winds as on both as, W/K : Cm = S(, m² sides of in = S (A x (A x k)	ffective wi iternal wai U)	indow U-va	37.2) 50.4 52.7 52.7 stue calcul Wons	ated using	0.35 formula t	//(1/U-vaiu) + (32) = ((26)	13.03 e)+0.04] a	2) + (32a).		37.7	(29 (31 (32 (32 (33 (34
Total a Party f Party c for win includ Fabric Heat c Therm For desi	loor ceiling dows and te the area heat los apacity al mass gn assess	roof winds son both ss, W/K : Cm = S(parame sments wh	, m ² sides of in = S (A x (A x k) ther (TMF	ffective wi iternal wai U) P = Cm - tails of the	Indow U-va Its and part	37.23 50.4 52.7 52.7 52.7 alue calcul Wons	x	0.35 formula t	((28) Indica	13.03 ee)+0.04] a (30) + (3: tive Value	2) + (32a). : Medium	(32e) =	37.7 3659.0001	(29 (31 (32 (32 (33 (34
Total a Party f Party c ' for win '' includ Fabric Heat c Therm For desi	loor ceiling dows and le the area heat los apacity al mass gn assess used inste	roof winds as on both as, W/K = Cm = S(parame sments wh ad of a del	, m ² sides of in = S (A x A x k) ter (TMF ere the de tailed calcu	ffective wi iternal wal U) P = Cm - tails of the ulation.	Indow U-va Its and part	37.23 50.4 52.7 52.7 52.7 52.7 52.7 52.7 52.7 52.7	s x	0.35 formula f	((28) Indica	13.03 ee)+0.04] a (30) + (3: tive Value	2) + (32a). : Medium	(32e) =	37.7 3659.0001	(29 (31 (32 (32 (33 (34 (35
Total a Party f Party c * for win * includ Fabric Heat c Therm For desi can be u Therm	loor ceiling dows and le the area heat los apacity al mass gn assess sed inste al bridge	roof winde as on both as, W/K : Cm = S(parame anexits wh ad of a del es : S (L	, m ² sides of it = S (A x (A x k)) ter (TMF ere the de tailed calco x Y) cal	ffective wi ternal wai U) P = Cm - tails of the ulation. culated	Indow U-va Is and part + TFA) in construct	37.23 50.4 52.7 52.7 sture catout thorns n kJ/m²K ton are not	s x	0.35 formula f	((28) Indica	13.03 ee)+0.04] a (30) + (3: tive Value	2) + (32a). : Medium	(32e) =	37.7 3659.0001 250	(29 (31 (32 (32 (33 (34 (35
Total a Party f Party c for who includ Fabric Heat c Therm For desi can be u Therm	loor ceiling dows and le the area heat los apacity al mass gn assess sed inste al bridge	roof winds as on both as, W/K = Cm = S(parame sments wh ad of a del es : S (L	, m ² sides of it = S (A x (A x k)) ter (TMF ere the de tailed calco x Y) cal	ffective wi ternal wai U) P = Cm - tails of the ulation. culated	Indow U-va Is and part ← TFA) ir construct using Ap	37.23 50.4 52.7 52.7 sture catout thorns n kJ/m²K ton are not	s x	0.35 formula f	((28) indicative	13.03 ee)+0.04] a (30) + (3: tive Value	2) + (32a). : Medium	(32e) =	37.7 3659.0001 250	(29 (31 (32 (32 (33 (34) (34) (35) (36)
Total a Party f Party c * for win * includ Fabric Heat c Therm for deal can be a Therm t details	loor ceiling dows and le the area heat los apacity al mass gn assess used inste al bridge of therma abric he	roof winds is on both is, W/K : Cm = S(parame sments wh ad of a dei es : S (L al bridging at loss	, m ² sides of it = S (A x (A x k)) ter (TMF ere the de tailed calco x Y) cal	ffective wi iternal wai U) P = Cm - tails of the ulation. culated own (36) -	Indow U-va Is and part + TFA) ir construct using Ap = 0.15 x (3	37.23 50.4 52.7 52.7 sture catout thorns n kJ/m²K ton are not	s x	0.35 formula f	(1)U-valu (1) + (32) = ((26) Indicative (33) +	13.03 e)+0.047 e (30) + (3) tive Values of (35) =	2) + (32a). : Medium	(32e) = 	37.7 3689.0001 250 5.54	(29 (31 (32 (32 (33 (34 (35) (35)
Total a Party f Party c * for win * includ Fabric Heat c Therm for deal can be a Therm t details	loor ceiling dows and le the area heat los apacity al mass gn assess used inste al bridge of therma abric he	roof winds is on both is, W/K : Cm = S(parame sments wh ad of a dei es : S (L al bridging at loss	, m ² ows, use e sides of in = S (A x (A x k) ter (TMF ere the de tailed calco x Y) call are not kn	ffective wi iternal wai U) P = Cm - tails of the ulation. culated own (36) -	Indow U-va Is and part + TFA) ir construct using Ap = 0.15 x (3	37.23 50.4 52.7 52.7 sture catout thorns n kJ/m²K ton are not	s x	0.35 formula f	(1)U-valu (1) + (32) = ((26) Indicative (33) +	13.03 e)+0.047 e (30) + (3) tive Values of (35) =	2) + (32a). : Medium TMP in Tr	(32e) = 	37.7 3689.0001 250 5.54	(29 (31 (32 (32 (33 (34) (34) (35) (36)
Total a Party f Party o for win " includ Fabric Heat o Therm For deal can be o Therm details Total fo	loor ceiling dows and le the area heat los apacity al mass gn assess used inste- al bridge of therms abric he abric heat	roof winds as on both as, W/K : Cm = S(parame sments wh ad of a del es : S (L af bridging at loss at loss ca	, m ² sides of in = S (A x (A x k) ter (TMF ere the de tailed calci x Y) cal are not kn alculated	ffective will ternal wait U) P = Cm - tails of the ulation. culated own (36)	Indow U-va Is and part TFA) ir construct using Ap - 0.15 x (3 y	37.23 50.4 52.7 52.7 52.7 52.7 52.7 52.7 52.7 52.7	t known pr	0.35 formula 1 (26)(30) ecclesity the	//(1/U-valu + (32) = ((28) Indicative (33) + (38)m	13.03 e)+0.047 a (30) + (3) tive Values of (36) = = 0.33 × (2) + (32a). : Medlum 7MP in 7/ 25)m x (5)	(32e) =	37.7 3689.0001 250 5.54	(29 (31 (32 (32 (33 (34 (35 (35) (36) (37)
Total a Party f Party of ' for win Fabric Heat c Therm ' details Total fr Total fr (ventila (38)m=	loor ceiling dows and le the area heat los apacity al mass gn assess used inste- al bridge of therma abric heat tion heat Jan 37.3	roof winds as on both as, W/K : Cm = S(parame aments wh ad of a del as : S (L al bridging at loss at loss ca Feb	, m ² sides of in = S (A x A x k) ter (TMF ere the de tailed calco x Y) call are not kn alculated Mar 35.9	ffective will ternal wait U) P = Cm - tails of the station. culated own (36) f month!	ndow U-va ts and part ► TFA) ir construct using Ap ► 0.15 x (3 y May	37.23 50.4 52.7 52.7 52.7 52.7 52.7 52.7 52.7 52.7	t known pr	0.35 formula f (26)(30) ecclosely the	((1/U-valu) (+ (32) = ((28) Indica <i>i</i> indicative (33) + (38)m Sep 32.18	(36) = = 0.33 × (Oct	2) + (32a). : Medium <i>TMP in Tr</i> 25)m x (5) <u>Nov</u> 34.58	(32e) =	37.7 3689.0001 250 5.54	(29 (31 (32 (32
Party f Party c * for win ** includ Fabric Heat c Therm For deal Can be u Therm # details Total fo Ventila	loor ceiling dows and le the area heat los apacity al mass gn assess used inste- al bridge of therma abric heat tion heat Jan 37.3	roof winds as on both as, W/K = Cm = S(parame cments wh ad of a del es : S (L af bridging at loss at loss ca Feb 35.9	, m ² sides of in = S (A x A x k) ter (TMF ere the de tailed calco x Y) call are not kn alculated Mar 35.9	ffective will ternal wait U) P = Cm - tails of the station. culated own (36) f month! Apr	ndow U-va ts and part ► TFA) ir construct using Ap ► 0.15 x (3 y May	37.23 50.4 52.7 52.7 52.7 52.7 52.7 52.7 52.7 52.7	t known pr	0.35 formula f (26)(30) ecclosely the	((1/U-valu) (+ (32) = ((28) Indica <i>i</i> indicative (33) + (38)m Sep 32.18	$(36) = 0.33 \times (0.33)$	2) + (32a). : Medium <i>TMP in Tr</i> 25)m x (5) <u>Nov</u> 34.58	(32e) =	37.7 3689.0001 250 5.54	(29 (31 (32 (32 (33 (34 (35) (35) (35) (37)

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	ss parar	neter (H	ILP), W/	m ² K					(40)m	= (39)m +	(4)			
40)m=	1.53	1.5	1.5	1.45	1.42	1.41	1.4	1.4	1.43	1.45	1.48	1.5		
umbe	veb to v	s in mor	nth (Tabl	e 1a)		1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -		di (di	1	Average -	Sum(40),	u /12=	1.45	(40
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m=	31	26	31	30	31	30	31	31	30	31	30	31		(41
			gy requi	rement							_	kWh/yea	15	
	ed occu A > 13.9			[1 - exp	(-0.0003	149 x (TI	FA -13.9)2)] + 0.0	0013 x (1	TFA -13		77		(4)
	A£13.9			5 m										-
								(25 x N) to achieve		e target o		.24		(43
t more	that 125	itres per p	person per	day (ali w	ater use, i	hot and co	id)							
ot wate	Jan trusage in	Feb Ntres per	Mar day for ea	Apr ch month	May Vd,m = fa	Jun ctor from	Jul Table fc x	Aug (43)	Sep	Oct	Nov	Dec		
4)m=	65.27	85.06	01.05	78.64	75.43	72.22	72.22	75.43	78.64	81.85	85.06	88.27		-
ergy c	content of I	hot water	used - cal	culated m	anithly = 4.	190 x Vd,	n x nm x L	0006 / mTC		and in case of the local division of the loc	m(44),	internet internet	962.92	(4
-m(5	131.21	114,76	118.42	103.24	99.06	05,40	79.21	90.9	91.98	107.2	117.02	127.07		
						1				Total = Bu	m(45) _{1.0} *		1265.00	(4
nstant	arieous w	ater heally	ng at point	of use (n	hot water	atorage),	enter 0 In	poxes (46)	10 (61)					10
100	19.65 storage	17.21	17.76	15.49	14.00	12.82	11.68	13.63	13.8	16.08	17.55	19.06		(4
	-	1	clared lo	ss facto	r is know	vn (kWh	day):				—	0		(4
			m Table				13				<u> </u>	0		(4
			storage		ear			(47) x (48)	-		1	0		(4
			red cylin			s not kn	own:							10
ylinde	er volum	e (litres) includir	ng any s	olar stor	age with	nin same				1	50		(5
			no tank in t water (thi					enter '0' In	bax (50)					
ot wa	ter stora	ge loss	factor fr	om Tab	le 2 (kW	h/litre/da	av)				0	02		(5
	e factor f	1000			0.000.000							93		(5
			m Table	2b								54		(5
nergy	lost from	n water	storage	kWh/y	ваг			((50) x (51) x (52) x ((53) =	1	44		(5
	49) or (5											44		(5
later (storage	loss cal	culated f	or each	month			((56)m = (55) × (41)r	m				
Charles 1		40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53		(5
	44.53			10.00	m = (56)m	x ((50) - (H11)] + (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendix	н	
6)m=		dedicate	d solar sto	rage, (57)										
5)m= ;ytinde		dedicate 40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53		(5
5)m= ;ylinde 7)m=	er contains 44.53	40.22	44.53	43.09	44.53		44.53	44.53	43.09	44.53	_	44.53		
5)m= (cylinde 7)m= (rimary rimary	44.53 y circuit y circuit	40.22 loss (an loss cal	44.53 nual) fro culated f	43.09 m Table for each	44.53 9 3 month (43.09 59)m =	(58) ÷ 30	65 × (41)	m		0			
5)m= [cylinde 7)m= [rimary rimary (mod	44.53 44.53 y circuit y circuit dified by	40.22 loss (an loss cal factor fr	44.53 inual) fro culated f rom Tabl	43.09 m Table for each le H5 if t	44.53 9 3 month (here is s	43.09 59)m = solar wa	(58) ÷ 30 ter heati	65 × (41) ng and a	m cylinder	r thermo	stat)	10		(5
5)m= [cylinde 7)m= [rimary rimary (mod	44.53 y circuit y circuit	40.22 loss (an loss cal	44.53 nual) fro culated f	43.09 m Table for each	44.53 9 3 month (43.09 59)m =	(58) ÷ 30	85 × (41)	m		0			(5
6)m= cylinde 7)m= rimary rimary (mod 9)m=	44.53 44.53 y circuit y circuit dified by 51.81	40.22 loss (an loss cal factor fr 46.79	44.53 inual) fro culated f rom Tabl	43.09 m Table for each le H5 if t 50.14	44.53 = 3 month (here is a 51.81	43.09 59)m = solar wa 50.14	(58) ÷ 3(ter heati 51.51	85 × (41) ng and a 51.01	m cylinder	r thermo	stat)	10		(5 (5 (5



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n + (59)m + (61)m
41 (62
ing)
(63
41
2399.84 (64
9)m]
32 (05
ly heating
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ic l
9 (00
6 (67
-
44 (05
-
5 (09
(70
_
79 (71
38 (72
42 (73
Gains (W)
(W)
(W) (76
(W) - 78.61 (76 - 152.36 (76
(W) - 78.61 (76 - 152.36 (76 - 243.52 (76

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11.32

11.32

x

×

112.64

95.03

x

×

0.72

0.72

x

×

0.7

0.7

.

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445.55

387.78

(76)

(76)

East

East

0.9

0.9x

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East	0.9x	1	x	11.	32	×	73.6	*	0.72	×	0.7		291.14	(70
asr.	0.9x	1	x	11.	32	x 4	6.91) x [0.72] × [0.7	[185,55	(70
ast	0,9x	1	x	11	32	x 2	4.71	x [0.72] × [0.7	<u> </u>	97.73	(70
ast	0.9x	1	×	11	32	x 1	6.39	x [0.72	× [0.7	- - [64.54	(70
iolar g	ains in	watts, ca	alculated	l for eac	h month	5		(ð3)m = S	um(74)m	(62)m				
53)m=	78.61	152.36	243.52	361.57	439.93	459.04	445.55	387.78	291.14	105.55	97.73	64.84		(8)
fotal g	ains – i	nternal a	and solar	r (84)m =	= (73)m ·	+ (83)m	, watts	1 0		2		3		
64)m=	478.03	548.91	628.29	728.4	789.29	791.93	768.21	716.67	629.8	542.33	474.71	456.26		(6
7. Me	an inter	nal temp	erature	(heating	season)								
Temp	erature	during h	eating p	eriods i	the livi	ng area	from Tal	ble 9, Th	1 (°C)			Г	21	(8)
		-	ains for			-								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
-m(86	0.99	0.95	0.96	0.9	0.76	0.57	0.39	0.42	0.71	0.92	0.95	0.99		(0)
	17.1	1	19 8.9											
			1	-	20.83	20.96	20.99	7 in Tabl	-		10.00	10.00		(8
67)m=	19.57	19.78	20.12	20.51	20.03	20.96	20.99	20.99	20.9	20.53	19.95	19.62		10
Temp	erature	during h	neating p	eriods i	rest of	dwelling	from Ta	able 9, T	h2 (°C)					
-in(60	19.67	19.69	19.69	19.73	19.75	19.76	19.77	19.77	19.74	19.73	19.71	18.69		(0)
Utilisa	ation fac	tor for a	ains for	rest of d	welling.	h2.m (se	e Table	9a)						
-m(65	0.99	0.97	0.94	0.00	0.69	0.47	0.27	0.29	0.61	6 6 D	0.97	0.99		(8)
	-		-	about the second	- C - A	TO /			The Tabl	- 0-1	1			
Mean 90)m=	15.42	10.04	10.97	the rest	19.00	19.74	19.77	19.77	19.7	19.35	18.82	10.40		(9
50)11-	10.42	10.04	10.97	19.30	19.00	15.74	ABUTE	19.77	-	LA = Livin				_
		100 37	A							LA CITI	Amen - t	- L	0.49	(9
Mean	interna	temper	ature (fo	r the wh	ole dwe	ling) = f	LA × T1	+ (1 - fL	A) × T2					
	100.000	19.2	19.54	19.93	20.23	20.34	20.37	20.37	20.29	19.95	19.38	19.05		(9)
92)m=	18.99	10.2	CONCERNITY.				Table	An who	ere appr	opriate				
			he mear	n interna	temper	ature fro	m lable	- + C , will C	ne appr			and the second se		
Apply			he mear 19.54	n interna 19.93	20.23	20.34	20.37	20.37	20.29	19.95	19.38	19.05		(9)
Apply 93)m=	adjustn 18.99	nent to t 19.2	1	19.93		-	-	1		-	19.38	19.05		(9
Apply 93)m= 8. Sp	adjustn 18.99 aca hea	nent to t 19.2 ting regi	19.54 uirement	19.93	20.23	20.34	20.37	20.37	20.29	19.95	-	19.05 Id re-calcu	late	(9
Apply 93)m* 8 Sp Set T	adjustn 18.99 ace hea i to the r	nent to t 19.2 ting regi mean int	19.54 uirement	19.93 mperatu	20.23 re obtair	20.34	20.37 ep 11 of	20.37	20.29	19.95	-	1. S.A.	late	(9
Apply 93)m* 8 Sp Set T	adjustn 18.99 ace hea i to the r	nent to t 19.2 ting regi mean int	19.54 uirement temal ter	19.93 mperatu	20.23 re obtair	20.34	20.37	20.37	20.29	19.95	-	1. S.A.	late	(9
Apply 93)m= 8 Sp Set T the ut	adjustn 18.99 ace hea i to the r tilisation Jan ation fac	nent to t 19.2 ting requ mean int factor fo Feb tor for g	19.54 ternal ter or gains Mar ains, hm	19.93 mperatu using Ta Apr	20.23 re obtair able 9a May	20.34 ied at st	20.37 ep 11 of	20.37 Table 9	20.29 b, so tha	19.95 t Ti,m=(76)m an	id re-calcu	late	
93)m* 8 Sp Set T the ut	adjustn 18.99 ace hea i to the r tilisation Jan	nent to t 19.2 ting requ mean int factor fo Feb	19.54 ternal ter or gains Mar	19.93 mperatu using Ta Apr	20.23 re obtair ible 9a	20.34 ied at st	20.37 ep 11 of	20.37 Table 9	20.29 b, so tha	19.95 t Ti,m=(76)m an	id re-calcu	late	
Apply 93)m* 8 Sp Set T the ut Utilisa 94)m* Usefu	adjustr 18.99 ace hea i to the r iilisation Jan Jan ation fac 0.95 al gains,	nent to t 19.2 ting requ mean int factor fo Feb tor for g 0.97 hmGm	19.54 aremal ter or gains Mar ains, hm 0.94 , W = (94	19.93 mperatu using Ta Apr 1: 0.87 4)m x (8	20.23 re obtair able 9a May 0.72 4)m	20.34 ied at str Jun 0.52	20.37 ep 11 of Jul 0.33	20.37 Table 9 Aug 0.35	20.29 b, so tha Sep 0.00	19.95 tt Ti,m=(Oct 0.89	76)m an Nov 0.97	Dec	late	(9
Apply 93)m= 8 Sp Set T the ut Utilisa 94)m= Usefu	adjustn 18.99 ace hea i to the r illisation Jan ation fac 0.98	nent to t 19.2 ting requ mean int factor fo Feb tor for g 0.97	19.54 urement ternal ter or gains Mar ains, hm 0.94	19.93 mperatu using Ta Apr 1: 0.87	20.23 re obtair ble 9a May 0.72	20.34 ied at sti Jun	20.37 ep 11 of Jul	20.37 Table 9 Aug	20.29 b, so tha Sep	19.95 tt Ti,m=(Oct	76)m an Nov	id re-calcul	late	(9
Apply 93)m= 8 Sp Set T the ut Utilisa 94)m= Usefu 95)m=	adjustr 18.99 ace hea i to the r illisation Jan ation fac 0.95 al gains, 470.2	nent to t 19.2 ting requ mean int factor fo Feb tor for g 0.97 hmGm 533.45	19.54 aremal ter or gains Mar ains, hm 0.94 , W = (94	19.93 mperatu using Ta Apr 1: 0.87 4)m x (8 632.04	20.23 re obtain ble 9a May 0.72 4)m 565.73	20.34 ed at st Jun 0.52 412.5	20.37 ep 11 of Jul 0.33	20.37 Table 9 Aug 0.35	20.29 b, so tha Sep 0.00	19.95 tt Ti,m=(Oct 0.89	76)m an Nov 0.97	Dec	late	(9
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Space heating: Fraction of space heat from secondary/supplementary system (201) 0.1 (202) = 1 - (201) =Fraction of space heat from main system(s) 0.9 (202) Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 0.9 (204) Efficiency of main space heating system 1 78.9 (206) Efficiency of secondary/supplementary heating system, % 208) 100 Jan Feb Mar Apr May Sep Oct Nov Dec kWh/year Jun Jul Aug Space heating requirement (calculated above) 516.36 396.66 310.83 104.04 55.41 0 361.42 ö 0 160.19 495.67 0 (211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206) (211) 591.28 452.7 354.56 187.11 63.21 0 Ċ. 0 Ő. 182.72 412.26 565.63 Total (kWh/year) =Sum(211) 2812.68 (211) Space heating fuel (secondary), kWh/month = {[(98)m x (201)] + (214) m } x 100 ÷ (208) (215)m- 51.84 39.69 31.08 10.4 5.54 16.02 36.14 49.67 0 0 0 0 Total (kWh/year) =Sum(215). 246.55 (215)Water heating Output from water heater (calculated above) 227.55 201.77 214.76 196.47 195.4 195.4 178.71 175.55 167.23 185.21 203.53 210.24 223.41 Efficiency of water heater (216) 65.8 (217)m= 75.20 74.93 (217) 74.17 72.8 70.04 65.5 68.8 65.0 65.5 72.66 74.0 75.23 Fuel for water heating, kWh/month (219)m = (64)m x 100 + (217)m (219)m = 302.26 269.26 269.54 2 269.65 276.62 258,76 255.10 272.14 209.2 200.13 251.83 296.97 Total 33.22.75 (219) Annual totals kWh/year kWh/year Space heating fuel used, main system 1 2612.68 Space heating fuel used, secondary 246.55 Water heating fuel used 3322.79 Electricity for pumps, fans and electric keep-hot central heating pump: (230c) 130 boiler with a fan-assisted flue (230e) 45 Total electricity for the above, kWh/year sum of (230a)...(230g) = (231) 175 Electricity for lighting (232) 413.38 Energy Emission factor Emissions kWh/year kg CO2/kWh kg CO2/year (211) x Space heating (main system 1) (261)0.194 545.66 (215) x Space heating (secondary) 0.422 104.05 (203) Water heating (219) x 0.194 (264) 644.62

TER WorkSheet: New dwelling design stage

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TER WorkSheet: New dwelling design stage





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APPENDIX E

Business Unit- Typical BRUKL Data Output



BRUKL Output Document

🛞 HM Government Compliance with England and Wales Building Regulations Part L 2010

Project name

Lower Ground Floor Units

Date: Tue Sep 09 12:28:44 2014

Administrative information

Building Details Address: London,

Certification tool

Calculation engine version: v4.1.d.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v3.0.0

BRUKL compliance check version: v4.1.d.0

Address: , ,

Telephone number:

Owner Details

Name:

Certifier details Name: Darryl Vardill

Telephone number: Address: ...

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

1.1	CO2 emission rate from the notional building, kgCO2/m2.annum	19.9
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.9
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	6.9
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	Ua-Limit	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	Lower Ground Floor - Employment use EAST
Floor	0.25	0.11	0.11	Lower Ground Floor - Employment use EAST
Roof	0.25	0.18	0.18	Lower Ground Floor - Employment use EAST
Windows***, roof windows, and rooflights	2.2	1.6	1.6	Lower Ground Floor - Employment use EAST
Personnel doors	2.2	-	-	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No heat loss vehicle access doors"
High usage entrance doors	3.5	-	-	"No heat loss high usage entrance doors"
Usums = Limiting area-weighted average U-values [W/(m*K)] UsCak = Calculated area-weighted average U-values [W/(m*K)]			Uscale = C	alculated maximum individual element U-values [W/(m²K)]
* There might be more than one surface where the n				

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 ^a /(h.m ²) at 50 Pa	10	5

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Calculation engine: SBEM

140904-2601-6- EN Statement-DV

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Shell and Core

As designed



2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- CHP PV

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(I/s)]	HR seasonal e	efficiency
0.93	-	-	-	
Automatic monitoring & targe	ting with alarms for out-of-ran	ge values for this H	IVAC system	YES

1- Project DHW

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
Hot water provided by HVAC system	-

"No zones in project where local mechanical ventilation or exhaust is applicable"

Shell and core configuration	
------------------------------	--

Zone	Assumed shell?
Lower Ground Floor - Employment use EAST	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
Lower Ground Floor - Employment us	62 E005 T	-

Criterion 3: The spaces in the building should have propriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lower Ground Floor - Employment us	eNEA(SIT2%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use		
Area [m²]	Actual 484.9	Notional 484.9	% Area Building Type A1/A2 Retail/Financial and Professional services		
External area (m ²) Weather Infiltration (m ³ /hm ² @ 50Pa) Average conductance (W/K) Average U-value (W/m ² K) Alpha value* (%)	1167.3 LON 5 232.77 0.2	1167.3 LON 5 367.04 0.31	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 Inst.: Hospitals and Care Homes C2 Residential Inst.: Residential schools		
	na value* [%] 15.12 11.55 entage of the building's average heat transfer coefficient which is due to thermal bridging		. C2 Residential Inst.: Universities and colleges C2A Secure Residential Inst. Residential spaces D1 Non-residential Inst.: Community/Day Centre D1 Non-residential Inst.: Litrarles, Museums, and Gallerles D1 Non-residential Inst.: Education D1 Non-residential Inst.: Primary Health Care Building D1 Non-residential Inst.: Crown and County Courts D2 General Assembly and Leisure, Night Clubs and Theatre		

Others: Passenger terminals Others: Emergency services Others: Telephone exchanges 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	22.23	28.73		
Cooling	0	0		
Auxiliary	1.68	0.98		
Lighting	14.77	19.15		
Hot water	4.52	3.51		
Equipment*	42.19	41.13		
TOTAL	36.9	52.38		

* Energy used by equipment does not count towards the total for calculating emissions.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	8.16	0
Wind turbines	0	0
CHP generators	6.3	0
Solar thermal systems	0	0

Energy & CO ₂ Emissions Summary				
	Actual	Indicative Target		
Heating + cooling demand [MJ/m ²]	165.47	184.84		
Total consumption [kWh/m ²]	36.9	52.38		
Total emissions [kg/m ²]	6.9	19.9		

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ŀ	IVAC Sys	stems Per	formanc	e						
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2		Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST	[ST] Central heating using water: radiators, [HS] District heating, [HFT] District Heating, [CFT] Natural Gas									
	Actual	23.2	107.5	7.4	0	1.7	0.87	0	0.93	0
	Notional	81.9	102.9	28.7	0	1	0.79 / 0.81	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

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Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

U i-Тур	Ui-Nin	Surface where the minimum value occurs*		
0.23	0.2	Lower Ground Floor - Employment use EAST_W_5		
0.2	0.11	Lower Ground Floor - Employment use EAST_S_3		
0.15	0.18	Lower Ground Floor - Employment use EAST_R_4		
1.5	1.6	Lower Ground Floor - Employment use EAST_G_8		
1.5	-	"No heat loss personnel doors"		
1.5	-	"No heat loss vehicle access doors"		
1.5	-	"No heat loss high usage entrance doors"		
Ū.		U _{MM} = Minimum individual element U-values [W/(m ² K)]		
* There might be more than one surface where the minimum U-value occurs.				
	0.23 0.2 0.15 1.5 1.5 1.5 1.5 1.5	0.23 0.2 0.2 0.11 0.15 0.18 1.5 1.6 1.5 - 1.5 - 1.5 - 1.5 - 1.5 -		

A	ir Permeability	Typical value	This building
m	³ /(h.m²) at 50 Pa	5	5

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APPENDIX F

KINGS CROSS ENERGY CENTRE CORRESPONDENCE



From: Sent:	Paul Dakin 07 February 2014 12:15
To:	Chris Rowe
Cc:	Paul Bushell; 'Clare Hebbes'; Robert Clarke
Subject:	RE: 140128 2601-6 101 Camley Street Mixed Use Development

Dear Chris

In response to your previous e mail requesting the feasibility of supplying 485kw heat/hot water load from the Kings Cross energy centre to your site, having discussed this with both our technical team and the client I can advise that we do not believe this to be a feasible option. The reasons are as you have stated previously that the location of your site would be difficult to serve due to the crossing of the canal and the network rail and the associated legal/easement requirements that would need to be secured from the relevant parties.

Best Regards

Paul

From: Chris Rowe Sent: 28 January 2014 14:05 To: Paul Dakin Cc: Paul Bushell Subject: 140128 2601-6 101 Camley Street Mixed Use Development

Dear Mr Dakin

I have been given your name via Vital Energy and note you are responsible for the Kings Cross Development CHP Energy Centre

We have been requested as part of our Planning Application (planned not submitted yet) by Camden to enquire about the potential for the KC CHP plant to serve our development also

We have a heating/hot water demand of approx. 485kw and would appreciate your thoughts on the feasibility of supplying such a load to our site; lattach a site plan showing your site and ours and their relationship

Appreciate the issue of the Network Rail line and Canal but as noted above would be pleased to receive your initial comments

Kind Regards, Chris Rowe Director

Slender Winter Partnership Ltd

The Old School London Road Westerham Kent TN16 1DN

T: +44(0)1959 564777 W: www.swoltd.co.uk

Registered in England: 3735841 VAT Registration: 794 1182 14



APPENDIX G

KSR - DESIGN FOR SHADING



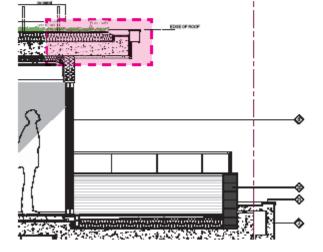
DESIGN FOR SHADING

The external building envelope has been designed to minimise excessive solar heat gain in particular south and west facing facades. Deep balconies and external blinds have been provided as necessary. All 121 units have at least one of following features;

1) Deep roof overhang (on Penthouse unit)

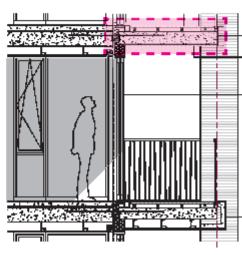
2) Typical deep balconies for main living area (shown as Green Dot)

3) External blind (shown as Blue Dot)



TYPICAL SECTION 1

Deep roof overhang on penthouse unit (refer to planning drawing CML-334 for further detail)



TYPICAL SECTION 2 Deep balcony (refer to planning drawing CML-330 for further detail)



external venetian blind 10.00 TYPICAL SECTION 3

External Blind (refer to planning drawing CML-332 for further detail)

101 CAMLEY STREET SUPPLEMENTARY SUBMISSION

DESIGN FOR SHADING



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