

Section 73 (Ref. 2015/1243/P) Revised Energy Strategy

44 Gloucester Avenue

On behalf of Victoria Square Property Company

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Planning Masterplanning Architecture Renewable Energy Sustainable Development

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1.0 Introduction

- 1.1 This revised Energy Strategy has been prepared by Metropolis Green on behalf of Victoria Square Property Company in relation to the Section 73 amendments made to the approved development at 44 Gloucester Avenue, Camden, London, NW1 8JD.
- 1.2 The development of 44 Gloucester Avenue (Application Ref. 2015/1243/P) was granted full planning permission, subject to a Section 106 Agreement dated 30th November 2015.
- 1.3 The approved mixed-use development at 44 Gloucester Avenue comprises of:
 - "Demolition of existing buildings identified as Number 2 at the northwest corner of the site and Number 4 at the eastern corner of the site to provide a new ground plus 5 upper storey building along the north west part of the site and a ground plus 2 storey building at the eastern corner and refurbishment of existing building on site to create 40 residential units, employment floor area (Class B1a), car parking and landscaping within the courtyard with ancillary works."
- 1.4 The refurbished blocks A, C, E & F consist of 22Nos. residential units whereas new blocks B & D consist of 18Nos. residential units; and approximately 698m² of commercial space at basement and ground floor levels.
- 1.5 The original Energy Strategy for the approved development was prepared by XCO2 Energy, dated September 2015.
- 1.6 During the detailed design stages of the development, changes and improvements to the scheme were identified. As such, a revised Energy Strategy has been undertaken to reflect the minor amendments to the scheme and to ensure that the

- measures proposed in the original Energy Strategy submitted for planning by XCO₂ Energy have been implemented and met, where feasible.
- 1.7 This revised Energy Strategy details the design changes impacting the energy performance of the approved development and how the proposed changes will ensure compliance with GLA and LBC.'s energy targets.
- 1.8 A summary of the main changes and improvements to the fabric and M&E design include;
 - Existing external wall of the refurbished residential units to be retained with a U value of 2.10W/m2K
 - Existing external wall of the commercial units to be upgraded from 2.10W/m2 to 0.5W/m2K
 - New external wall of the new build units to be improved from 1.5W/m2K to 1.3W/m2K.
 - 60% of the total windows (windows facing Sunny Mews and Network Rail) to be affected by increased U value from 1.2W/m2K to 1.8W/m2K due to the requirement of fire rated windows.
 - Remaining 40% windows to be double glazed with a U value of 1.4W/m2K. A U value of 1.2W/m2K has not been possible to achieve for double glazed windows.
 - Major change to the building services design include replacement of individual gas boilers with communal gas boilers. Individual gas boiler to be retained for the private house.



- 12 new build residential units facing the railway tracks to be specified with cooling to mitigate overheating risks.
- Ventilation to all new build units will be provided via Mechanical Ventilation with Heat Recovery unit (MVHR).
- 36Nos. efficient PV panels of E20/333 to be specified to achieve the approved total system output of 11.9kWp requiring a roof area of 60m².
- 1.9 Based on the above changes and improvements, the revised energy calculation undertaken have demonstrated a marginal 3.6% reduction from the original 44.3% to the revised 40.7% CO₂ reduction. However, the revised calculation results demonstrate that scheme is still compliant by achieving an overall 40.7% reduction and exceeding the LP Policy 5.2 and LBC's DP 22 to achieve a 35% reduction in regulated carbon on 2013 Building Regulations.
- 1.10 Figure 1. Appendix A provides the floor plans from the 44 Gloucester Avenue development.

Figure 1 - Planned Development



Policy Requirements

- 1.11 This revised Energy Strategy prepared for the approved development at 44 Gloucester Avenue (Application Ref. 2015/1243/P) has considered the following key planning policies set out in the London Plan (LP), LBC's local core strategy (November 2010) and other relevant supplementary guidance:
 - LP Policy 5.2 and LBC's DP 22, requires developments to achieve a 35% reduction in regulated carbon on 2013 Building Regulations.
 - Relevant sections of LP Policy 5.3 on sustainable design and construction standards, regarding energy and carbon reduction have been addressed.



- Investigation of decentralised energy use on site or the possible integration of a Combined Heat and Power plant, in line with LP Policies 5.5 and 5.6.
- LP Policy 5.7 and LBC CS 13 encourages developments, to include on-site renewable energy technologies to achieve a 20% in carbon emissions.
- The potential for overheating must be addressed through the cooling hierarchy in line with LP Policy 5.9.
- 1.12 Appendix A of the report provides full details of national, regional, local policies and Building Regulations with regards to sustainability and energy conservation.

- 2.1 This document has been prepared in line with best practice¹ and the methodology that has been applied is in line with the widely adopted energy hierarchy and national calculation methodologies.
- 2.2 All energy and carbon figures have been calculated using approved Standard Assessment Procedure (SAP) software and Simplified Building Energy Modelling (SBEM), which are used to demonstrate compliance with Approved Documents Part L1A, L1B, L2A and L2B 2013 edition, and BREEAM requirements.
- 2.3 The London Plan promotes a 'regulated' energy approach to calculating the energy demand and carbon baseline of development. The baseline therefore includes the energy consumed in the operation of the space heating/cooling and hot water systems, ventilation and all internal lighting. Reported separately, are the carbon emissions from cooking and all electrical appliances which are not covered by the Building Regulations, this is called 'unregulated' energy.
- 2.4 All residential and commercial areas were modelled. Table 1 below provides the summary of the Notional Baseline results for the 44 Gloucester Avenue development. Detailed calculation results, sample As Designed SAP and BRUKL reports, can be found in Appendix C and D, of this report.



^{2.0} Methodology and Notional Baseline

¹ Energy Planning, Greater London Authority guidance on preparing energy assessments (March 2016)

- 2.5 Please note that the revised calculations in this report are based on the updated scheme drawings and detailed design specifications prepared by 21st Architecture Ltd. The M&E design and technical specifications are based on the M&E tender documents and technical specifications prepared by GDM Partnership Building Services Consultants Limited.
- 2.6 These results reflect the detailed As Designed stage SAP and SBEM calculations to achieve the targets set out in the Energy Strategy prepared by XCO2 Energy, dated October 2015.

Table 1 - Notional Baseline: CO₂ Emissions

Notional Baseline	Total
Regulated Carbon Emissions (tCO₂/yr)	218.6
Un-Regulated Carbon Emissions (tCO₂/yr)	102.7

3.0 Demand Reduction (Be Lean)

- 3.1 The first stage in the energy hierarchy is to improve the energy performance of the building through fabric and services improvements.
- 3.2 Metropolis Green have worked with 21st Architecture Ltd. and GDM Partnership to identify the proposed changes to the scheme and determine the most efficient and feasible way to reduce the carbon emissions of the development through both passive and active design measures.

Fabric: Changes and Improvements

- 3.3 21st Architecture Ltd. have placed particular consideration on the thermal performance of the construction build ups, providing significantly low U-values without impacting on space.
- 3.4 The changes to the fabric, fenestration and mechanical elements proposed during the detailed design stages are discussed below and the design parameters are detailed in Table 2 to 6.
- 3.5 In the approved original Energy Strategy, improvements were proposed to the external cavity wall of the existing building with increased insulation thickness. However, due to space constraints and loss of internal floor area, the existing external cavity walls for the refurbished residential units with a U value of 2.10W/m2K have been retained and are in compliance with Part L1B Building Regulations 2013.
- 3.6 However, the existing external cavity walls of the commercial areas have been upgraded from 2.10W/m2K to 0.50W/m2K and have therefore improved significantly due to the additional insulation levels.



- 3.7 Detailed architectural specifications have demonstrated that external wall U value of the new build units has been improved from 1.5W/m2K to 1.3W/m2K providing improved thermal performance and therefore reduced CO₂ emissions.
- 3.8 Further changes to the envelope include variations to the performance of the windows for the new build areas facing the Sunny Mews and Network Rail. Due to the requirement of fire rated windows on the external boundary of the development, achieving high thermal performance from this window type has not been feasible. The fire rated windows consists of clips around the edges creating cold bridging and therefore reducing the thermal performance. Detailed design specification of windows have demonstrated that approximately 60% of the total windows to the new build element of the scheme will be fire rated windows with a U Value of 1.8W/m².K
- 3.9 Furthermore, the thermal performance of the remaining 40% windows has been reduced from 1.2 W/m².K (from the original Energy Strategy) to 1.4 W/m².K. During the design development stage, manufactures specifications demonstrated that a U value of 1.2 W/m².K is not achievable for double glazed window. However, calculation results demonstrated that high specification double glazed windows with a U value of 1.4W/m².K can achieve the required thermal performance and contribute sufficiently towards reducing the total CO₂ emissions.
- 3.10 All existing windows have been upgraded to achieve a U value of 2.0 W/m².K and are better than Part L1B Building Regulations 2013 limiting parameters.
- 3.11 In summary, the thermal performance of the new and existing building fabric has been improved where feasible. However, elements where improvements have not been feasible i.e. existing external wall U value and windows with reduced thermal

performance, considerations have been given to comply with the limiting parameters set in Part L of the Building Regulations.

M&E Services: Changes and Improvements

- 3.12 In addition to the changes and improvements to the fabric and fenestration, following are the improvements being made to the mechanical systems and building services design.
- 3.13 The main change to the building services design is the replacement of individual boilers with communal boilers providing space heating and DHW to the whole site. The approved original Energy Strategy specified space heating and DHW to all residential and commercial units via individual gas boilers. However, during design development stage, calculations and detailed feasibility studies demonstrated that a communal boilers will offer the maximum benefits of reducing CO2 emissions of the site whilst delivering heat to all the residential units in the most efficient way.
- 3.14 The boiler plant will be located within a dedicated boiler/chiller plantroom located within the basement of the building. Three floor standing condensing boilers will generate low temperature hot water (LTHW) to meet the site heating demand. Communal condensing boilers with 97.9% seasonal efficiency are highly efficient boilers that have much lower fuel and running costs than individual gas boilers with SEDBUK efficiency of 89.5%.
- 3.15 Calculations undertaken have demonstrated that the proposed communal boilers with 97.9% seasonal efficiency provide the most optimal CO₂ savings for the site, hence providing a higher CO₂ savings when compared to the proposed individual gas boilers.
- 3.16 Due to technical feasibility and uncomplicated arrangement for provision and operation of services, the individual private house



- will have its own standalone system for delivering space heating and DHW via 89.5% SEDBUK 2009 efficiency individual gas boiler.
- 3.17 Further changes to the scheme include the specification of cooling to the new build residential units facing the Network Rail. Due to the orientation of 12 units within Block B and D facing network rail, these units will likely have a limited scope for opening windows due to air quality and noise impact arising from the adjacent railway tracks. As such, to avoid overheating and provide comfortable indoor conditions cooling has been specified to these units.
- 3.18 Comfort cooling to the 12 new residential units will be provided via void mounted or low level exposed or concealed fan coil units (FCUs), provided with chilled water from the central chilled water pipes which branch from the main riser to the heat exchanger in each apartment.
- 3.19 Due to adjacency of the railway tracks, the single house will also be specified with comfort cooling via standalone VRF condenser unit.
- 3.20 Other improvements include changing the ventilation system for the new build residential units and the private from local extract fans for toilets and kitchens to Mechanical Ventilation & Heat Recovery (MVHR). All refurbished units will be naturally ventilated with openable windows.
- 3.21 Space heating and cooling to all commercial units will be provided with ceiling mounted exposed cassette 4 pipe fan coil units (FCUs) to achieve the space design temperatures.
- 3.22 Ventilation to all commercial areas will be provided via Mechanical Ventilation with Heat recovery (MVHR) units.

- 3.23 In summary, the changes and improvements proposed to the M&E services design and efficiencies of systems have altered the energy performance of the development by marginally reducing the overall site-wide CO₂ emissions improvements.
- 3.24 The fabric parameters utilised in the revised Energy Strategy are listed in the Table 2 below. These parameters are compared alongside the parameters from the approved original Energy strategy.

Table 2 - Building Fabric Performance

Passive Design Measures	Approved Scheme (September 2015) (W/m²K)	Revised Scheme 2016 (W/m²K)
External Wall U-value (Refurbished Residential)	0.50	2.10
External Wall U-value (Refurbished Commercial)	0.50	0.50
External Wall U-value (New Build Residential)	0.15	0.13
Ground floor / Exposed floor U-Value (Refurbished Residential & Commercial)	0.25	0.25
Ground floor / Exposed floor U-Value (New Build Residential & Commercial)	0.10	0.10
Roof U-value (Refurbished Residential & Commercial)	0.18	0.18
Roof U-value (New Build Residential)	0.10	0.10
Windows U-values (Refurbished Residential & Commercial)	2.0	2.0



Windows U-values (fire rated) (New Build Residential facing Sunny Mews & Network Rail)	1.2	1.8
Windows U-values (other New Build Residential)	1.2	1.4

3.25 In addition to the fabric improvements, building services improvements are shown in Table 3 to 6 below.

Table 3 – Active Demand Reduction Measures (New Build Dwellings)

Active Design Measures	Approved Scheme (September 2015)	Revised Scheme (2016)
Space Heating System	Individual gas boilers	Communal gas boiler with 97.9% seasonal efficiency
DHW System	Individual gas boilers	Communal gas boiler with 97.9% seasonal efficiency with HIU located in each dwelling
Ventilation System	Local extract fans for Toilets and Kitchen	MVHR Vent Axia Kinetic Plus E
Cooling (New Build units facing railway tracks)	None	Comfort cooling via Water Cooled Chiller with SEER of 4.65
Water Consumption	105 litres per person per day or less	105 litres per person per day or less
Energy Efficient Lighting	100%	100%

Table 4 – Active Demand Reduction Measures (Refurbished Dwellings)

Active Design Measures	Approved Scheme (September 2015)	Revised Scheme (2016)
Space Heating System	Individual gas boilers	Communal gas boiler with 97.9% seasonal efficiency
DHW System	Individual gas boilers	Communal gas boiler with 97.9% seasonal efficiency with HIU located in each dwelling
Ventilation System	Naturally Ventilated with fully openable windows	Naturally Ventilated with fully openable windows
Cooling (REFURB)	None	None
Water Consumption	105 litres per person per day or less	105 litres per person per day or less
Energy Efficient Lighting	100%	100%

Table 5 - Active Demand Reduction Measures (New Build House)

Active Design Measures	Approved Scheme (September 2015)	Revised Scheme (2016)
Space Heating System	Individual gas boilers	Gas boiler, 89.5% SEDBUK 2009 efficiency, radiators, time and temperature zone control, weather compensator
Domestic Hot Water System	Individual gas boilers	Indirect cylinder 210 L, heat loss 1.9 kWh/24h



Ventilation System	Local extract fans for Toilets and Kitchen	MVHR Vent Axia Kinetic Plus E
Cooling	None	Individual VRF condenser unit (A+ rated)
Water Consumption	105 litres per person per day or less	105 litres per person per day or less
Energy Efficient Lighting	100%	100%

Table 6 - Active Demand Reduction Measures (Commercial)

Active Design Measures	Approved Scheme (September 2015)	Revised Scheme (2016)
Space Heating System	Individual gas boilers	Communal gas boiler with 97.9% seasonal efficiency to feed 4 pipe FCU
Domestic Hot Water System	Electric Point of use water heaters	Electric Point of use water heaters
Ventilation System	MVHR	MVHR system with 88% Heat recovery efficiency and SFP of 0.5 W/l/s or lower
Cooling	Comfort cooling via Chiller	Cooling via Water Cooled Chiller with SEER of 4.65
Energy Efficient Lighting	Energy efficient lighting with Occupant sensors	Luminaire efficacy of 85 lm/W, photoelectric control, metering with 'out of range' alarm

3.26 As a result of the revised fabric and M&E design measures, calculations results have demonstrated that a total 83.6 tonnes of $\rm CO_2$ can be saved, equating to a 38.3% improvement over the Notional Baseline, shown in Table 7.

Table 7 – Efficient Baseline: CO₂ Emissions

Efficient Baseline	Approved Scheme (September 2015)	Revised Scheme (2016)
Regulated Carbon Emissions (tCO₂/yr)	159	134.9
Total Improvement over Notional Baseline	42.5%	38.3%



4.0 Overheating and Cooling

- 4.1 Through the application of passive design and low energy measures, the design team have worked to reduce the risk of summer overheating in line with the 'cooling hierarchy' and London Plan Policy 5.9, as follows:
 - Minimising internal heat generation through energy efficient design
 - ii. Reducing the amount of heat entering the building in summer
 - iii. Use of thermal mass and high ceilings to manage the heat within the building
 - iv. Passive Ventilation
 - v. Mechanical Ventilation
 - vi. Comfort Cooling
- 4.2 Refer to Appendix E: Thermal Comfort analysis report for further information on the principles and methodology of the cooling hierarchy, and for details on how passive design and low energy strategies have been applied to the development to diminish the risk of overheating in summer.

Thermal Comfort analysis.

4.3 The GLA's Guidance on Preparing Energy Assessments, March 2016, states that developments should undertake Dynamic Simulation Modelling (DSM) to demonstrate that the proposed development does not overheat in the summer months. As such, Metropolis Green have modelled selected occupied areas against CIBSE TM52 criteria and TM49 future climate scenarios,

- in line with the LP's cooling hierarchy approach to address thermal comfort.
- 4.4 A sample of 10 expected worst performing residential units (i.e. mid and top floor residential units & units facing the railway tracks) and all commercial units were selected and simulated considering all aspects of occupancy, solar gains and predicted internal heat gains.

Conclusion: Overheating and Cooling.

- 4.5 Passive design considerations, natural ventilation, background mechanical ventilation to remove heat build-up, and internal blinds to selectively control solar gains, work together to prevent and mitigate overheating.
- 4.6 With expedient prevention and mitigation measures proposed at the detailed design stage, all of the residential units meet the TM52 thermal comfort overheating criteria for the main 'future near extreme summer' weather file (DSY1). Compliance with this standard demonstrates that the building is resilient to overheating during its lifetime.
- 4.7 Although all residential units are in compliance with the TM52 overheating assessment methodology, comfort cooling has been specified for 12 new build residential units in Blocks B, D and E1, adjacent to the railway tracks. It is considered that due to the air quality and noise impact arising from the adjacent railway tracks, these units will be subject to restricted window openings. In addition to the noise and air quality issues, the ground floor units will be subject to security issues with restricted window openings during day and night. As such, to mitigate overheating risks and maintain favourable internal conditions, cooling to these units has been specified.



- 4.8 Similarly, due to the location of the individual private house and adjacency of the railway tracks, cooling has been specified to the house via standalone (A+ rated) VRF condenser unit.
- 4.9 Commercial areas tend to have particularly high internal gains from equipment, people, lighting, with periods of occupation and activity typically through the hottest parts of the day.
- 4.10 However, even with expedient prevention and mitigation measures in place, all of the commercial units demonstrated non-compliance against the TM52 overheating criteria.
- 4.11 Therefore, to maintain specific internal conditions and to meet the market expectations and requirements of the occupants cooling has been specified to the commercial units via water cooled chillers.
- 4.12 The cooling demand of all the commercial spaces has been reduced significantly from the notional cooling demand of a standard commercial building by introducing improved passive and active design measures. This can be seen from the Efficient Baseline SBEM BRUKL report in Appendix D.
- 4.13 Refer to Appendix E: Thermal Comfort Analysis report prepared by Metropolis Green for further information on the principles and methodology of the cooling hierarchy, and for details on how passive design and low energy strategies have been applied to the development to diminish the risk of overheating in summer.

5.0 Heating Infrastructure Including CHP (Be Clean)

- 5.1 The Mayor's energy hierarchy and London Plan Policy 5.6 require all major developments to demonstrate that the proposed energy systems have been selected in accordance with the following hierarchy:
 - Connection to existing or planned area wide, low carbon heat distribution networks;
 - 2. Site wide heat networks:
 - Combined Heat and Power (CHP).

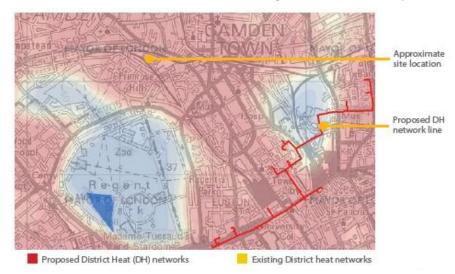
Connection to an Existing Heat Network

- 5.2 The approved original Energy Strategy prepared by XCO2 Energy identified the proposed District Heating Network on Euston Road, as the closest network (within 2km to the southeast) to the development site. Due to distance and subsequent large connection cost, this was not investigated further.
- 5.3 The original Energy Strategy also concluded that it is not considered economically or technically feasible to incorporate a communal heat system with a CHP for a predominantly refurbishment based and relatively small scale development, therefore, it was not investigated further.
- 5.4 Metropolis Green has further investigated the progress with the potential Euston Road District Heat Network and have not identified any additional progress or updates on expansion of this network. As shown in Figure 2, the London Heat Map tool identified that the Euston Road Network is potentially extending towards southeast and in the opposite direction to the site.



5.5 In addition to the above constraints, it is also identified that the site is located within a predominantly low rise area, mainly consisting of low density single dwellings on the south and railway tracks on the north. As such, due to a relatively low heat demand in the area around the site it is considered very unlikely for a heat network to come forward. Therefore, due to the reasons and constraints discussed above, the site has not been future proofed to connect to a future heat network.

Figure 2 - London Heat Map



Site Wide Heat Network and Combined Heat and Power

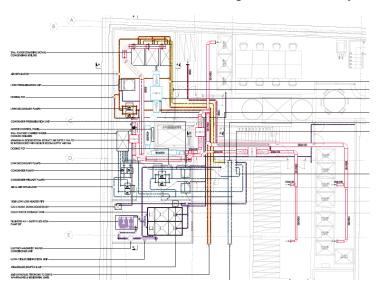
- 5.6 As stated in the approved original Energy Strategy, a CHP engine was investigated and found not suitable for the proposed development.
- 5.7 However, further major amendments to the building services elements of the scheme include the provision of site-wide communal plant serving heating and DHW to the entire development. The communal arrangement has demonstrated

improvements in CO₂ emission reduction of the scheme as compared to the approved scheme consisting of individual gas boilers.

Plantroom and Services Design

The boiler plant will be located within a dedicated boiler/chiller plantroom located within the basement of the building. Three floor standing condensing boilers will generate low temperature hot water (LTHW) to meet the site heating demand. Refer to Figure 3 below for the plantroom layout prepared by GDM Partnership Building Services Consultants Limited.

Figure 3 - Plantroom Layout



5.9 To maximise the efficiency of the communal plant, the communal gas boilers will include heat exchangers to maximise heat transfer from the burner whilst recovering useful heat, normally lost with the flue gases.



- 5.10 Heat Interface Units (HIUs) that incorporate plate heat exchangers will be used to transfer heat from the central plant to provide localised heating and hot water to each residential apartment.
- 5.11 The chiller plant will be located within the same basement plant. Two water cooled chillers will generate chilled water to meet the site cooling demand. Dry air coolers will be fitted on the roof for heat rejection purposes.
- 5.12 All residential apartments and the individual private house will be heated via underfloor heating, whereas bathrooms will be provided with electric towel heaters. The 12 identified new residential units consisting comfort cooling will be serviced via ceiling mounted fan coil units, fed by chilled water from the central chiller.
- 5.13 All commercial areas will be heated and cooled via ceiling mounted exposed cassette 4 pipe fan coil units, fed by chilled water from the central chiller.

6.0 Renewable Energy

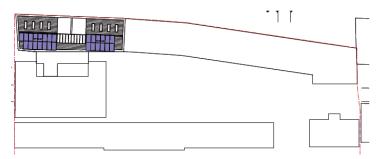
- The third stage of the energy hierarchy refers to the production of renewable energy, which relates to London Plan Policy 5.7 and LBC CS 13.
- 6.2 London Plan approved renewable energy technologies include:
 - Photovoltaics
 - Solar Water systems
 - Biomass Heating
 - Ground Source Heat Pumps
 - Air Source Heat Pumps
 - Wind
- The original Energy Strategy prepared by XCO2 Energy identified PVs as the most suitable technology for this development. An installation of 49 PV panels covering 78m² of roof area with 15% efficient PV panels (0.15kWp per panel), rated at a total system output of 11.8kWp was specified on the south-southwest facing areas of the roof. Please see the original PV layout in Figure 4 and 5 below;

Proposed area for PV panels

Figure 4 - Original PV layout - Fifth Floor



Figure 5 - Original PV layout - Sixth Floor



- 6.4 However, Metropolis Green have further investigated and found that the most efficient PV panel currently available is the Sunpower E20/333. As such, the approved total system output of 11.98kWp can be achieved by specifying 36Nos. PV panels of E20/333 having an out of 0.333kWp per panel and requiring a total roof area of approximately 60m².
- 6.5 For the purposes of the revised Energy Strategy, an efficient PV module of Sunpower E20/333 has been used, however there are a number of products available which may be selected and as such the PV array is subject to change.
- 6.6 The revised energy calculations have therefore concluded that 36Nos. Photovoltaic (PV) panels delivering 11.9kWp can provide a 2.5% reduction in CO₂ over the Notional Baseline, and 4% reduction over the Efficient Baseline.
- 6.7 An appropriate location for the 36Nos. PV panels was identified once the site constraints were taken into account. The factors considered were;
 - avoiding any potential overshadowing from adjacent PV panels or roof forms;

- space required for maintenance including all health and safety requirements for roof access;
- avoiding areas which are intended as outdoor spaces (e.g. terraces)
- Reduction of visual impact as far as possible due to the location of the site within a Conservation Area.
- 6.8 The PV panels have been positioned for optimal performance in terms of exposure to light, orientation and angle to reduce their visual impact. The panels are therefore south- southwest facing as far as possible. A revised PV array is illustrated in Figures 6 and 7 below.

Figure 6 - Revised PV Layout - Fifth Floor

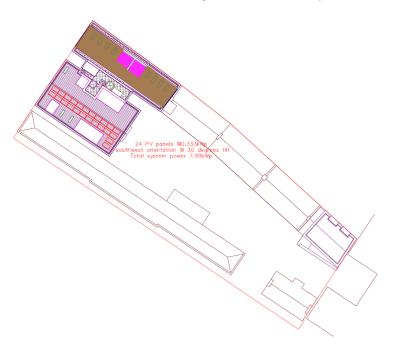
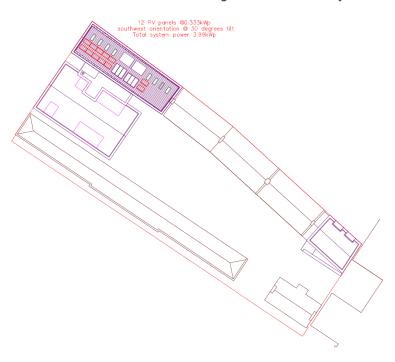




Figure 7 - Revised PV Layout - Sixth Floor



6.9 Table 8 below sets out the carbon emissions results from the revised energy calculations from the Renewables Baseline.

Table 8 – Renewable Baseline: CO₂ Emissions

Renewable Baseline	Consented Scheme (September 2015)	Revised Scheme (2016)
Regulated Carbon Emissions (tCO ₂ /yr)	154.2	129.6
& Improvement over Notional Baseline	1.7%	2.5%

7.0 Conclusion

- 7.1 A summary of all amendments and improvements to the fabric and M&E design is stated below;
 - The existing external wall U value of the refurbished residential units have been retained to 2.1W/m2K due to space implications. However, the existing external wall of the commercial units has been significantly improved from 2.1W/m2K to 0.5W/m2K.
 - Detailed architectural design specification and calculations have demonstrated improvement in the new build external wall U value from 1.5W/m2K to 1.3W/m2K providing improved thermal performance and therefore reduced CO₂ emissions.
 - The thermal performance of 60% of the total windows facing Sunny Mews and Network Rail has been affected due to the requirement for fire rated windows. As such, the U value of these windows has been increased from 1.2W/m2k to 1.8W/m2K. In addition, the remaining 40% windows have been proposed as double glazed windows with a realistic U value of 1.4W/m2K, as specified by the glazing manufacture. It was confirmed by the manufacturer that a U value of 1.2W/m2K is only achieved for triple glazed windows.
 - A considerable improvement to the building services design includes replacement of individual gas boilers with communal gas boilers providing space heating and domestic hot water to the apartments and commercial areas. Individual gas boiler has been retained for the individual private house.
 - Due to air quality, noise and security issues arising from the adjacent railway tracks, the 12 new build residential units



- facing the railway tracks have been specified with cooling to mitigate overheating risks.
- Ventilation to all new build units will be provided via Mechanical Ventilation with Heat Recovery unit (MVHR) of Vent Axia Kinetic Plus E or similar.
- 36Nos. efficient PV panels of E20/333 with a module output of 0.333kWP per panel has been specified to achieve the approved total system output of 11.9kWp requiring a comparatively less roof area of 60m² from the original 78 m².
- 7.2 As such, the revised energy strategy has maximised the carbon emissions reductions (where possible) calculated for the 44 Gloucester Avenue development. A total overall carbon reduction of 40.7% can be achieved through the energy strategy detailed in this report.
- 7.3 Site analysis and calculations have determined that:
 - A carbon reduction of 38.3% can be achieved with revised fabric and M&E measures.
 - The renewable strategy has determined that 36Nos. PV panels with a system size of 11.9 kWp, can deliver 2.5% reduction over the Notional Baseline and 4% reduction over Efficient Baseline.
- 7.4 Table 9 below demonstrates a marginal 3.6% reduction (from 44.3% to 40.7%) in the total carbon reduction improvement due to the proposed changes to the scheme at detailed design stage, as stated above. The revised calculation results demonstrate that scheme is still compliant by achieving an overall 40.7% reduction and exceeding the LP Policy 5.2 and LBC's DP 22 to achieve a 35% reduction in regulated carbon on 2013 Building Regulations.

- 7.5 Table 10 and 11 below provides a summary of the CO₂ emissions, and overall carbon reductions for the modelled baselines of the development at 44 Gloucester Avenue.
- 7.6 A summary of revised U-values and input parameters for the proposed development are shown in Appendix G.

Table 9 - Regulated CO2 Emissions Reduction

		Approved Scheme (September 2015)	Revised Scheme (2016)
Notional	Un-Regulated Carbon Emissions (tCO₂/yr)	92.3	102.7
Baseline	Regulated Carbon Emissions (tCO ₂ /yr)	276.6	218.6
Efficient Baseline	Regulated Carbon Emissions (tCO₂/yr)	159	134.9
	% Improvement over Notional Baseline	42.5%	38.3%
Renewable	Regulated Carbon Emissions (tCO ₂ /yr)	154.2	129.6
Baseline	% Improvement over Notional Baseline	1.7%	2.5%
Total Re	gulated Carbon Emission Improvement	44.3%	40.7%



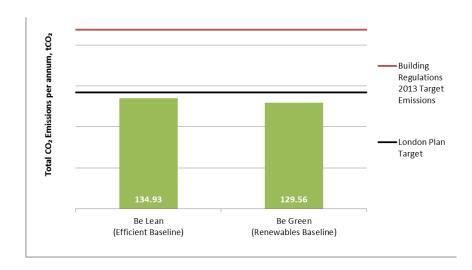
Table 10 - CO₂ emissions after Each Stage of the Energy Hierarchy

	Carbon dioxide emissions (Tonnes CO2 per annum)	
	Regulated	Unregulated
Building Regulations 2013 Part L Compliant Development	218.6	102.7
After energy demand reduction	134.9	102.7
After renewable energy	129.6	102.7

Table 11 - CO₂ savings after Each Stage of the Energy Hierarchy

	Regulated Carbon dioxide savings	
	Tonnes CO ₂ per annum	%
Savings from energy demand reduction	83.6	38.3%
Savings from renewable energy	5.4	4.0%
Total Cumulative Savings	89.0	40.7%
Total Target Savings	76.5	35.0%

Figure 8 – The Energy Hierarchy





Glossary

Building Emissions Rate (BER) or Dwelling Emission Rate (DER) - the actual building/dwelling CO2 emission rate. It is expressed in terms of the mass of CO2 emitted per year per square metre of the total useful floor area of the building (kg/m2/year). In order to comply with Part L of the Building Regulations, the BER/DER must be less than the TER (see below).

Combined Heat and Power (CHP) - defined as the simultaneous generation of heat and power in a single process.

Communal heating - a general term for a shared heating system where heat is supplied to multiple dwellings and/or non-domestic buildings using pipes containing hot water.

District Heat Network – a system for distributing heat generated in a centralized location for residential and commercial heating requirements such as space heating and water heating.

Individual gas boiler – a gas boiler is installed in a dwelling or a non-domestic building to provide the property with heat. In this case natural gas (rather than hot water) is piped to the property.

Kilowatt (kW) – One thousand watts. A watt is a measure of power.

Megawatt (MW) – One million watts. A watt is a measure of power.

Part L of the Building Regulations – Approved documents Part L of the Building Regulations relate to the conservation of fuel and power in new dwellings and new buildings other than dwellings respectively.

Regulated CO2 emissions – The CO2 emissions arising from energy used by fixed building services, as defined in Approved Document Part L of the Building Regulations. These include fixed systems for lighting, heating, hot water, air conditioning and mechanical ventilation.

Shared Heat Network – A heat network created as part of a new development which includes the connection of neighbouring buildings.

Simplified Building Energy Model (SBEM) - a computer program that provides an analysis of a building's energy consumption. The purpose of the software is to produce consistent and reliable evaluations of energy use in non-domestic buildings for Building Regulations compliance.

Site wide heat network – a set of flow and return pipes circulating hot water to the apartment blocks (and apartments contained therein) and non-domestic buildings on a development.

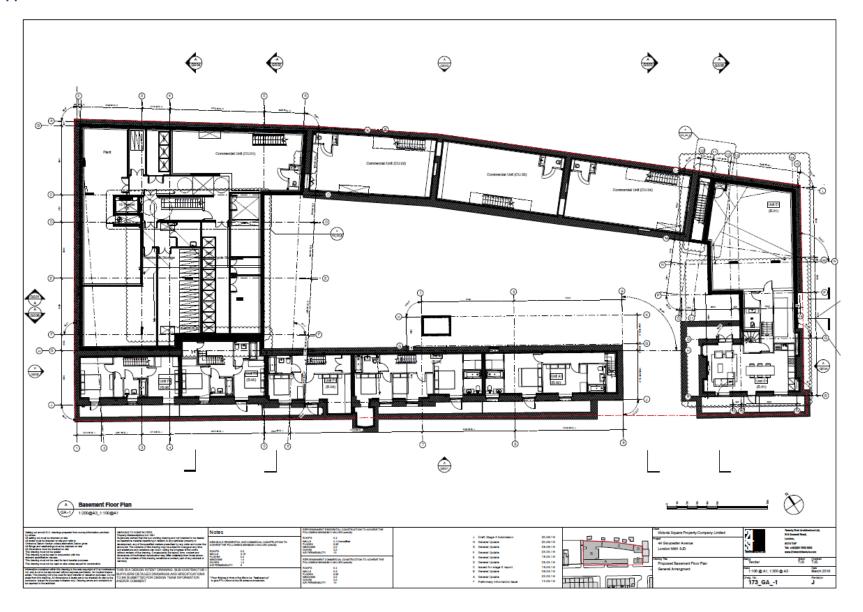
Standard Assessment Procedure (SAP) - a methodology for assessing and comparing the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of dwelling energy performances that are needed to underpin Building Regulations and other policy initiatives

Target CO2 Emission Rate (TER) - the minimum energy performance requirement for a new dwelling/building. It is expressed in terms of the mass of CO2 emitted per year per square metre of the total useful floor area of the building (kg/m2/year).

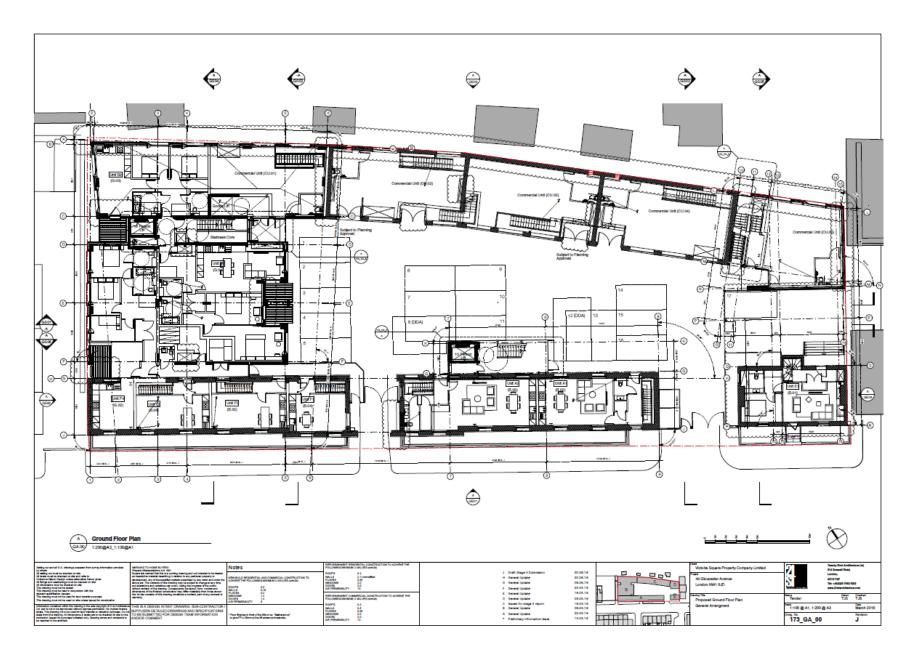
 $\label{lem:covered} \textbf{Unregulated CO}_2 \ \textbf{Emissions} - \text{carbon emissions from cooking and all electrical appliances which are not covered by the Building Regulations}$



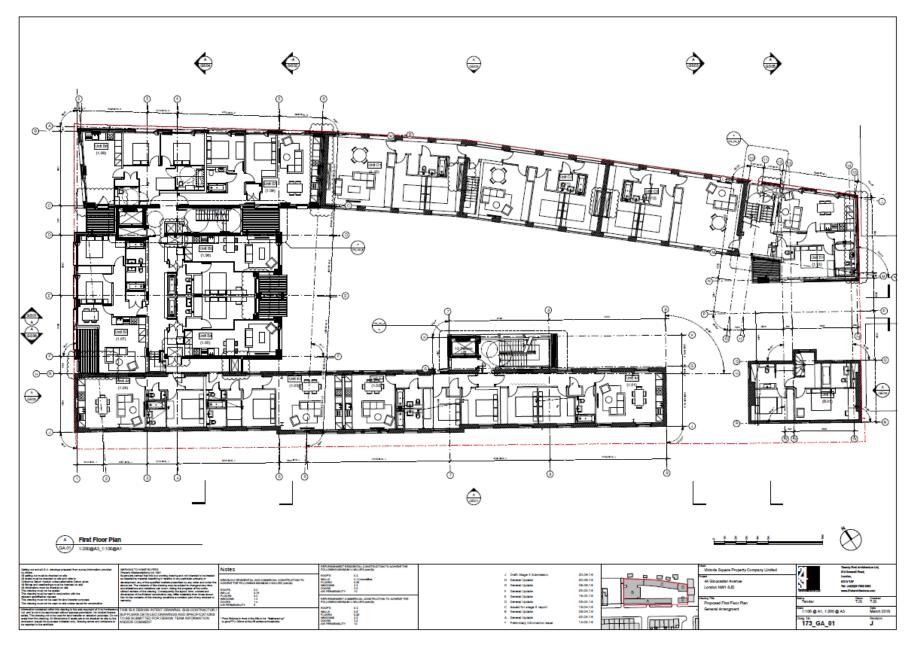
Appendix A – Floor Plans



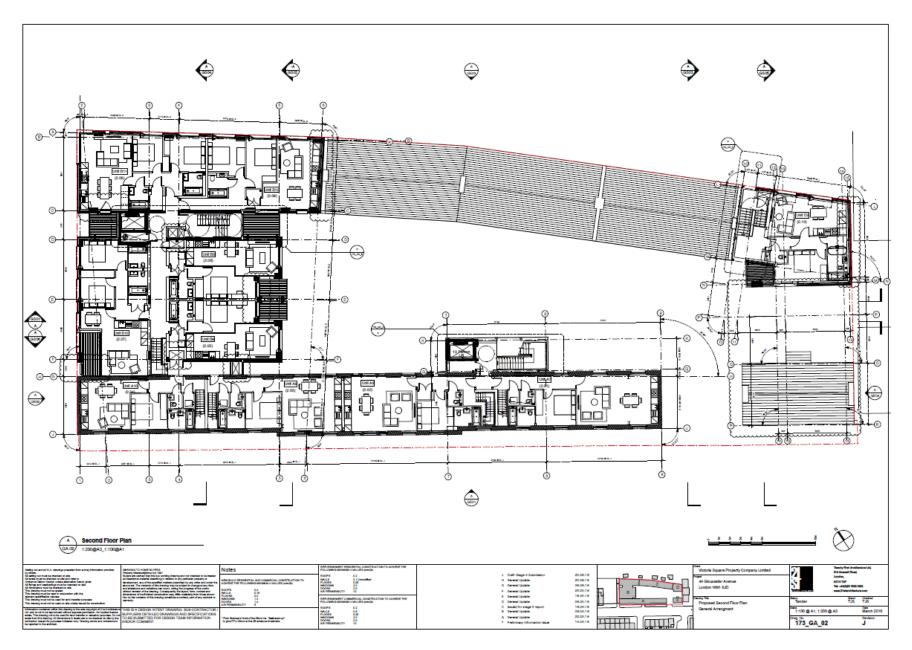




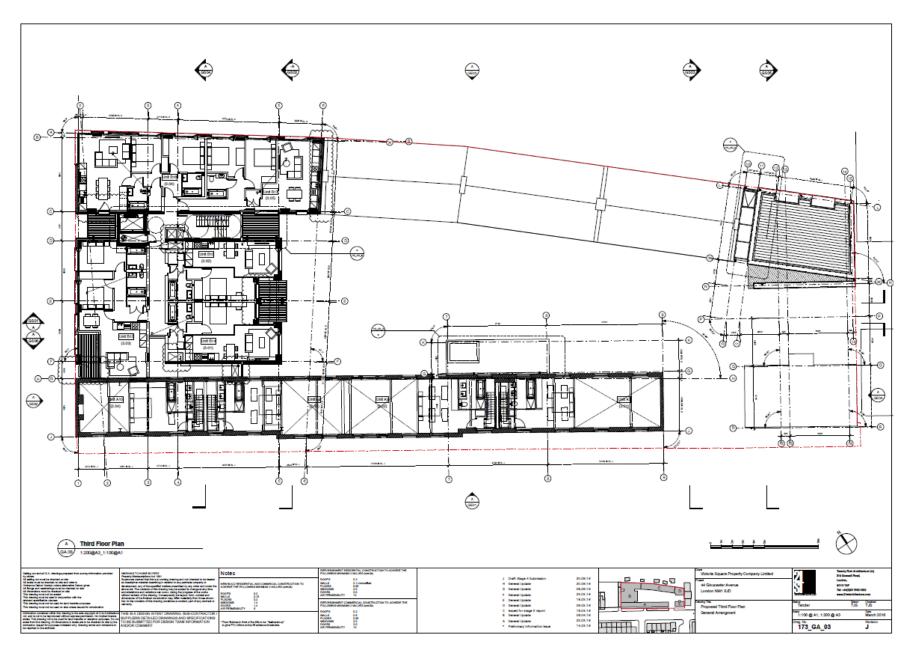




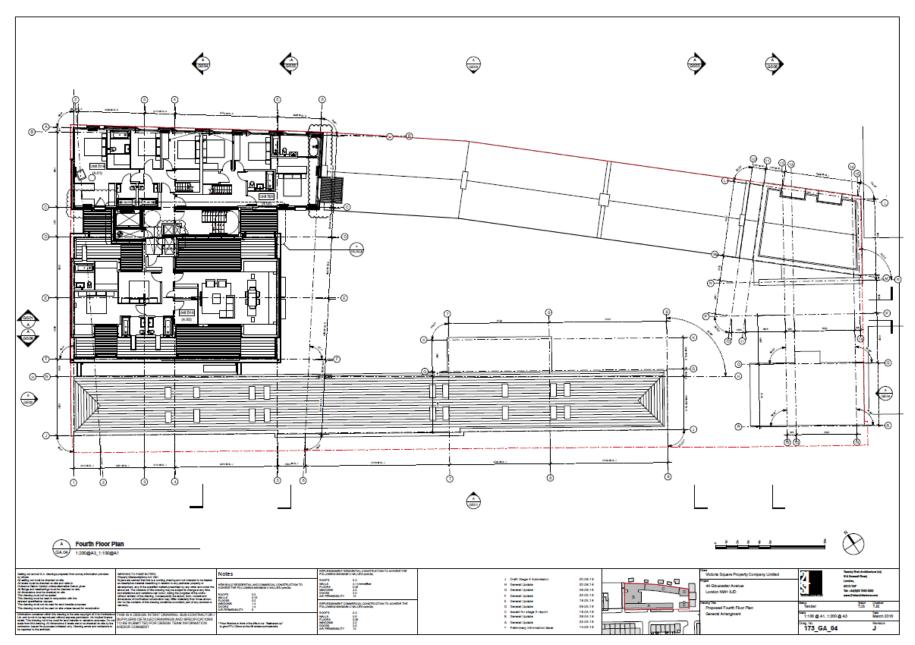




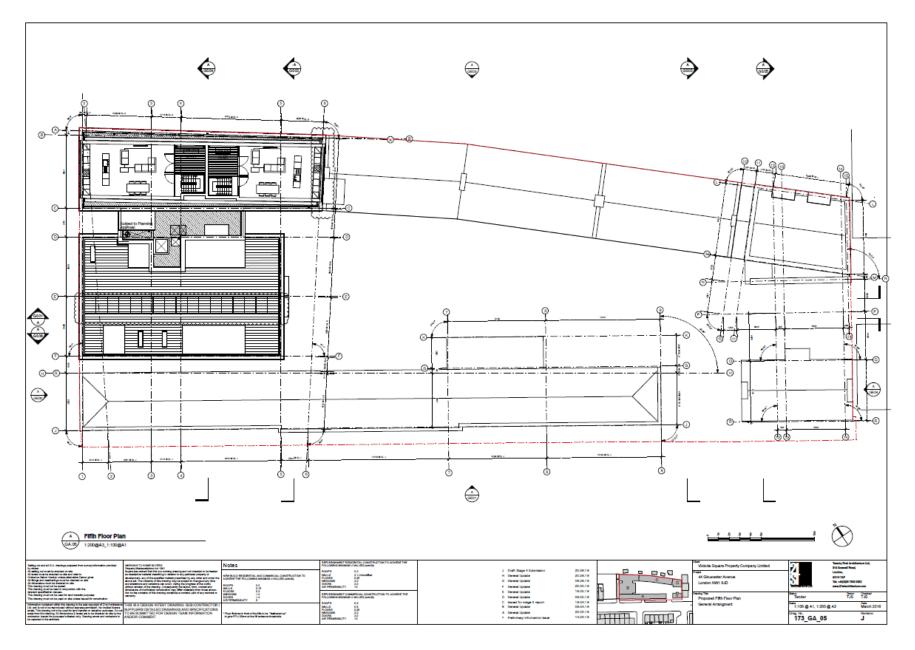




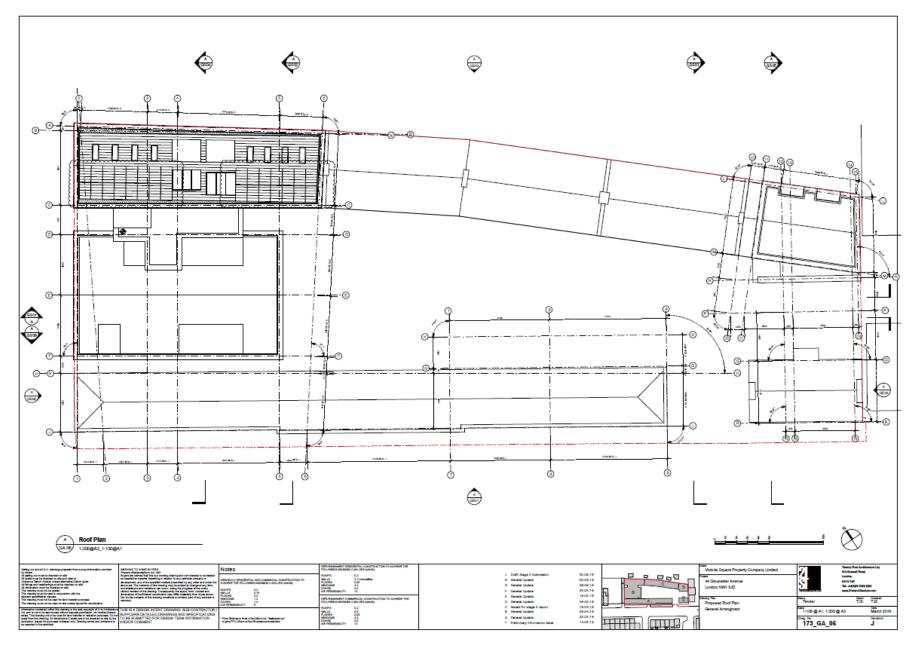














Appendix B - Policy Context

- B.0.1 The proposed development at Royal Docks must comply with a number of the following policies, regulations and standards which require the calculation of energy demand and carbon emissions:
 - Approved Document Part L1A, 2013 edition
 - London Plan and London Borough of Newham (LBN)
- B.0.2 The calculations of energy demand and carbon emissions are slightly different for each of the policies/standards; this is discussed in the sections below.
- B.0.3 Increased development of renewable energy resources and improvements in energy efficiency are vital to facilitating the delivery of the European, National, Regional and Local commitments on climate change. It is also worth noting that the EU has an ever increasing focus on carbon emissions and in February 2007, EU environment ministers agreed in principle to cut greenhouse gas emissions by 20% by 2020 based on 1990 levels.
- B.0.4 The key documents of relevance to this development are highlighted below.

B.1 National Policy

B.1.1 Sustainable development is the core principle underpinning planning. At the heart of sustainable development is the simple idea of ensuring a better quality of life for everyone, now, and for future generations. A widely used definition was drawn up by the World Commission on Environment and Development in 1987: "development that meets the

- needs of the present without compromising the ability of future generations to meet their own needs."
- B.1.2 Planning has a key role to play in the creation of sustainable communities: communities that will stand the test of time, where people want to live, and which will enable people to meet their aspirations and potential.

National Planning Policy Framework

- B.1.3 The National Planning Policy Framework (NPPF) was published in March 2012 and sets out the Government's planning policies for England, and how these policies are expected to be applied. The policies in the document, taken as a whole, constitute the Government's view of what sustainable development in England means in practice for the planning system.
- B.1.4 Paragraph 14 of the NPPF states that:

At the heart of the NPPF is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking. For decision-taking this means approving development proposals that accord with the development plan without delay.

B.1.5 The NPPF outlines a set of core land-use planning principles that should underpin both plan-making and decision-taking, three of which are particularly relevant to this SDCS. Under paragraph 17, these principles are that planning should:



- support the transition to a low carbon future in a changing climate, taking full
 account of flood risk and coastal change, and encourage the reuse of existing
 resources, including conversion of existing buildings, and encourage the use
 of renewable resources (for example, by the development of renewable
 energy);
- Contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser environmental value, where consistent with other policies in this Framework; and
- Encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value.
 - B.1.6 Design is addressed in section 7 of the NPPF, and paragraph 56 states:

The Government attaches great importance to the design of the built environment. Good design is a key aspect of sustainable development, is indivisible from good planning, and should contribute positively to making places better for people.

B.1.7 Meeting the challenge of climate change is addressed in section 10 of the NPPF, and paragraph 93 states: Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development.

B.1.8 Further to the above, paragraph 95 addresses local planmaking and state:

To support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.
 - B.1.9 Additionally, paragraph 96 discussed decision-taking and states that:

In determining planning applications, local planning authorities should expect new development to:

 comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

B.1.10 Lastly, it is important to note that paragraph 187 of the NPPF addresses decision-taking by local planning authorities with respect to development applications. This paragraph states that:

Local planning authorities should look for solutions rather than problems, and decision-takers at every level should seek to approve applications for sustainable development where possible. Local planning authorities should work



proactively with applicants to secure developments that improve the economic, social and environmental conditions of the area.

B.2 Building Regulations

- B.2.1 Building Regulations exist to ensure the health, safety, welfare and convenience of people in and around buildings, and the energy efficiency of buildings. The regulations apply to most new buildings and many alterations of existing buildings in England and Wales, whether new residential, commercial or industrial.
- B.2.2 The development at Orchard Wharf will be constructed to be compliant with Building Regulations which are current at the time of construction. The relevant Approved Document Part L1A "Conservation of fuel and power in new dwellings" (Edition 2013) provide guidance on ways of complying with the energy efficiency requirements.
- B.2.3 The development has been assessed for Part L compliance using approved Government Standard Assessment Procedures for Energy Rating of Dwellings/Building (SAP software).

B.3 Regional Policy

B.3.1 The London Plan (2011) is the Spatial Development Strategy for London. Section 5 of the Plan covers the mitigation of, and adaptation to climate change and the management of natural resources. The London Plan supports the Mayor's Energy Strategy. The key policies regarding energy efficiency are summarised below.

Policy 5.2 - Minimising CO₂ Emissions

Planning decisions

- A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:
 - 1. Be lean: use less energy
 - 2. Be clean: supply energy efficiently
 - 3. Be green: use renewable energy
- B. The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Residential buildings:

Year	Improvement on 2010 Building Regulations
2010 – 2013	25 per cent
	(Code for Sustainable Homes level 4)
2013 – 2016	40 per cent
2016 – 2031	Zero carbon

Non-domestic buildings:

Year	Improvement on 2010 Building Regulations
2010 – 2013	25 per cent
2013 – 2016	40 per cent
2016 – 2019	As per building regulations requirements
2019 – 2031	Zero carbon

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



- D. As a minimum, energy assessments should include the following details:
 - Calculation of baseline energy demand and carbon dioxide emissions on a 'whole energy' basis, showing the contribution of emissions both from uses covered by building regulations and those that are not (see paragraph 5.22)
 - b. Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services
 - Proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)
 - d. Proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.
- E. The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

Policy 5.6 - Decentralised Energy in Development Proposals

Planning decisions

- A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.
- B. Major development proposals should select energy systems in accordance with the following hierarchy:
 - 1. Connection to existing heating or cooling networks
 - 2. Site wide CHP network
 - 3. Communal heating and cooling.
- C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7 - Renewable Energy

Strategic

A. The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.

Planning decisions

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

B.3.2 Section 5.42 of the London Plan states that:

Individual development proposals will also help to achieve these targets by applying the energy hierarchy in Policy 5.2. There is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20 per cent through the use of on-site renewable energy generation wherever feasible.

Policy 5.9 – Overheating and Cooling

Strategic

A. The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

Planning decisions



- B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:
 - 1. minimise internal heat generation through energy efficient design
 - reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
 - 3. manage the heat within the building through exposed internal thermal mass and high ceilings
 - 4. passive ventilation
 - 5. mechanical ventilation
 - 6. active cooling systems (ensuring they are the lowest carbon options).
- C. Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

B.4 Local Policy

B.4.1 The London Borough of Camden (LBC) require all developments to take measures to minimise the effects of and adapt to - climate change, and encourages all development to meet the highest feasible environmental standards that are financially viable during construction and occupation.

London Borough of Camden's Core Strategy, November 2010

B.4.2 The London Borough of Camden's Core Strategy sets out the key elements of the Council's planning vision and strategy for the borough. It is a central part of Local

- Development Framework (LDF) and was adopted in November 2010.
- B.4.3 Within the Core Strategy, specific policies set out the Council's approach to managing Camden's growth so that it is sustainable, meeting needs for homes, jobs and services, and protecting and enhancing quality of life and the borough's many valued and high quality places. Section 3 focuses on delivering the key elements of Camden's strategy relating to:
- making Camden more sustainable and tackling climate change, in particular improving the environmental performance of buildings, providing decentralised energy and heating networks, and reducing and managing our water use;
- promoting a more attractive local environment through securing high quality places, conserving our heritage, providing parks and open spaces, and encouraging biodiversity;
- improving health and well-being;
- making Camden a safer place while retaining its vibrancy; and
- dealing with our waste and increasing recycling.

CS13: Tackling climate change through promoting higher environmental standards

B.4.4 Policy CS13 sets out the approach that developers should take when considering energy and carbon reductions for developments:

Reducing the effects of and adapting to climate change

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



- a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
- b) promoting the efficient use of land and buildings;
- c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
 - 1. ensuring developments use less energy,
 - making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralized energy networks;
 - 3. generating renewable energy on-site; and
- d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions.

Local energy generation

The Council will promote local energy generation and networks by:

- e) working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them:
- f) protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road).

Water and surface water flooding

The Council will make Camden a water efficient borough and minimise the potential for surface water flooding by:

- g) protecting our existing drinking water and foul water infrastructure, including Barrow Hill Reservoir, Hampstead Heath Reservoir, Highgate Reservoir and Kidderpore Reservoir;
- h) making sure development incorporates efficient water and foul water infrastructure:
- i) requiring development to avoid harm to the water environment, water quality or drainage systems and prevents or mitigates local surface water and down-stream flooding, especially in areas up-hill from, and in, areas

known to be at risk from surface water flooding such as South and West Hampstead, Gospel Oak and King's Cross.

Camden's carbon reduction measures

The Council will take a lead in tackling climate change by:

- i) taking measures to reduce its own carbon emissions;
- k) trialling new energy efficient technologies, where feasible; and
- raising awareness on mitigation and adaptation measures.
 - B.4.5 The Camden Core Strategy contains other policies relevant to this report, which are not outlined in full. These policies are set out below, and reference should be made to the original document for further information:
 - Policy CS16: Improving Camden's health and wellbeing; and
 - Policy CS18: Dealing with our waste and encouraging recycling.

Camden Development Policies, November 2010

B.4.6 Camden Development Policies contribute towards delivering the Core Strategy by setting out detailed planning policies that the Council will use when determining applications for planning permission, to achieve the vision and objectives of the Core Strategy.

Policy DP22: Promoting sustainable design and construction

B.4.7 Policy DP22 has been developed to provide details on sustainability standards. The policy states, in part:



The Council will require development to incorporate sustainable design and construction measures. Schemes must:

- a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5, have been incorporated into the design and proposed implementation; and
- b) incorporate green or brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:

e) expecting non-domestic developments of 500sqm of floorspace or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

- f) summer shading and planting;
- g) limiting run-off;
- h) reducing water consumption;
- reducing air pollution; and
- j) not locating vulnerable uses in basements in flood-prone areas.
 - B.4.8 Paragraph 22.5 states: When a building is constructed, the accessibility of its location; its density and mix of uses; its detailed design taking into account the orientation of the site: and the mechanical services and materials chosen can all have a major impact on its energy efficiency. The Council will require all schemes to consider these general sustainable development principles, along with the detailed elements identified in the table below, from the start of the design process. Developments of 5 or more dwellings or 500sqm of any floorspace should address sustainable development principles in their Design and Access statements or in a separate Energy Efficiency Statement, including how these principles have contributed to reductions in carbon dioxide emissions. When justifying the chosen design with regards to sustainability the following appropriate points must be considered:

Design

- the layout of uses
- floorplates size/depth
- floor to ceiling heights
- location, size and depth of windows
- limiting excessive solar gain
- reducing the need for artificial lighting
- shading methods, both on or around the building
- optimising natural ventilation
- design for and inclusion of renewable energy technology
- impact on existing renewable and low carbon technologies in the area
- sustainable urban drainage, including provision of a green or brown roof
- adequate storage space for recyclable material, composting where possible
- bicycle storage
- measures to adapt to climate change (see below)
- · impact on microclimate

Fabric/ Services

- level of insulation
- choice of materials, including responsible sourcing, re-use and recycled content
- air tightness
- efficient heating, cooling and lighting systems
- effective building management system
- · the source of energy used
- metering
- counteracting the heat expelled from plant equipment
- enhancement of / provision for biodiversity
- · efficient water use
- re-use of water
- educational elements, for example visible meters
- on-going management and review

- B.4.9 The Camden Development Policies contains a number of other policies relevant to this report, which are not outlined in full. These policies can be found in the list below, and reference should be made to the original document for further information:
 - Policy DP23: Water;
 - Policy DP28: Noise and vibration; and
 - Policy DP32: Air quality and Camden's Clear Zone.



Camden Planning Guidance - Sustainability (CPG3), July 2015

- B.4.10 The Core Strategy is supported by Supplementary Planning Documents and CPG3 contains advice and guidance for developers on ways to achieve carbon reductions and more sustainable developments. It also highlights the Council's requirements and guidelines which support the relevant Development Policies, including DP22 as noted above.
- B.4.11 Within this document it sets standards for:
 - Renewable energy;
 - Water efficiency;
 - Sustainable use of materials;
 - Brown and green roofs;
 - Flooding;
 - · Adapting to climate change; and
 - Biodiversity.
- B.4.12 It is stated within the document that developments should achieve a 20% reduction in carbon dioxide emissions from on-site renewable technologies. All developments should also be water efficient and look to install efficient water fixtures and fittings.
- B.4.13 Materials should be responsibly sourced, and the waste hierarchy should be implemented to prioritise the reduction, re-use and recycling of materials.



Appendix C – Calculation Results

Notion	al baseline																	
	Residential										SAP	2012	Baseline CO ₂ Emissions	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions			
Hoor	Unit	Dwelling Type	Floor area (m²)	FEE (kWh/m²/yr)	Space Heating from Boiler (Main 1) (kWh/an)	Space Heating (Main 2) (kWh/an)	Space Heating (Secondary) (kWh/an)	DHW from Boiler (kWh/an)	Cooling (kWh/an)	Lighting (KWh/an)	Aux (kWh/an)	Occupants	Un-Reg (kWh/an)	8 E	DER	kgCO2/annum	kgCO2/annum	kgCO2/annum
7	New Build Flats	Apt, mid tce	1379.29										67,540	19.05	19.05	26,275	26,275	35,053
2	Refurb Flats	Apt, mid tce	1768.91										65,500	74.08	74.08	131,041	131,041	33,995
Total /	42		3985.7	#DIV/0!	0	0	0	0	0	0	0	0	168,432	49.97	49.97	199,166	199,166	87,416
					1	Non-Residential								SBEM	2013	Baseline CO ₂ Emissions	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions
Floor		Description	Floor area (m2)	HLP	Space Heating (Main) (KWh/an)	Space Heating (Main 2) (KWh/an)	Space Heating (Secondary) (kWh/an)	DHW (kwh/an)	Cooling (SBEM) (KWh/an)	Lighting (kWh/an)	Aux (kWh/an)		Un-Reg (kwh/an)	TER	BER	kgCO2/annum	kgCO2/annum	kgCO2/annum
_	No	n-resi	698		0			0	0	0	0		29,449	27.80	27.80	19,404	19,404	15,284
Total			698		0	0	0	0	0	0	0		29,449	27.80	27.80	19,404	19,404	15,284

Efficie	fficient baseline																				
	Residential									SAP	2012	Baseline CO ₂ Emissions	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions	Co						
Total Units	n c	Dave Illing Type	Floor area (m²)	FEE (kNV)/m²/yr)	Space Heating from Boller (Main 1) (kWh/an)	Space Heating (Main 2) (kWh/an)	Space Heating (Se condary) (KWIy/an)	MHO from Baller (kWN/an)	Cooling (MVh/an)	Lighting (kWh/an)	Aux(kWh/an)	Occupants	Un-Reg (kW1v/an)	NJ.	DER	kgCO2/annum	kgCO2/an num	kgCO2/annum	Standard case emis sions	Act ual case emissions	% Improvement DER over TER
22	22 New Build Flats	Apt, mid toe	1379.29										67,540	19.05	17.12	26,275	23,613	35,053	0.00	0.00	10.1%
2	20 Refurb Flats	Apt, mid tce	1768.91										65,500	74.08	40.42	131,041	71,499	33,995	0.00	0.00	45.4%
Total /	42		3985.7		0	0	0	1	0 0	0	0	0	168,432	49.97	30.21	199,166	120,415	87,416	0.00	0.00	39.5%
	Non-Residential										SBEM	2013	Baseline CO ₂ Emissions	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions	,	6	% Improvement			
Floor		uo o	Floor are a (m2)	H.P	Space Heating (Main) (KWN/an)	Space Heating (Main 2) (kWN/an)	Space Heating (Se condar y) (kWt/van)	DHW (kWIV an)	Cooling (SBEM) (KWh/an)	Lighting (kWh/an)	Aux (kWh/an)		Un-Reg (kWt//an)	AET.	BER	kgCOz/an num	kgCOz/an	kgCOz/an num	Improv BER ov	rement rer TER	BER over TER
	No	n-resi	698		0				0 0	0	0		29,449	27.80	20.80	19,404	14,518	15,284	25.	2%	25.2%
Total /			698		0	0	0		0 0	0	0		29,449	27.80	20.80	19,404	14,518	15,284	25.	2%	25.2%

Renewa	enewables Baseline																					
	Residential										Sty st SAP 2012		Baseline CO ₂ Emissions	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions							
Roor	Unit	Dwelling Type	Floor area (m²)	FEE (kWh/m²/yr)	Space Heating from Boiler (Main 1) (W/h/an)	Space Heating (Main 2) (KWIV/an)	Space Heating (Secondary) (kWh/an)	DHW from Beller (AVM/an)	Cooling (kWh/an)	Lighting (kWh/an)	Aux (kWh/ an)	Occupants	Un-Reg (kWh/ an)	PVSkWp	PVs Energy Offset	W/h/ annum	TER	B B B	kgCO s/ annum	kgCO s/ annum	kgCO s/ annum	Improvement DER over TER
22	22 New Build Flats	Apt, mid tce	1379.29								0		67,540	4.149	-3582.74		19.05	15.77	26,275	21,754	35,053	17.2%
2	20 Refurb Flats	Apt, mid tce	1768.91								0		65,500	5.320	-4594.79		74.08	39.07	131,041	69,115	33,995	47.3%
Total /.	42		3985.7	0.00	0	0	#DIV/0!		0	0	0		168,432	11.988	-10352.957	#DIV/0!	49.97	28.86	199,166	115,042	87,416	5 42.2%
							Non-Reside	ential						P	Vs	Electricity Offset	SBEM 2	2010	Baseline CO ₂ Emissions	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions	
Floor		Description	Floor area (m 2)	H.P	Space Heating (Main) (KWh/ an)	Space Heating (Main 2) (KWh/ an)	(Secondary) (WVN/ an)	(we /uwa) MHD	Cooling (SEE.N) (WWI\/ an)	(ne /4ww)	Aux (KWTh/an)		Un-Reg (kWh/ an)	(Zw) sAd	PVs Energy Officet	www.c./W	馬馬	89	kgC01/annum	weene / rooky	umuse/rgp8sj	Improvement BER over TER
	#F	REF!	698		0				0 0	#REF!	#REF! I	nuu	29,449	0	0.00	#REF!	27.80	20.80	19,404	14,518	15,284	25.2%
Total /			698		0	0	0	1	0 0	#REF!	#REF!		29,449	0	0	#REF!			19,404	14,518	15,284	25.2%



Appendix D - Sample SAPs and BRUKL reports

BRUKL Output Document

M HM Government

Compliance with England Building Regulations Part L 2013

Project name

44 Gloucester Ave_Commercial Only

As built

Date: Wed Apr 13 11:19:21 2016

Administrative information

Building Details

Address: Address 1, Address 2, City, Postcode

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3 Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.5

BRUKL compliance check version: v5.2.g.3

Owner Details Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone Address: Street Address, City, Postcode

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	27.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	27.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	20.8
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red. **Building fabric**

Element	Ua-Limit	Ua-Calo	U _{I-Calo}	Surface where the maximum value occurs*
Wall**	0.35	0.44	0.5	BS000002_W11
Floor	0.25	0.25	0.25	BS000002_F1
Roof	0.25	0.2	0.2	BS000002_C_2
Windows***, roof windows, and rooflights	2.2	1.82	2.01	GR000001_W1-W0
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_{*-unit} = Limiting area-weighted average U-values [W/(m²K)] U_{*-Calc} = Calculated area-weighted average U-values [W/(m²K)]

Ui-Calc = Calculated maximum individual element U-values [W/(mºK)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. " Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool

Air Permeability	Worst acceptable standard	This building
m3/(h,m2) at 50 Pa	10	9.4

Page 1 of 6



Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Heating & Cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency
This system	0.98	4.65	-	0.5	0.88
Standard value	0.91*	N/A	N/A	1.6^	0.5
Automatic moni	toring & targeting w	rith alarms for out-of	range values for th	is HVAC syster	n NO
		ns <=2 MW output. For sing nulti-boiler system, limiting		r multi-boiler system	ns, (overall) limiting

^ Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- SYST0002-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
Α	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
Е	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
Н	Fan coil units
1	Zonal extract system where the fan is remote from the zone with grease filter

Zone name				SF	P [W/	(l/s)]				HR efficiency		
ID of system type	Α	В	С	D	Е	F	G	н	1	пке	miciency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
Basement Unit CU.02	-	-	-	-	-	-	-	0.3	-	-	N/A	
Basement Unit CU.03	-	-	-	-	-	-	-	0.3	-	-	N/A	
Basement Unit CU.04	-	-	-	-	-	-	-	0.3	-	-	N/A	
Ground Floor Unit CU.01	-	-	-	-	-	-	-	0.3	-	-	N/A	
Ground Floor Unit CU.02	-	-	-	-	-	-	-	0.3	-	-	N/A	
Ground Floor Unit CU.03	-	-	-	-	-	-	-	0.3	-	-	N/A	
Ground Floor Unit CU.04	-	-	-	-	-	-	-	0.3	-	-	N/A	
Ground Floor Unit CU.05	-	-	-	-	-	-	-	0.3	-	-	N/A	
Basement Unit CU.01	-	-	_	-	-	-	-	0.3	-	-	N/A	

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Basement Unit CU.02	85	-	-	696



General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Basement Unit CU.03	85	-	-	675
Basement Unit CU.04	85			686
Ground Floor Unit CU.01	85	-		580
Ground Floor Unit CU.02	85	-	-	668
Ground Floor Unit CU.03	85	-	-	650
Ground Floor Unit CU.04	85	-	-	663
Ground Floor Unit CU.05	85	-	-	445
Basement Unit CU.01	85	-	-	595

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Basement Unit CU.02	N/A	N/A
Basement Unit CU.03	N/A	N/A
Basement Unit CU.04	N/A	N/A
Ground Floor Unit CU.01	NO (-40.6%)	NO
Ground Floor Unit CU.02	NO (-49.7%)	NO
Ground Floor Unit CU.03	NO (-54.4%)	NO
Ground Floor Unit CU.04	NO (-53.3%)	NO
Ground Floor Unit CU.05	NO (-81.7%)	NO
Basement Unit CU.01	N/A	N/A

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO



Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters				
	Actual	Notional	% <i>F</i>	
Area [m²]	771.8	771.8		
External area [m²]	1099.3	1099.3	_	
Weather	LON	LON	100	
Infiltration [m³/hm²@ 50Pa]	9	3	-	
Average conductance [W/K]	544.29	642.92		
Average U-value [W/m²K]	0.5	0.58	_	
Alpha value* [%]	19.67	18.61	_	
			_	

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
0	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
- C2 Residential Inst.: Universities and colleges
- C2A Secure Residential Inst.
- Residential spaces
- D1 Non-residential Inst.: Community/Day Centre
- D1 Non-residential Inst.: Libraries, Museums, and Galleries
- 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 Theatres
- Others: Passenger terminals
- Others: Emergency services
- Others: Miscellaneous 24hr activities Others: Car Parks 24 hrs
- Others Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	24.59	15.46
Cooling	4.57	10.7
Auxiliary	11.59	15.99
Lighting	14.09	19.63
Hot water	2.89	3.34
Equipment*	42.19	42.19
TOTAL**	57.73	65.11

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

** Total is not of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	148.18	184.21
Primary energy* [kWh/nr²]	121.09	161.17
Total emissions [kg/m²]	20.8	27.8

^{*} Primary energy is net of any electrical energy displaced by CHP generators, if applicable.



Key Features

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

Building fabric

Element	U⊩тур	Ul-Min	Surface where the minimum value occurs*			
Wall	0.23	0.15	GR000002_W11			
Floor	0.2	0.2	GR000002_F_2			
Roof	0.15	0.2	BS000002_C_2			
Windows, roof windows, and rooflights	1.5	1.4	GR000002_W1-W0			
Personnel doors	1.5	-	"No external personnel doors"			
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"			
High usage entrance doors	1.5	-	"No external high usage entrance doors"			
Ul-Typ = Typical individual element U-values [W/(m ³ K))]		U _{I-Min} = Minimum individual element U-values [W/(m ² K)]			
* There might be more than one surface where the minimum U-value occurs.						

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	9.4

H	HVAC Systems Performance									
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] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Natural Gas									
	Actual	69	79.2	24.6	4.6	11.6	0.78	4.81	0.98	5.99
	Notional	45.6	138.6	15.5	10.7	16	0.82	3.6		

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) = Cooling system seasonal energy efficiency ratio

 FT
 = System type

 IS
 = Heat source

 IFT
 = Heating fuel type

 FFT
 = Cooling fuel type



Project InformationBuilding type Mid-floor flat

Reference

8 April 2016 Date

NW1 Project

SAP 2012 worksheet for notional dwelling - calculation of target emissions

1. Overall dwelling dimens	sions
----------------------------	-------

	Area (m²)	Av. Storey heiaht (m)	Volume (m³)	
First floor	100.18	3.00	300.54	(3a)
Total floor area	100.18			(4)
Dwelling volume (m³)			300.54	(5)

2. Ventilation rate

			m³ per hour		
	main + seor heating	ndary + other			
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)	
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)	
Number of intermittent fans	4	x 10	40.00	(7a)	
Number of passive vents	0	x 10	0.00	(7b)	
Number of flueless gas fires	0	x 40	0.00	(7c)	

		Air chang	es per hour
Infiltration due to chimneys, fans and flues		0.13	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.38	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.33	(21)
Infiltration rate modified for monthly wind speed			•

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

						0.0	1.10				
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70
	•		•	•	•	1	,				52.

Wind Fa	actor										02.0
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18

1.21	1.23	1.23	1.10	1.07	0.33	0.33	0.33	1.00	1.07	1.13	1.10		
	•	•	•	•		•	•		•		13.1	3	(22a)
Adiusted	l infiltrati	on rate (allowing	for shelt	er and w	ind spec	ed)						` '

(22)

Ventilation: natural	ventilation.	intermittent	extract fans

Effective air change rate

	an ona	.go .a.c										
0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(25)

A	3. Heat losses and heat loss Element Gross	<i>paramete</i> Openings	e r Net are	ea U-	value	AxU				
Soft coat North 2013 External Window New, Ground Floor Unit B1 G.01 Living Window New Ground Floor Unit B1 G.01 Living Window New Ground Floor Unit B1 G.01 Window New Ground Floor Uni	area, m ² r Window - Double-glazed,		•				04			(27)
2013 External Window New, Ground Floor Unit B1 G.01 Living										
Mindow - Double-glazed, air-filled, low-E, En-O.1, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Window - Double-glazed, air-filled, low-E, En-O.1, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Window - Double-glazed, air-filled, low-E, En-O.1, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Window - Double-glazed, air-filled, low-E, En-O.1, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Walks 23.57 0.18 4.24 (29) 2013 External Window New, Ground Floor Unit B1 G.01 Walks 23.57 0.18 4.24 (29) 2013 External Window New, Ground Floor Unit B1 G.01 Living 32.13 0.18 5.78 (29) 2013 External Wall New, Ground Floor Unit B1 G.01 Living 44.60 0.00 0.00 2013 Internal Partition, Ground Floor Unit B1 G.01 Living 96.02 0.00 0.00 2013 Internal Partition, Ground Floor Unit B1 G.01 Living 1000 142.01 0.00 0.00 2013 Internal Partition, Ground Floor Unit B1 G.01 Internal kelling 1000 142.01 0.00 0.00 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 1000 0.00 0.00 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 1000 0.00 0.00 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 1000 0.00 0.00 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 1000 0.00	2013 External Window New,	Ground								
air-filled, low-E, En-0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Window - Double-glazed, 3.080 1.33 (1.40) 4.08 (27) air-filled, low-E, En-0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Window - Double-glazed, 3.080 1.33 (1.40) 4.08 (27) air-filled, low-E, En-0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Window - Double-glazed, 3.080 1.33 (1.40) 4.08 (27) air-filled, low-E, En-0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Walls 2013 External Wall New, Ground Floor Unit B1 G.01 Living Walls 3.213 0.18 5.78 (29) 2013 External Wall New, Ground Floor Unit B1 G.01 Living Internal wall 2013 Internal Partition, Ground Floor Unit B1 G.01 Living Internal wall 2013 Internal Partition, Ground Floor Unit B1 G.01 Living Internal Wall 2013 Internal Partition, Ground Floor Unit B1 G.01 Living Internal Wall 2013 Internal Celling/Floor, Ground Floor Unit B1 G.01 Living Internal Roo Unit B1 G.01 Living Internal floor 2013 Internal Celling/Floor, Ground Floor Unit B1 G.01 Living Internal Floor Unit B1 G.01 Living Internal Roo Unit B1 G.01 L			3 80	0 1:	33 (1 40)	5 (Դ4			(27)
2013 External Window New, Ground Floor Unit B1 G.01 Window - Double-glazed, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Window - Double-glazed, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Window - Double-glazed, soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 Walls 23.57 0.18 4.24 (29) 2013 External Window New, Ground Floor Unit B1 G.01 Walls 23.57 0.18 4.24 (29) 2013 External Wall New, Ground Floor Unit B1 G.01 Living Walls 23.51 0.18 5.78 (29) 2013 External Wall New, Ground Floor Unit B1 G.01 Walls 23.51 0.18 5.78 (29) 2013 External Wall New, Ground Floor Unit B1 G.01 Walls 2013 Internal Partition, Ground Floor Unit B1 G.01 Walls 2013 Internal Partition, Ground Floor Unit B1 G.01 Walls 2013 Internal Partition, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Walls 2013 Internal Ceiling/Floor, Grou	air-filled, low-E, En=0.1,		0.00		00 (1.40)	0.0	.			(27)
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2013 External Window New, Ground Floor Unit B1 G.01										
Mindow - Double-glazed,	2013 External Window New,	Ground								
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Soft coat (North) 2013 External Window New, Ground Floor Unit B1 G.01 23.57 0.18 4.24 (29) 2013 External Wall New, Ground Floor Unit B1 G.01_Living 32.13 0.18 5.78 (29) 2013 External Wall New, Ground Floor Unit B1 G.01_Living 32.13 0.18 5.78 (29) 2013 External Wall New, Ground Floor Unit B1 G.01 Internal wall 44.60 0.00 0.00 0.00 2013 Internal Partition, Ground Floor Unit B1 G.01_Living 11.00			3.08	0 1.	33 (1.40)	4.0	J8			(27)
Floor Unit B1 G.0.1										
Mails 23.57 0.18 4.24 (29) 2013 External Wall New, Ground Floor Unit B1 G.01 Living Walls 32.13 0.18 5.78 (29) 2013 External Wall New, Ground Floor Unit B1 G.01 Internal wall 44.60 0.00 0.00 2013 External Partition, Ground Floor Unit B1 G.01 Living Ploor Unit B1 G.01 Pl		Ground								
Section Mail New, Ground Floor Unit B1 G.01_Living Section Mails			23.5	7	0.18	4 3	24			(29)
Malls		und	20.0	•	0.10	7.2				(20)
Stephal Wall New, Ground Floor Unit B1 G.01			00.4	0	0.40	- -	70			(00)
Internal wall		und	32.1	3	0.18	5.7	78			(29)
Partition		aria								
Floor Unit B1 G.01_Living 96.02 0.00		اد	44.6	0	0.00	0.0	00			
Internal wall		10								
Floor Unit B1 G.01			96.0	2	0.00	0.0	00			
Internal Floor		nd								
2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Internal floor			142 0	1	0.00	0.0	20			
Internal floor		round		•	0.00	0.0				
2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01_Living			50.0	_	0.00	0.4	20			
Floor Unit B1 G.01_Living Internal ceiling		round	58.3	5	0.00	0.0	J0			
2013 Internal Ceiling/Floor, Ground Floor Unit B1 G.01 Total area of external elements Sigma A, m² 69.46 (31) Fabric heat loss, W/K 28.27 (33) Thermal mass parameter, kJ/m²K (user-specified TMP) 250.00 (35) Effect of thermal bridges 3.47 (36) Total fabric heat loss (31.74 (37) Ventilation heat loss calculated monthly 58.14 57.80 57.48 55.95 55.67 54.33 54.33 54.09 54.85 55.67 56.24 56.85 (38) Heat transfer coefficient, W/K 89.88 89.55 89.22 87.69 87.41 86.08 86.08 85.83 86.59 87.41 87.99 88.59 87.69										
Total area of external elements Sigma A, m² 69.46 (31) Fabric heat loss, W/K 28.27 (33) Thermal mass parameter, kJ/m²K (user-specified TMP) 250.00 (35) Effect of thermal bridges 3.47 (36) Total fabric heat loss 31.74 (37) Ventilation heat loss calculated monthly		round	0.0	1	0.00	0.0	00			
Total area of external elements Sigma A, m² 69.46 (31) Fabric heat loss, W/K 28.27 (33) Thermal mass parameter, kJ/m²K (user-specified TMP) 250.00 (35) Effect of thermal bridges 3.47 (36) Total fabric heat loss 31.74 (37) Ventilation heat loss calculated monthly 58.14 57.80 57.48 55.95 55.67 54.33 54.33 54.09 54.85 55.67 56.24 56.85 (38) Heat transfer coefficient, W/K 89.88 89.55 89.22 87.69 87.41 86.08 86.08 85.83 86.59 87.41 87.99 88.59 Heat loss parameter (HLP), W/m²K 0.90 0.89 0.89 0.88 0.87 0.86 0.86 0.86 0.86 0.87 0.88 0.88 HLP (average) 0.88 0.87 0.86 0.86 0.86 0.86 0.87 0.88 0.88 Number of days in month (Table 1a)		rouna								
Fabric heat loss, W/K Thermal mass parameter, kJ/m²K (user-specified TMP) Effect of thermal bridges Total fabric heat loss Ventilation heat loss calculated monthly 58.14 57.80 57.48 55.95 55.67 54.33 54.33 54.09 54.85 55.67 56.24 56.85 (38) Heat transfer coefficient, W/K 89.88 89.55 89.22 87.69 87.41 86.08 86.08 85.83 86.59 87.41 87.99 88.59 (39) Heat loss parameter (HLP), W/m²K 0.90 0.89 0.89 0.88 0.87 0.86 0.86 0.86 0.86 0.87 0.88 0.88 (40) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	. 1001 01111 21 0101									
Thermal mass parameter, kJ/m²K (user-specified TMP) 250.00 (35) Effect of thermal bridges 3.47 (36) Total fabric heat loss		Sigma A	, m²							\ /
Effect of thermal bridges 3.47 (36) Total fabric heat loss		ո²K (user-	specified	TMP)					_	()
Ventilation heat loss calculated monthly 58.14 57.80 57.48 55.95 55.67 54.33 54.09 54.85 55.67 56.24 56.85 (38) Heat transfer coefficient, W/K 89.88 89.55 89.22 87.69 87.41 86.08 85.83 86.59 87.41 87.99 88.59 Heat loss parameter (HLP), W/m²K 0.90 0.89 0.89 0.88 0.87 0.86 0.86 0.86 0.87 0.88 0.88 HLP (average) 0.88 (40) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Effect of thermal bridges	`	•	,						47 (36)
58.14 57.80 57.48 55.95 55.67 54.33 54.09 54.85 55.67 56.24 56.85 (38) Heat transfer coefficient, W/K 89.88 89.55 89.22 87.69 87.41 86.08 85.83 86.59 87.41 87.99 88.59 Heat loss parameter (HLP), W/m²K 0.90 0.89 0.89 0.88 0.87 0.86 0.86 0.86 0.86 0.88 0.88 0.88 HLP (average) 0.88 (40) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		monthly							31.	74 (37)
Heat transfer coefficient, W/K 89.88 89.55 89.22 87.69 87.41 86.08 86.08 85.83 86.59 87.41 87.99 88.59 87.69 (39) Heat loss parameter (HLP), W/m²K 0.90 0.89 0.89 0.88 0.87 0.86 0.86 0.86 0.86 0.87 0.88 0.88 HLP (average) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec			54 33	54 33	54.09	54 85	55 67	56 24	56.85	(38)
89.88 89.55 89.22 87.69 87.41 86.08 86.08 85.83 86.59 87.41 87.99 88.59 Heat loss parameter (HLP), W/m²K 0.90 0.89 0.89 0.88 0.87 0.86 0.86 0.86 0.86 0.87 0.88 0.88 HLP (average) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		00.07	01.00	101.00	01.00	01.00	00.07	00.21	00.00	(00)
Heat loss parameter (HLP), W/m²K 0.90 0.89 0.89 0.88 0.87 0.86 0.86 0.86 0.86 0.87 0.88 0.88		87.41	86.08	86.08	85.83	86.59	87.41	87.99	88.59	
0.90 0.89 0.89 0.88 0.87 0.86 0.86 0.86 0.87 0.88 0.88 HLP (average) 0.88 (40) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec						1			87.6	69 (39)
HLP (average) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec			0.00	10.00	10.00		0.07	10.00	10.00	1
Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		0.87	0.86	0.86	0.86	0.86	0.87	0.88		90 (40)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		le 1a)							0.0	30 (40)
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	31 28 31 30			31		30	31	30	31	

3. Heat		and heat Gross		n rameter enings	Net are	a II.	/alue	AxU				
Liemeni		area, m		zilligs	A, m ²		m²K	W/K				
Total are Fabric he Thermal Effect of Total fab	eat loss, mass p thermal	ernal ele W/K aramete bridges	ments S		m²	TMP)					69.46 28.27 250.00 3.47 31.74	7 (33) 0 (35) 7 (36)
Ventilation			ulated m	onthly							01.7-	(07)
58.14	57.80	57.48	55.95	55.67	54.33	54.33	54.09	54.85	55.67	56.24	56.85	(38)
Heat trai	nsfer co	efficient,	W/K									
89.88	89.55	89.22	87.69	87.41	86.08	86.08	85.83	86.59	87.41	87.99	88.59	
Heat los	s param	eter (HL	P), W/m ²	²K							87.69	9 (39)
0.90	0.89	0.89	0.88	0.87	0.86	0.86	0.86	0.86	0.87	0.88	0.88	
HLP (av Number		in month	(Table	1a)							0.88	3 (40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	
4. Water Assume Annual a	d occupa	ancy, N	· •		or day \	/d overe	20				kWh/ye 2.74 99.30	4 (42)
Jan	Feb	Mar			Jun	Jul	_	Con	Oot	Nov	Dec Jes	0 (43)
Hot wate			Apr	May		Jui	Aug	Sep	Oct	INOV	Dec	
		101.29		93.34	89.37	89.37	93.34	97.32	101.29	105.26	109.23	(44)
Energy of					03.07	03.57	30.04	37.52	101.23	103.20	103.23	(44)
161.99		146.20	127.46	122.30	105.54	97.79	112.22	113.56	132.34	144.46	156.88	
Energy of Distribut	content (127.10	122.00	100.01	07.70	112.22	110.00	102.01	111.10	1562.43	3 (45)
24.30	21.25	21.93	19.12	18.35	15.83	14.67	16.83	17.03	19.85	21.67	23.53	(46)
Cylinder Manufac Tempera Energy l	volume, cturer's d ature Fa	l leclared ctor	cylinder	loss fact			150.00 1.39 0.5400				0.75	(47) (48) (49)
Total sto	rage los	S		•								, ,
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
Net stora												
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
Primary							1					
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
						r each m						
						144.39	158.82	158.65	178.94	189.56	203.47	(62)
Output f							T . =	T	I	I		/ -
208.59	183.76	192.79	172.55	168.90	150.63	144.39	158.82	158.65	178.94	189.56	203.47 2111.0 ²	(64) 4 (64)
Heat gai	ns from	water he	ating, k\	Nh/mont	th						_	(-)
91.14	80.78	85.89	78.45	77.94	71.16	69.79	74.59	73.83	81.28	84.11	89.44	(65)

5. Internal	gains
-------------	-------

	iai yaiii							1 -	_		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metaboli												
		137.06	137.06	137.06	137.06	137.06	137.06	137.06	137.06	137.06	137.06	(66)
Lighting												
	21.89	17.80	13.48	10.07	8.51	9.19	11.95	16.03	20.36	23.76	25.33	(67
Applianc	es gains	5										
256.62	259.28	252.57	238.29	220.25	203.30	191.98	189.32	196.03	210.31	228.35	245.30	(68
Cooking	gains							•				
36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	(69
Pumps a	and fans	gains										
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70
Losses	e.g. evar	oration	negative	values)	Į.		ļ			1		
			<u> </u>			-109.65	-109.65	-109.65	-109.65	-109.65	-109.65	(71
Water he	1	1	1		1 3 3 3 3	1	1	1		1		`
		115.44	108.96	104.76	98.84	93.81	100.25	102.55	109.25	116.82	120.21	(72
Total inte			1.00.00	10 7.70	100.04	1 30.01	1.00.20	102.00	1.00.20	11.0.02	0 1	\.
			427 QA	402 20	377 77	362 10	368 64	381.73	407.04	436 04	457 96	(73
+70.00	400.43	+52.50	727.04	402.20	011.11	302.10	000.04	301.73	407.04	1400.04	437.30	(,,
6. Solar Window En=0.1,	- Double	e-glazed t (North)	, air-fillec	I, low-E,	Area 0.9		10.63 0) & FF).63 x 0.7		hading .77	Gains 12.3489	
Window En=0.1,	- Double soft coa	e-glazed t (North)	New, Gro , air-filled New, Gro	I, low-E,	0.9	x 3.800 ⁻).63 x 0.7	0 0.	.77	12.3489	
Window En=0.1,	- Double soft coa	e-glazed t (North)	, air-fillec	I, low-E,	0.9	x 3.080 1	10.63 0).63 x 0.7	0 0.	.77	10.0091	
Window En=0.1,	- Double soft coa	e-glazed t (North)		I, low-E,	0.9	x 3.080 1	10.63 0).63 x 0.7	0 0.	.77	10.0091	
Total sol	lar gains	, Januar	New, Gro	ouna Fio	or Unit E	31 G.01					44.72	(83
Solar ga		144 = 51	000 = 1	04455	000 5 5	04455	0.40	T4=4==	401 = 5	Tee	07.66	/00
44.72	85.45	145.21	233.24	314.20	336.36	314.03	249.14	174.59	101.72	55.16	37.28	(83
Total gai		T=-	T = =	r	I — .	T	T = .	T	T	T	T	
515.60	553.95	598.14	661.09	716.40	714.12	676.13	617.78	556.31	508.76	491.21	495.23	(84
Lighting	g calcul	ations										
14 <i>(</i>) - 1	Б		-1.60		Area		g	1		F x Shac		
Window				i, low-E,	0.9	x 3.80	0	0.80	0.	70 x 0.8	3 1.59	
En=0.1,		` ,	New, Gro	ound Ela	or I Ini+ E	R1 C 01	Living					
			, air-fillec			x 3.80		0.80	Λ	70 x 0.8	3 1.59	
En=0.1,			, an inioc	., L,	0.0	. 0.00	O		0.	o x 0.0	1.00	
			New, Gr	ound Flo	or Unit E	31 G.01						
			, air-fillec			x 3.08	0	0.80	0.	70 x 0.8	3 1.29	
En=0.1,	soft coa	t (North)										
			New, Gr				=		=	=0 -		
Window				i, low-E,	0.9	x 3.08	0	0.80	0.	70 x 0.8	3 1.29	
En=0.1,			New, Gro	ound Flo	or I Init F	R1 G 01						
2010 L	-AtGITIAI	• • II IGOW	i vov, ali	Juniu I 10	OI OIIIL E	J. G.01						

		responsi		N 4 -			Α .	0	0.1	NI.	1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	T	T	1	I	I	1	1	1	I		I
77.40	77.69	77.97	79.33	79.59	80.82	80.82	81.05	80.34	79.59	79.07	78.53
alpha											
6.16	6.18	6.20	6.29	6.31	6.39	6.39	6.40	6.36	6.31	6.27	6.24
Utilisati	on factor		for livin	g area							
1.00	1.00	1.00	0.98	0.91	0.73	0.55	0.63	0.89	0.99	1.00	1.00
Mean ir	nternal te	mperatui	re in livin	g area T	1						
20.03	20.13	20.31	20.59	20.84	20.97	21.00	20.99	20.90	20.60	20.28	20.02
Tempe	rature du	ring heat	ing perio	ds in res	st of dwe	lling Th2		•	•		
20.17	20.17	20.18	20.19	20.19	20.20	20.20	20.20	20.20	20.19	20.19	20.18
Utilisati	on factor	for gains	for rest	of dwelli	ing						
1.00	1.00	0.99	0.97	0.88	0.66	0.46	0.52	0.84	0.98	1.00	1.00
Mean ir	nternal te	mperatui	re in the	rest of d	welling T	2	•		•		
18.86	19.00	19.27	19.69	20.03	20.18	20.20	20.20	20.11	19.70	19.23	18.85
	rea fracti nternal te				dwelling))					0.29
19.20	19.33	19.58	19.95	20.26	20.41	20.43	20.43	20.34	19.96	19.54	19.19
Apply a	djustmen	it to the r	nean inte	ernal ten	perature	e, where	appropr	iate			
19.20	19.33	19.58	19.95	20.26	20.41	20.43	20.43	20.34	19.96	19.54	19.19
<i>3. Spac</i> Jan	e heatin	<i>g requir</i> Mar	rement Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisati	on factor	for gains			l	I			I		
1.00	1.00	0.99	0.97	0.88	0.68	0.49	0.55	0.85	0.98	1.00	1.00
Useful (1	1	l	l .	1	1	1	l .	1	
514.71		593.46	640.88	631.40	483.70	328.13	342.21	473.51	498.85	489.42	494.57
Monthly	/ average	externa	l tempera	ature							
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
	ss rate fo										
	7 1291.9			•		329.86	345.98	540.35	818.39	1094.13	1328.19
	n of mont			1 3.00	1 2 2 3 . 3 3	1 = 3.00	1 3.00	1 2 1 3 1 3 3	1 2 3 3 3 3	1	1
Fraction		1.00	1.00	1.00	_	I -	I -	-	1.00	1.00	1.00
	1.00				I	1			1		1.00
1.00	1.00 neating re	equireme	nt for ea	ch mont	h, kWh/ı	month					
1.00 Space I	neating re				h, kWh/ı	month	_	-	237.74	435.39	620.21
1.00 Space I 613.40		426.48	236.28	87.20	-	-		- //av)	237.74	435.39	620.21 3153.70

9a. Energy requirements

kWh/year												
Fraction	of space	eating sy e heat fro n heating	om main	system((s)				1.0000 3.50%		•	(202) (206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space h	eating re	quireme	nt	•								
613.40	497.05	426.48	236.28	87.20	-	-	-	-	237.74	435.39	620.21	(98)
Appendi	x Q - mo	onthly en	ergy sav	ed (mair	heating	system	1)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space h	eating fu	iel (main	heating	system	1)			•				
656.04	531.61	456.13	252.71	93.26	-	-	-	-	254.27	465.66	663.33	(211)
Appendi	x Q - mo	onthly en	ergy sav	ed (mair	heating	system	2)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space h	eating fu	iel (main	heating	system	2)							
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendi	x Q - mo	onthly en	ergy sav	ed (seco	ndary he	eating sy	stem)	•				
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space h	eating fu	iel (seco	ndary)									
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water h		equireme	nt		•							
208.59	183.76	192.79	172.55	168.90	150.63	144.39	158.82	158.65	178.94	189.56	203.47	(64)
Efficience	y of wat	er heatei	r								79.80	(216)
87.52	87.34	86.87	85.65	83.15	79.80	79.80	79.80	79.80	85.57	86.96	87.60	(217)
Water h	eating fu	iel										
238.32	210.40	221.92	201.45	203.13	188.76	180.94	199.02	198.81	209.11	217.97	232.28	(219)
Space h Water h	eating fu eating fu eating fu		ndary)								kWh/year 3373.00 0.00 2502.12	(211) (215) (219)
boiler with a fan-assisted flue 45.00 (23 Total electricity for the above, kWh/year 75.00 (23												(230c) (230e) (231) (232)
Energy		or genera :	ated ():								0.000 0.000	(236a) (237a)
Total de	livered e	nergy fo	r all uses	8							6385.38	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/ye	ear
Space heating, main system 1	3373.00	0.216	728.57	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	2502.12	0.216	540.46	(264)
Space and water heating			1269.03	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	435.26	0.519	225.90	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - μCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1533.85	(272)
			kg/m²/yea	ır
Emissions per m ² for space and water heating			12.67	(272a)
Emissions per m ² for lighting			2.25	(272b)
Emissions per m ² for pumps and fans			0.39	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.6675 x 1.00) + 2.2549 + 0.3886			15.31	(273)

Project InformationBuilding type Mid-floor flat

Reference

8 April 2016 Date

Project NW¹

SAP 2012 worksheet for New dwelling as designed - calculation of dwelling emissions

1.	Overall	dwelling	dime	ensions
• •	Ovciun	awciiiig	u	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

	Area (m²)	Av. Storey height (m)	Volume (m³)	
First floor	100.18	3.00	300.54	(3a)
Total floor area	100.18			(4)
Dwelling volume (m³)			300.54	(5)

2. Vent	ilation ra	ate									m³ pe	ar hoi	ır
						_	nain + so neating	eondary	+ other		pc) 11 0	
Number	r of chim	neys				0 + 0 + 0 x 40			40		0.	.00	(6a)
	r of open					(0 + 0 + 0	Х	20		0.	.00	(6b)
	r of interr						0	Х	10		0.	.00	(7a)
	r of pass						0	Х	10		0.	.00	(7b)
Number	r of fluele	ess gas f	ires				0	Х	40		0.	.00	(7c)
											Air ch	nange	es per hour
Infiltration	on due to	chimne	vs. fans	and flue:	s							00	(8)
	e test, re		,						5.00				(17)
	neability	•									0.	25	(18)
Number	r of sides	on whic	h shelter	red							2.	.00	(19)
Shelter	factor										0.	85	(20)
Infiltration	on rate ir	corporat	ting shelt	ter facto	r						0.	21	(21)
Infiltration	on rate m	nodified f	or month	nly wind	speed								, ,
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70
				•	•		•	•			52.5

Wind F	actor											(/
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
	•						•				13.13	(22a)

(22)

(23c)

Adjusted infiltration rate (allowing for shelter and wind speed)											10.	.0
0.27	0.27	0.26	0.33	0.33	0.20	0.20	0.20	0.21	0.33	0.24	0.25	7

0.27	0.27	0.20	0.23	0.23	0.20	0.20	0.20	0.21	0.23	0.24	0.23		
			•	•	•	•	•	•		•	2.7	'9 (22k	၁)
air cha	nge rate	through	system				0.50					(23	a)
efficie	ncv in %	allowing	for in-us	se factor			79.90					(230	c)

efficiency in % allowing for in-use factor	79.90
Ventilation: balanced whole house mechanica	I with heat recovery

Ventilation	: balanced whole	house mechanical	with heat recovery
Effootivo oi	r obongo roto		•

LITECTIVE	ali Cilai	ige rate										
0.37	0.37	0.36	0.33	0.33	0.30	0.30	0.30	0.31	0.33	0.34	0.35	(25)

<i>3. Heat</i> Element		and hea		<i>rametel</i> enings	r Net are	a II-	value	AxU	L	kappa-val	uo A v K	
Liemeni	_	area, m		riiigs	A, m ²		/m²K	W/K		καρρα-ναι κJ/m²K	kJ/K	
		le-glazed	,		3.08	2 1.0	68 (1.80)	5.1	17			(27)
air-filled soft coa												
) Window	New. Gr	ound								
	Jnit B1 (
		le-glazed	,		3.08	2 1.0	68 (1.80)	5.1	17			(27)
air-filled												
soft coa) Window	New Gr	ound								
	Jnit B1 (riow, an	ound								
Window	- Doubl	le-glazed	,		3.79	5 1.0	68 (1.80)	6.3	37			(27)
air-filled												
soft coa			Now Cr	aund								
	Jnit B1 (Window	inew, Gr	ouria								
		a.o i le-glazed	,		3.79	5 1.0	68 (1.80)	6.3	37			(27)
air-filled			•			_	,					()
soft coa												
		Window		ound								
Walls	Juit R1 (G.01_Liv	ing		32.13	3	0.14	4.5	50	21.95	705.32	(29)
	External	Wall Nev	w. Groun	d	JZ. 1	,	0.14	7.0	,,,	21.33	700.02	(23)
	Jnit B1 (,	-								
Walls	_		_		23.5	7	0.14	3.3	30	21.95	517.36	(29)
		Wall Nev		d								
Internal		G.01_Liv	irig		44.6	n	0.00	0.0	00	8.75	390.28	
		Partition,	Ground		77.0	5	0.00	0.0	,,	0.75	030.20	
		G.01_Liv										
Internal			0 1		96.0	2	0.00	0.0	00	8.75	840.18	
	nternal I Jnit B1 (Partition,	Ground									
Internal		G.01			58.3	5	0.00	0.0	00	95.00	5542.79	
		Ceiling/Fl	loor, Gro	und	00.0	,	0.00	0.0	,0	55.00	0042.70	
		G.01_Liv										
Internal		o /=			142.0	1	0.00	0.0	00	95.00	13490.67	7
	nternal (Jnit B1 (Ceiling/Fl	loor, Gro	und								
Internal		G.01			0.0	1	0.00	0.0	00	95.00	1.01	
		Ceiling/Fl	loor, Gro	und	0.0	•	0.00	0.0	, ,	00.00		
Floor l	Jnit B1 (G.01										
T.1.1	(.			·	0						00.40	(04)
Fabric h		ternal ele	ements 5	igma A,	m²						69.46 30.89	(31) (33)
		oaramete	r, kJ/m²k	(user-s	pecified	TMP)					250.00	(35)
Effect of	f therma	l bridges		`		,					0.08	(36)
Total fak			- 4 1								30.97	(37)
		loss calc			00.00	00.00	00.40	04.04	00.00	00.00	04.70	(00)
36.84	36.31	35.78	33.15	32.62	29.99	29.99	29.46	31.04	32.62	33.68	34.73	(38)
		efficient,		00.00	100.00	100.00	00.40	00.00	00.00	04.05	05.70	
67.81	67.28	66.76	64.12	63.60	60.96	60.96	60.43	62.02	63.60	64.65	65.70	(00)
Heat los	s paran	neter (HL	.P), W/m	²K							63.99	(39)
0.68	0.67	0.67	0.64	0.63	0.61	0.61	0.60	0.62	0.63	0.65	0.66	
HLP (av		1	1	I.	1		1	1			0.64	(40)
		in month	n (Table	1a)								` '
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	

3. Heat losses Element	and hea Gross area, m	Óре	e rameter enings	, Net are A, m²		value ′m²K	A x U W/K		ıppa-valı /m²K	ue A x K kJ/K	
Total area of external elements Sigma A, m ² Fabric heat loss, W/K Thermal mass parameter, kJ/m ² K (user-specified TMP) Effect of thermal bridges Total fabric heat loss Ventilation heat loss calculated monthly											(31) (33) (35) (36) (37)
36.84 36.31	35.78	33.15	32.62	29.99	29.99	29.46	31.04	32.62	33.68	34.73	(38)
Heat transfer co											
67.81 67.28	66.76	64.12	63.60	60.96	60.96	60.43	62.02	63.60	64.65	65.70	()
Heat loss param	neter (HL	P), W/m²	²K							63.99	(39)
0.68 0.67	0.67	0.64	0.63	0.61	0.61	0.60	0.62	0.63	0.65	0.66	
HLP (average) Number of days	in month	n (Table	1a)						•	0.64	(40)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31 28	31	30	31	30	31	31	30	31	30	31	
4. Water heatin	na enera	v reauire	ements				1			kWh/year	
Assumed occup Annual average	ancy, N	-		er day V	/d,avera	ge				2.74 104.53	(42) (43)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	in litres	per day 1	or each	month							
114.98 110.80			98.26	94.08	94.08	98.26	102.44	106.62	110.80	114.98	(44)
Energy content			T	I	I	T	T	I	T . = =	1	
170.52 149.13		134.17	128.74	111.09	102.94	118.13	119.54	139.31	152.07		(45)
Energy content Distribution loss										1644.66	(45)
25.58 22.37	23.08	20.13	19.31	16.66	15.44	17.72	17.93	20.90	22.81	24.77	(46)
Hot water storage Hot water cylind			/h/day)							110.00 0.0152	(50) (51)
Volume factor	CI 1035 IC	icioi (KVV	Ti/uay)							1.0294	(52)
Temperature fa										0.6000	(53)
Energy lost from Total storage lo		er cylinde	er (kWh/	day)						1.03	(55)
32.01 28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
Net storage loss		30.30	32.01	30.30	32.01	32.01	30.30	32.01	30.30	32.01	(30)
32.01 28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary loss	102.01	100.00	02.01	00.00	02.01	02.01	00.00	02.0.	100.00	02.01	()
23.26 21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Total heat requi	red for w	ater heat	ing calcu	lated fo	r each m	onth	ı	1	1		
225.79 199.06	209.17	187.66	184.01	164.58	158.22	173.40	173.03	194.59	205.56	220.41	(62)
Output from wa											
225.79 199.06	209.17	187.66	184.01	164.58	158.22	173.40	173.03	194.59	205.56		(64)
Heat gains from	water he	eating, k\	Wh/mont	h						2295.50	(64)
100.92 89.53	95.39	87.41	87.03	79.73	78.45	83.50	82.54	90.54	93.36	99.13	(65)

	_	
_	Internal	
	internai	nains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabol	ic gains,	Watts	,			•					
137.06	137.06	137.06	137.06	137.06	137.06	137.06	137.06	137.06	137.06	137.06	137.06
Lighting	gains										
23.96	21.28	17.31	13.10	9.79	8.27	8.94	11.61	15.59	19.79	23.10	24.63
Appliance	ces gains	3	•		•				•		
256.62	259.28	252.57	238.29	220.25	203.30	191.98	189.32	196.03	210.31	228.35	245.30
Cooking	gains	•	•		•	•			•		
36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71
Pumps a	and fans	gains	•		•	•			•		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Losses	e.g. evap	oration	negative	values)		•			•		
-109.65	-109.65	-109.65	-109.65	-109.65	-109.65	-109.65	-109.65	-109.65	-109.65	-109.65	-109.65
Water h	eating ga	ains									
135.64	133.23	128.21	121.40	116.97	110.74	105.44	112.23	114.64	121.70	129.66	133.24
Total int	ernal gai	ns									
480.34	477.91	462.21	436.90	411.14	386.43	370.48	377.28	390.38	415.92	445.23	467.28

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, air-filled, low-E,	0.9 x 3.082 10.63	0.63 x 0.80	0.77	11.4464
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B1 G.01			
Window - Double-glazed, air-filled, low-E,	0.9 x 3.082 10.63	0.63 x 0.80	0.77	11.4464
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B1 G.01			
Window - Double-glazed, air-filled, low-E,	0.9 x 3.795 10.63	0.63 x 0.80	0.77	14.0944
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B1 G.01			
Window - Double-glazed, air-filled, low-E,	0.9 x 3.795 10.63	0.63 x 0.80	0.77	14.0944
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B1 G.01 Living			

Lighting calculations

9 · 9 · · · · · · · ·	Area	g	FF x Shading	
Window - Double-glazed, air-filled, low-E,	0.9 x 3.08	Ŏ.80	0.80 x 0.83	1.47
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B1 G.01			
Window - Double-glazed, air-filled, low-E,	0.9 x 3.08	0.80	0.80 x 0.83	1.47
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B1 G.01			
Window - Double-glazed, air-filled, low-E,	0.9 x 3.79	0.80	0.80 x 0.83	1.81
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B1 G.01			
Window - Double-glazed, air-filled, low-E,	0.9 x 3.79	0.80	0.80 x 0.83	1.81
En=0.1, soft coat (North)				

2013 External Window New, Ground Floor Unit B1 G.01_Living

GL = 6.58 / 100.18 = 0.066

C1 = 0.500

C2 = 1.005

El = 423

Гетрег	ature du	ring heat	ing peric	ds in the	living a	rea, Th1	(°C)				21.00
	system i				l ,		۱.				1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau					1	1	1	1	1		
102.59	103.40	104.21	108.49	109.39	114.12	114.12	115.11	112.18	109.39	107.61	105.88
alpha											
7.84	7.89	7.95	8.23	8.29	8.61	8.61	8.67	8.48	8.29	8.17	8.06
Jtilisatio	on factor	for gains	for livin	g area							
1.00	1.00	0.99	0.93	0.75	0.51	0.37	0.42	0.71	0.96	1.00	1.00
Mean in	ternal ter	mperatui	e in livin	g area T	1						
20.38	20.48	20.64	20.87	20.98	21.00	21.00	21.00	20.99	20.85	20.59	20.39
Temper	ature du	ing heat	ing perio	ds in res	st of dwe	lling Th2					
20.36	20.37	20.37	20.39	20.40	20.42	20.42	20.43	20.41	20.40	20.39	20.38
Utilisatio	n factor	for gains	for rest	of dwelli	ing		!	!	!	li .	
1.00	1.00	0.98	0.91	0.70	0.46	0.32	0.37	0.66	0.95	0.99	1.00
Mean in	ternal ter	nperatur	e in the	rest of d	welling T	2					
19.52	19.66	19.91	20.25	20.38	20.42	20.42	20.43	20.41	20.22	19.85	19.54
	rea fracti						I.				0.29
Mean in	ternal ter	mperatui	e (for th	e whole	dwelling))					
19.77	19.90	20.12	20.43	20.56	20.59	20.59	20.59	20.58	20.40	20.07	19.79
Apply ac	djustmen	t to the r	nean inte	ernal ten	perature	e, where	appropr	iate			
19.77	19.90	20.12	20.43	20.56	20.59	20.59	20.59	20.58	20.40	20.07	19.79
	•										
e Cnac	o bootin	~ ro~!!	omont								
	<i>e heatin</i> Feb	Mar		Mov	lun	Jul	Aug	Con	Oot	Nov	Doo
Jan	n factor		Apr	May	Jun	Jui	Aug	Sep	Oct	Nov	Dec
				0.70	0.47	0.00	0.00	0.07	0.05	0.00	1.00
1.00	0.99	0.98	0.91	0.72	0.47	0.33	0.38	0.67	0.95	0.99	1.00
Useful g	•	047.44	0.44.00	FF4 00	004.00	0.40.00	050.40	000.00	504.00	E04.07	500.00
	572.57				364.86	243.26	253.42	396.60	504.90	504.87	508.93
	average				4400	10.00	10.10	1110	10.00	7.40	1.00
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
	s rate fo					T	T	T	T		1
	1009.25			563.30	365.17	243.27	253.45	401.67	623.36	838.51	1024.31
	of mont										
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
	eating re				h, kWh/ı	month					
	293.45			8.91	-	-	-	-	88.13	240.22	383.44
	ace heat					ar) (Oct	ober to N	Лау)			1687.73
Space h	eating re	equireme	nt per m	ı² (kWh/r	n²/year)						16.85

8c. Space cooling requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Externa	ıl temper	aturers								•	
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-
Heat lo	ss rate V	V				1	4	1	•	1	
-	-	-	-	-	573.04	451.12	459.31	-	-	-	-
Utilisati	on factor	for loss	-1					1			
-	-	-	-	-	1.00	1.00	1.00	-	-	-	-
Useful I	oss W										
-	-	-	-	-	570.90	450.70	458.42	-	-	-	T-
Internal	gains W	i i	-1								
0.00	0.00	0.00	0.00	0.00	543.86	523.33	532.84	0.00	0.00	0.00	0.00
Solar ga	ains W										
0.00	0.00	0.00	0.00	0.00	449.11	419.30	332.66	0.00	0.00	0.00	0.00
Gains V	٧										
-	-	-	-	-	992.98	942.64	865.50	-	-	-	-
Fraction	of mon	th for cod	oling					1			
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Space h	neating k	Wh	-1					1			
-	-	-	-	-	26.34	4.54	0.00	-	-	-	T-
Space o	cooling k	Wh									
-	-	-	-	-	303.90	366.00	302.87	-	-	-	-
Total						.1		1			972.77
	fraction	_									0.80
Intermit	tency fac	ctor							_		
-	-	-	-	-	0.25	0.25	0.25	-	-	-	-
Space o	cooling re	equireme	ent for m	onth							
-	-	-	-	-	60.78	73.20	60.57	-	-	-	-
		June to A		o2 (IdN/h	/m2/\ \n = =\						194.55
opace (cooling re	equireme	ant ber u	i- (KVVN/	/m²/year)						1.94

9b. Energy requirements

		kWh/year	
Fraction of space heat from secondary system	0.00	•	(301)
Fraction of space heat from community system	1.00		(302)
Fraction of community heat from Boilers	1.00		(303a)
Fraction of total space heat from Boilers	1.00		(304a)
Factor for control and charging method for community space heating			(305)
Factor for charging method for community water heating	1.00		(305a)
Distribution loss factor	1.05		(306)
Space heating			
Annual space heating requirement	1687.73		(98)
Space heat from Boilers		1772.11	(307a)
Efficiency of secondary heating system	0.00		(308)
Space heating fuel for secondary system		0.00	(309)
Water heating			
Annual water heating requirement	2295.50		(64)
Water heat from Boilers		2410.27	(310a)
Other energy			
Cooling system energy efficiency ratio	5.81%		(314)
Space cooling		33.47	(315)
Electrical energy for heat distribution		41.82	(313)
Electricity for pumps and fans within dwelling:			
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outs	side (SFP=0.60)	220.73	(330a)
warm air heating system fans		0.00	(330b)
pump for solar water heating		0.00	(330g)
pump for waste water heat recovery		0.00	(330h)
Total electricity for the above, kWh/year		220.73	(331)
Electricity for lighting (100.00% fixed LEL)		423.16	(332)
Energy saving/generation technologies			
Appendix Q -			
Energy saved or generated ():		0.000	(336a)
Energy used ():		0.000	(337a)
Total delivered energy for all uses		4868.10	(338)
Total delivered effergy for all uses		+000.10	(000)

10a. Does not apply

11a. Does not apply

12b. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/ye	_
Efficiency of Boilers - 97.90%	•	· ·	,	(367a)
CO2 emissions from Boilers	4272.10	0.2160	922.77	(368)
Electrical energy for heat distribution	41.82	0.5190	21.71	(372)
Total CO2 associated with community systems			944.48	(373)
Total CO2 associated with space and water heating			944.48	(376)
Space cooling	33.47	0.519	17.37	(377)
Electricity for pumps and fans	220.73	0.519	114.56	(378)
Electricity for lighting	423.16	0.519	219.62	(379)
Electricity generated - PVs	0.00	0.519	0.00	(380)
Electricity generated - μCHP	0.00	0.000	0.00	(380)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(381)
Energy used ():	0.00	0.000	0.00	(382)
Total CO2, kg/year			1296.03	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			kg/m²/yea 12.94	r (384)

rejects/5395 44 Glovector Avenue, Comdon/001, Energy Stretagy/ IPA Designer/SARs with reduced Window II val

Project InformationBuilding type Top-floor flat

Reference

Date 8 April 2016

Project NW1

SAP 2012 worksheet for notional dwelling - calculation of target emissions

7.	Overai	ı awe	ilina	aıme	ensions

	Area (m²)	Av. Storey heiaht (m)	Volume (m³)	
Third floor	` 52.56	3.00	`157.68	(3a)
Total floor area	52.56			(4)
Dwelling volume (m³)			157.68	(5)

2 Ventilation rate

2. Ventilation	rate									m³ pe	r hoı	ır	
						main + senerating	eondar	y + othe	r	60			
Number of chir	nneys				(0 + 0 + 0		x 40		0.0	00	(6a)	
Number of ope	n flues				(0 + 0 + 0		x 20		0.0	00	(6b)	
Number of inte	rmittent fa	ans				2		x 10		20.0	00	(7a)	
Number of pas	sive vents	3				0		x 10		0.0	00	(7b)	
Number of flue	ess gas f	ires				0		x 40		0.0	00	(7c)	
										Air ch	ange	es per ho	our
Infiltration due	o chimne	ys, fans	and flue	s						0.		(8)	
Pressure test,	esult q50	•						5.00				(17)	
Air permeability	'									0.0	38	(18)	
Number of side	s on whic	h shelte	red							2.0	00	(19)	
Shelter factor										0.0	35	(20)	
Infiltration rate	ncorpora	ting shel ⁱ	ter facto	r						0.0	32	(21)	
Infiltration rate	modified t	for month	nly wind	speed									
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
5.10 5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70			

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
											13.1	3 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.41	0.40	0.39	0.35	0.34	0.30	0.30	0.30	0.32	0.34	0.36	0.38
											4 /

(22b)4.20

Ventilation: natural ventilation, intermittent extract fans

Effective air change rate

	, , , , ,	an ona	.go .ato										
0.5	8	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

soft coat (North) 2013 External Window New, Ground
Floor Unit B8 2.06 Window - Double-glazed, 3.800 1.33 (1.40) 5.04 (27) air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground
Floor Unit B8 2.06_Living Walls 17.24 0.18 3.10 (29) 2013 External Wall New, Ground Floor Unit B8 2.06_Living
Walls 3.83 0.18 0.69 (29) 2013 External Wall New, Ground Floor
Unit B8 2.06 Walls 6.33 0.18 1.14 (29) 2013 External Wall New, Ground Floor Unit B8 2.06 Living
Internal wall 74.42 0.00 0.00 2013 Internal Partition, Ground Floor
Unit B8 2.06 Internal wall 20.84 0.00 0.00 2013 Internal Partition, Ground Floor
Unit B8 2.06_Living Internal floor 69.88 0.00 0.00 2013 Internal Ceiling/Floor, Ground
Floor Unit B8 2.06 Internal floor 31.47 0.00 0.00 2013 Internal Ceiling/Floor, Ground
Floor Unit B8 2.06_Living Internal ceiling 3.77 0.00 0.00 2013 Internal Ceiling/Floor, Ground Floor Unit B8 2.06
Total area of external elements Sigma A, m ² Fabric heat loss, W/K Thermal mass parameter, kJ/m ² K (user-specified TMP) Effect of thermal bridges Total fabric heat loss Ventilation heat loss calculated monthly 34.34 (31) 250.00 (35
30.36 30.19 30.02 29.25 29.10 28.43 28.43 28.30 28.69 29.10 29.40 29.70 (38)
Heat transfer coefficient, W/K
46.21 46.04 45.87 45.10 44.95 44.28 44.28 44.15 44.54 44.95 45.24 45.55
Heat loss parameter (HLP), W/m²K (39)
0.88 0.88 0.87 0.86 0.86 0.84 0.84 0.84 0.85 0.86 0.86 0.87
HLP (average) Number of days in month (Table 1a) 0.86 (40)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
31 28 31 30 31 30 31 30 31 30 31

4. Wate Assume		g energy	require	ements							kWh/year 1.77	(42)
Annual a			r usage	in litres p	er dav V	/d.avera	ge				76.13	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(-
		in litres	•	_		100.	, lug	СОР	1001	1.101	200	
83.75	80.70	77.66	74.61	71.56	68.52	68.52	71.56	74.61	77.66	80.70	83.75	(44)
		of hot wa			00.02	00.02	7 1.00	7 4.01	17.00	00.70	00.70	(
	108.62		97.72	93.76	80.91	74.98	86.04	87.06	101.46	110.76	120.27	
Energy			07.72	30.70	00.01	7 4.00	00.04	07.00	101.40	110.70	1197.86	(45
Distribut	ion loss	,										(10
18.63	16.29	16.81	14.66	14.06	12.14	11.25	12.91	13.06	15.22	16.61	18.04	(46
Cylinder Manufac Tempera Energy I Total sto	cturer's c ature Fa lost from	leclared ctor hot wate	-		,		150.00 1.39 0.5400				0.75	(47 (48 (49 (55
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56
Net stora	age loss											
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57
Primary	loss	1							1			
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59
Total he	at requir	ed for wa	ater heat	ing calci	ulated fo	r each m	onth					,
		158.68					132.63	132.16	148.06	155.85	166.87	(62
Output f							1 10 - 100	1 1 3 2 1 1 3	1 10100	1		`
170.79							132.63	132.16	148.06	155.85	166.87	(64
	100.71	100.00	1 .2.0 .	1 10.00	120.00	121.07	102.00	102.10	1 10.00	100.00	1746.48	(64)
Heat gai	ins from	water he	ating, k\	Nh/mont	th							(
78.57	69.78	74.54	68.57	68.45	62.98	62.21	65.88	65.02	71.01	72.90	77.27	(65
5. Interr				.				0		IN.		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabol			1	1	1	1	1	T	I	1	1	(00
88.28	88.28	88.28	88.28	88.28	88.28	88.28	88.28	88.28	88.28	88.28	88.28	(66
Lighting		1	1	1	1	1	1	ı	1	1		
14.91	13.24	10.77	8.15	6.09	5.14	5.56	7.23	9.70	12.31	14.37	15.32	(67
Applianc												
	155.47	151.45	142.88	132.07	121.91	115.12	113.52	117.55	126.11	136.93	147.09	(68
Cooking												
31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	(69
Pumps a	and fans	gains										
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70
Losses	e.g. evar	oration	negative	values)		1	1	I	1	1		
-70.62	-70.62	-70.62	-70.62	-70.62	-70.62	-70.62	-70.62	-70.62	-70.62	-70.62	-70.62	(71
Water h			<u> </u>	1		1	1		1	1		`
		100.19	95.23	92.01	87.47	83.61	88.55	90.31	95.45	101.25	103.85	(72
	ernal ga		100.20	32.01	37.47	55.51	1 30.00	30.01	30.40	1	.00.00	' _
326.87		314.90	298 75	282.65	267.00	256 77	261.78	270.04	286 36	305.03	318.75	(73
020.07	020.00	017.30	200.73	202.00	207.00	200.77	201.70	210.04	200.00	000.00	310.73	(10

6. Solar gains	(calculat	ion for .	January)							
Window - Doub	ole-glazed	l, air-fille	d, low-E,		a & Flux x 3.140 1		g & FF 0.63 x 0.7		Shading 1.77	Gains 10.2041	
En=0.1, soft co 2013 Externa Window - Doub	l Window ble-glazed	New, Gil, air-fille			B8 2.06 x 3.800 1	10.63	0.63 x 0.7	70 0).77	12.3489	
En=0.1, soft co 2013 Externa Total solar gair	l Window	New, G	round Flo	oor Unit	B8 2.06_l	Living				22.55	(83-1)
Solar gains 22.55 43.10	73.24	117.64	158.47	169.65	158.39	125 66	88.05	51.30	27.82	18.80	(83)
Total gains	70.24	117.04	100.47	100.00	100.00	120.00	7 00.00	01.00	27.02	10.00	(33)
349.43 368.1	5 388.13	416.39	441.12	436.65	415.16	387.44	4 358.09	337.66	332.85	337.55	(84)
	'				'				1		
Lighting calcu	ılations			۸	_		_	_	T v Cha	مائم م	
Window - Doub	ole-glazed	l, air-fille	d, low-E,	Are 0.9	а х 3.14		g 0.80		F x Shad .70 x 0.8		
En=0.1, soft co	at (North))			D						
2013 Externa Window - Doub					B8 2.06 x 3.80	(0.80	0	.70 x 0.8	3 1.59	
En=0.1, soft co	at (North))					0.00	·	o x o.o	1.00	
2013 Externa GL = 2.90 / 52.			round Flo	oor Unit	B8 2.06_L	Living					
GL = 2.90 / 52. C1 = 0.500	36 = 0.03	5									
C2 = 1.043											
El = 263											
7. Mean intern			nds in th	e livina a	area Th1	(°C)				21 00	(85)
7. Mean intern Temperature d Heating system	uring hea	ting perio	ods in th	e living a	area, Th1	(℃)				21.00 1.00	(85)
Temperature d	uring hea	ting perio	ods in the	e living a	area, Th1	(℃) Aug	Sep	Oct	Nov		(85)
Temperature d Heating system	uring hea respons	ting perio	_				Sep	Oct	Nov	1.00	(85)
Temperature d Heating system Jan Feb tau 78.99 79.28	uring hea respons	ting perio	_				Sep 81.96	Oct 81.20	Nov 80.67	1.00	(85)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha	uring hea respons Mar 79.57	ting perio	May 81.20	Jun 82.44	Jul 82.44	Aug 82.67	81.96	81.20	80.67	1.00 Dec 80.13	(85)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29	uring hean respons Mar 79.57	ting periodiveness Apr 80.94	May 81.20	Jun	Jul	Aug			1	1.00 Dec	(85)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor	respons Mar 79.57 6.30 or for gain	ting perion iveness Apr 80.94 6.40 s for livir	81.20 6.41 ng area	Jun	Jul	Aug 82.67 6.51	81.96	81.20	80.67	1.00 Dec 80.13	
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99	respons Mar 79.57 6.30 respons 0.99	ting periciveness Apr 80.94 6.40 s for livir 0.95	May 81.20 6.41 ng area 0.84	Jun	Jul 82.44	Aug 82.67	81.96	81.20	80.67	1.00 Dec 80.13	(85)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99 Mean internal t	respons Mar 79.57 6.30 r for gain 0.99 emperatu	ting perior iveness Apr 80.94 6.40 s for livir 0.95 re in livir	May 81.20 6.41 ng area 0.84 ng area 1.84 ng area 1.84	Jun	Jul	Aug 82.67 6.51 0.52	81.96	81.20 6.41 0.96	80.67 6.38 0.99	1.00 Dec 80.13 6.34 1.00	(86)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99 Mean internal t 20.20 20.29	respons Mar 79.57 6.30 refor gain 0.99 emperatu 20.47	ting perior tiveness Apr 80.94 6.40 s for livir 0.95 re in livir 20.72	May 81.20 6.41 ng area 0.84 ng area 20.91	Jun	Jul	Aug 82.67 6.51 0.52	81.96	81.20	80.67	1.00 Dec 80.13	
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99 Mean internal t 20.20 20.29 Temperature d	respons Mar 79.57 6.30 or for gain 0.99 emperatu 20.47 uring hea	ting periciveness Apr 80.94 6.40 s for livin 0.95 re in livin 20.72 ting perici	May 81.20 6.41 ng area 0.84 ng area 20.91 ods in re	Jun	Jul	Aug 82.67 6.51 0.52 21.00	81.96 6.46 0.79	81.20 6.41 0.96	80.67 6.38 0.99	1.00 Dec 80.13 6.34 1.00 20.19	(86)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99 Mean internal t 20.20 20.29	respons Mar 79.57 6.30 refor gain 0.99 emperatu 20.47 uring hea 20.19	ting periciveness Apr 80.94 6.40 s for livir 0.95 re in livir 20.72 ting perici	May 81.20 6.41 ng area 0.84 ng area 20.91 ods in re 20.21	Jun 82.44 6.50 0.63 1 20.99 st of dwe 20.22	Jul	Aug 82.67 6.51 0.52	81.96	81.20 6.41 0.96	80.67 6.38 0.99	1.00 Dec 80.13 6.34 1.00	(86)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99 Mean internal t 20.20 20.29 Temperature d 20.19 20.19	respons Mar 79.57 6.30 refor gain 0.99 emperatu 20.47 uring hea 20.19	ting periciveness Apr 80.94 6.40 s for livir 0.95 re in livir 20.72 ting perici	May 81.20 6.41 ng area 0.84 ng area 20.91 ods in re 20.21	Jun 82.44 6.50 0.63 1 20.99 st of dwe 20.22	Jul	Aug 82.67 6.51 0.52 21.00	81.96 6.46 0.79	81.20 6.41 0.96	80.67 6.38 0.99	1.00 Dec 80.13 6.34 1.00 20.19	(86)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99 Mean internal t 20.20 20.29 Temperature d 20.19 20.19 Utilisation factor	respons Mar 79.57 6.30 or for gain 0.99 emperatu 20.47 uring hea 20.19 or for gain 0.98	ting periciveness Apr 80.94 6.40 s for livin 0.95 re in livin 20.72 ting perici 20.20 s for resi 0.94	May 81.20 6.41 ng area 0.84 ng area 20.91 ods in re 20.21 t of dwel 0.80	Jun	Jul	Aug 82.67 6.51 0.52 21.00	81.96 6.46 0.79 20.95	81.20 6.41 0.96 20.73	80.67 6.38 0.99 20.44	1.00 Dec 80.13 6.34 1.00 20.19	(86) (87) (88)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99 Mean internal t 20.20 20.29 Temperature d 20.19 20.19 Utilisation factor 0.99 0.99 Mean internal t 19.12 19.26	respons Mar 79.57 6.30 6.30 10.99 20.47 20.19 ar for gain 0.98 emperatu 19.51	ting periciveness Apr 80.94 6.40 s for livir 0.95 re in livir 20.72 ting perici 20.20 s for resi 0.94 re in the 19.87	May 81.20 6.41 ng area 0.84 20.91 ods in re 20.21 t of dwel 0.80 rest of c 20.12	Jun	Jul	Aug 82.67 6.51 0.52 21.00	81.96 6.46 0.79 20.95	81.20 6.41 0.96 20.73	80.67 6.38 0.99 20.44	1.00 Dec 80.13 6.34 1.00 20.19 20.20 1.00 19.11	(86) (87) (88) (89) (90)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factod 1.00 0.99 Mean internal t 20.20 20.29 Temperature d 20.19 20.19 Utilisation factod 0.99 0.99 Mean internal t	respons Mar 79.57 6.30 6.30 or for gain 0.99 emperatu 20.47 uring hea 20.19 or for gain 0.98 emperatu 19.51 stion (15.7)	ting periciveness Apr 80.94 6.40 s for livir 0.95 re in livir 20.72 ting perici 20.20 s for resi 0.94 re in the 19.87	May 81.20 6.41 ng area 0.84 ng area 20.91 ods in re 20.21 t of dwel 0.80 rest of c 20.12 6)	Jun	Jul	Aug 82.67 6.51 0.52 21.00 20.22	81.96 6.46 0.79 20.95 20.21	81.20 6.41 0.96 20.73 20.21	80.67 6.38 0.99 20.44 20.20	1.00 Dec 80.13 6.34 1.00 20.19 20.20 1.00	(86) (87) (88) (89)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99 Mean internal t 20.20 20.29 Temperature d 20.19 20.19 Utilisation factor 0.99 0.99 Mean internal t 19.12 19.26 Living area fractor	respons Mar 79.57 6.30 6.30 or for gain 0.99 emperatu 20.47 uring hea 20.19 or for gain 0.98 emperatu 19.51 stion (15.7)	ting periciveness Apr 80.94 6.40 s for livir 0.95 re in livir 20.72 ting perici 20.20 s for resi 0.94 re in the 19.87	May 81.20 6.41 ng area 0.84 ng area 20.91 ods in re 20.21 t of dwel 0.80 rest of c 20.12 6)	Jun	Jul	Aug 82.67 6.51 0.52 21.00 20.22	81.96 6.46 0.79 20.95 20.21	81.20 6.41 0.96 20.73 20.21	80.67 6.38 0.99 20.44 20.20	1.00 Dec 80.13 6.34 1.00 20.19 20.20 1.00 19.11	(86) (87) (88) (89) (90)
Temperature d Heating system Jan Feb tau 78.99 79.28 alpha 6.27 6.29 Utilisation factor 1.00 0.99 Mean internal t 20.20 20.29 Temperature d 20.19 20.19 Utilisation factor 0.99 0.99 Mean internal t 19.12 19.26 Living area fract Mean internal t	respons 79.57 6.30 79.57 6.30 or for gain 0.99 emperature 20.47 uring hear 20.19 or for gain 0.98 emperature 19.51 stion (15.7) emperature 19.80	ting periciveness Apr 80.94 6.40 s for livir 0.95 re in livir 20.72 ting peric 20.20 s for resi 0.94 re in the 19.87 74 / 52.56 re (for th	May 81.20 6.41 ag area 0.84 ag area 20.91 ads in re 20.21 af of dwel 0.80 cest of column 20.12 6) ae whole 20.36 20.36	Jun	Jul	Aug 82.67 6.51 0.52 21.00 20.22 0.43 20.22	81.96 6.46 0.79 20.95 20.21 20.18	81.20 6.41 0.96 20.73 20.21 0.95	80.67 6.38 0.99 20.44 20.20 0.99	1.00 Dec 80.13 6.34 1.00 20.19 20.20 1.00 19.11 0.30	(86) (87) (88) (89) (90) (91)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisatio	n factor	for gains	5			•						
0.99	0.99	0.98	0.93	0.81	0.58	0.41	0.46	0.74	0.94	0.99	0.99	
Useful g	ains		•	•								
347.16	364.40	379.66	388.66	355.23	255.09	170.17	178.23	265.92	319.03	328.40	335.75	
Monthly	average	externa	tempera	ature	•	•	•		•	•		
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	
Heat los	s rate fo	r mean i	nternal te	emperati	ire							
699.82	675.19	609.94	506.18	389.12	258.67	170.48	178.86	281.03	429.08	572.86	694.03	
Fraction	of mont	h for hea	iting									
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space h	eating re	quireme	nt for ea	ch mont	h, kWh/r	nonth			•			
262.38	208.85	171.33	84.61	25.22	-	-	-	-	81.87	176.01	266.56	
	ace heat leating re					ar) (Oct	ober to N	lay)	•		1276.84 24.29	

9a. Energy requirements

9a. Energy requirements	•								kWh/year	
No secondary heating sys Fraction of space heat fro Efficiency of main heating	m main		s)				1.0000 3.50%		•	(202) (206)
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requiremen	nt									
262.38 208.85 171.33	84.61	25.22	-	-	-	-	81.87	176.01	266.56	(98)
Appendix Q - monthly ene	rgy save	ed (main	heating	system	1)					
		0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main	heating	system	1)			•				
280.62 223.37 183.24	90.50	26.97	-	-	-	-	87.56	188.24	285.09	(211)
Appendix Q - monthly ene	rgy save	ed (main	heating	system	2)					
0.00 0.00 0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main	heating :	system 2	2)							
		0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly ene	ergy save	ed (seco	ndary he	eating sy	stem)					
		0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secon	idary)									
	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating										
Water heating requiremen		1 10 00	100.00	101 57	100.00	100.10	1 10 00	455.05	100.07	(C4)
170.79 150.71 158.68	142.81	140.36	126.00	121.57	132.63	132.16	148.06	155.85	166.87	(64)
Efficiency of water heater	00.47	04.00	70.00	70.00	70.00	70.00	00.04	05.44	79.80	(216)
85.96 85.68 85.02 Water heating fuel	83.47	81.26	79.80	79.80	79.80	79.80	83.31	85.14	86.06	(217)
	171.09	172.72	157.90	152.34	166.20	165.61	177.73	183.05	193.90	(219)
190.09 1/3.00 100.04	171.09	172.72	157.90	152.34	100.20	105.01	177.73	163.05	193.90	(219)
Annual totals Space heating fuel used, i Space heating fuel (secon Water heating fuel	ndary)		hat						kWh/year 1365.60 0.00 2101.77	(211) (215) (219)
Electricity for pumps, fans central heating pump boiler with a fan-assisted Total electricity for the abo Electricity for lighting (100 Energy saving/generation Appendix Q -	I flue ove, kWI .00% fix	h/year ed LEL)							30.00 45.00 75.00 263.27	(230c) (230e) (231) (232)
Energy saved or genera Energy used ():	.,								0.000	(236a) (237a)
Total delivered energy for	all uses								3805.64	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/ye	ear
Space heating, main system 1	1365.60	0.216	294.97	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	2101.77	0.216	453.98	(264)
Space and water heating			748.95	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	263.27	0.519	136.64	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - μCHP	0.00	0.000	0.00	(269)
Appendix Q -				, ,
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			924.52	(272)
			kg/m²/yea	
Emissions per m ² for space and water heating			14.25	(272a)
Emissions per m ² for lighting			2.60	(272b)
Emissions per m ² for pumps and fans			0.74	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2495 x 1.00) + 2.5997 + 0.7406			17.59	(273)

Project InformationBuilding type Top-floor flat

Reference

Date 8 April 2016 Project NW1

1. Ove	rall dwel	ling dim	ensions	;									
	oor oor area ng volume	e (m³)					Area (m²) 52.56 52.56		Av. Store height (r 3.00		Volume (m³) 157.68	3	(3a) (4) (5)
2. Ven	tilation ra	ate											
							main + s	eonda	ry + othe	r	m³	per	hour
Numbe Numbe Numbe	er of chimer of open er of interier of pass er of fluele	flues mittent fa ive vents	3				heating 0 + 0 + 0 0 + 0 + 0 0 0		x 40 x 20 x 10 x 10 x 40			0.00 0.00 0.00 0.00) (6b)) (7a)) (7b)
Pressu Air peri Numbe Shelter Infiltrati	ion due to tre test, re meability er of sides factor ion rate ir	esult q50 s on whic ncorpora	ting shel	red ter facto	r				5.00			cha 0.00 0.25 2.00 0.85 0.21	(17) 5 (18) 0 (19) 5 (20)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70		
Wind F	actor	•	1	•			-	1	•		5	2.50) (22)
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18		
Adiuste	ed infiltrat	ion rate	(allowing	for shel	ter and v	wind sn	eed)				1	3.13	3 (22a)
0.27	0.27	0.26	0.23	0.23	0.20	0.20	0.20	0.21	0.23	0.24	0.25		
air cha efficie Ventila	ange rate ency in % tion : bala re air cha	through allowing	system g for in-u	se facto	,		0.50 79.90	ı		ı		2.79	(22b) (23a) (23c)
0.37	0.37	0.36	0.33	0.33	0.30	0.30	0.30	0.31	0.33	0.34	0.35		(25)

		and hear										
Element	t	Gross		enings	Net are		-value	AxU		kappa-val		
Window	- Doubl	area, m e-glazed			A, m ² 3.79 !		'/m²K 33 (1.40)	W/K 5.0		kJ/m²K	kJ/K	(27)
air-filled			,		5.75		55 (1. 4 6)	0.0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			(21)
soft coa												
		Window	New, Gr	ound								
Floor l	Jnit B8 2	2.06_Livi	ng									
		e-glazed	,		3.13	61.	33 (1.40)	4.1	16			(27)
air-filled												
soft coa												
		Window	new, Gr	ouna								
Walls	Jnit B8 2	2.06			17.2	4	0.14	2.4	11	21.95	378.37	(20)
	Evternal	Wall Nev	w Groun	d Floor	17.2	+	0.14	۷.۲	+ 1	21.95	370.37	(29)
	8 2.06_L		w, Groun	u i 1001								
Walls	0 2.00_5	-141119			6.33	3	0.14	3.0	39	21.95	139.01	(29)
	External	Wall Nev	w, Groun	d Floor			• • • • • • • • • • • • • • • • • • • •					()
	8 2.06_L		,									
Walls	_	Ü			3.83	3	0.14	0.5	54	21.95	83.98	(29)
		Wall Nev	w, Groun	d Floor								
Unit B												
Internal					20.8	4	0.00	0.0	00	8.75	182.36	
		Partition,	Ground	Floor								
	8 2.06_L	iving			74.4	2	0.00	0.0	20	8.75	651.18	
Internal		Partition,	Ground	Eloor	74.42	2	0.00	0.0	JU	0.75	031.16	
Unit B		artition,	around	1 1001								
Internal					69.88	8	0.00	0.0	00	95.00	6638.30)
		Ceiling/Fl	loor, Gro	und	00.0		0.00	0.1		00.00	0000.00	
	Jnit B8 2		,									
Internal	floor				31.4	7	0.00	0.0	00	95.00	2989.88	3
		Ceiling/Fl		und								
		2.06_Livi	ng									
Internal		- ··· /=			3.7	7	0.00	0.0	00	95.00	358.48	
		Ceiling/Fl	loor, Gro	und								
Floor	Jnit B8 2	2.06										
Total ar	oa of ov	ternal ele	monte S	iama A	m²						34.33	3 (31)
Fabric h			inenis c	ngilia A,	111-						13.02	
			r. kJ/m²ł	(user-s	specified	TMP)					250.00	
		l bridges		(0.00.		,					0.08	
Total fal											13.10	
Ventilati	on heat	loss calc	ulated m	onthly								
19.33	19.05	18.77	17.39	17.12	15.73	15.73	15.46	16.29	17.12	17.67	18.22	(38)
Heat tra	nsfer co	efficient,	W/K			1			-1			
32.43	32.16	31.88	30.50	30.22	28.84	28.84	28.56	29.39	30.22	30.77	31.33	
	10-110	10.1100	100.00		1-0.0	1 - 0 . 0	1-0100			100	30.43	3 (39)
Heat los	s param	neter (HL	P), W/m	²K							00.10	(00)
0.62	0.61	0.61	0.58	0.57	0.55	0.55	0.54	0.56	0.57	0.59	0.60	
HLP (av		10.01	0.00	1 3.3,	10.00	10.00	10.01	10.00	10.07	10.00	0.58	3 (40)
		in month	n (Table	1a)							0.50	, (40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	
31	20	3	30	31	130	131] 3 1	130	01	30	31	

	er heating ed occupa		require	ements							kWh/yeai 1.77	(42
	average		r usage	in litres p	er day V	/d,avera	ge				80.14	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	er usage		•			100.	1.1.9					
88.15	84.95	81.74	78.54	75.33	72.13	72.13	75.33	78.54	81.74	84.95	88.15	(44)
	content of			1 0 10 0	11211	1	1 0 10 0	1 0 10 1				
	114.34		102.86	98.70	85.17	78.92	90.56	91.65	106.80	116.59	126.60	
	content (102.00	00.70	00.17	70.02	00.00	01.00	100.00	110.00	1260.91	(45
	tion loss	aa.a.,									00.0.	(. •
19.61	17.15	17.70	15.43	14.80	12.78	11.84	13.58	13.75	16.02	17.49	18.99	(46
Hot water	er storag	e volume	e (litres)								110.00	(50
	er cylinde	er loss fa	ctor (kW	/h/day)							0.0152	(51
Volume		tor									1.0294	(52
	ature faction		er cylinde	er (kWh/	dav)						0.6000 1.03	(53 (55
	orage los		or Oymiac	21 (100011)	aay)						1.00	(00)
32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56
Net stor	age loss											•
32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57
Primary												`
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59
	eat requir								1-0:-0			(
	164.26						145.84	145.14	162.08	170.08	181.88	(62
	from water						140.04	140.14	102.00	170.00	101.00	(02
186.01		173.26			138.66		145.84	145.14	162.08	170.08	181.88	(64
100.01	104.20	175.20	130.30	133.30	130.00	134.20	145.04	145.14	102.00	170.00		(0-1
Heat na											1911 75	(64
. ioui ya	ins from	water he	eating, k\	Nh/mont	th						1911.75	(64
	77.96					70.46	74.33	73.27	79.73	81.56	,	(64) (65)
87.69	77.96	water he	eating, k\ 77.00	Wh/mont 77.04	th 71.11	70.46	74.33	73.27	79.73	81.56	1911.75	,
87.69	77.96	83.45				70.46	74.33	73.27	79.73	81.56	,	(64) (65)
87.69	77.96	83.45 S	77.00				74.33		79.73		86.32	, ,
87.69	77.96	83.45				70.46 Jul	74.33 Aug	73.27 Sep	79.73	81.56 Nov	,	, ,
87.69 <i>5. Interi</i> Jan	77.96	83.45 s Mar	77.00	77.04	71.11						86.32	,
87.69 <i>5. Interi</i> Jan	77.96 nal gains	83.45 s Mar	77.00	77.04	71.11						86.32	(65
87.69 5. Interior Jan Metabol	77.96 nal gains Feb lic gains, 88.28	83.45 S Mar Watts	77.00	77.04 May	71.11 Jun	Jul	Aug	Sep	Oct	Nov	86.32 Dec	(65
87.69 5. Interior Jan Metabol 88.28	77.96 nal gains Feb lic gains, 88.28	83.45 S Mar Watts	77.00	77.04 May	71.11 Jun	Jul	Aug	Sep	Oct	Nov	86.32 Dec	•
87.69 5. Interior Jan Metabol 88.28 Lighting 14.49	77.96 nal gains Feb lic gains, 88.28 gains	83.45 Mar Watts 88.28	77.00 Apr	77.04 May 88.28	71.11 Jun 88.28	Jul 88.28	Aug 88.28	Sep 88.28	Oct 88.28	Nov 88.28	86.32 Dec 88.28	(65
5. Interior Jan Metabol 88.28 Lighting 14.49 Appliance	r77.96 mal gains Feb lic gains, 88.28 gains 12.87	83.45 S Mar Watts 88.28	77.00 Apr 88.28	77.04 May 88.28	71.11 Jun 88.28	Jul 88.28 5.40	Aug 88.28	Sep 88.28	Oct 88.28	Nov 88.28	86.32 Dec 88.28 14.89	(65 (66 (67
5. Interior Jan Metabol 88.28 Lighting 14.49 Appliance	ral gains Feb lic gains, 88.28 gains 12.87 ces gains 155.47	83.45 S Mar Watts 88.28	77.00 Apr 88.28	77.04 May 88.28	71.11 Jun 88.28	Jul 88.28 5.40	Aug 88.28 7.02	Sep 88.28 9.43	Oct 88.28	Nov 88.28	86.32 Dec 88.28 14.89	(65 (66 (67
5. Interior Jan Metabol 88.28 Lighting 14.49 Appliance 153.88	ral gains Feb lic gains, 88.28 gains 12.87 ces gains 155.47	83.45 S Mar Watts 88.28	77.00 Apr 88.28	77.04 May 88.28	71.11 Jun 88.28	Jul 88.28 5.40	Aug 88.28 7.02	Sep 88.28 9.43	Oct 88.28	Nov 88.28	86.32 Dec 88.28 14.89	(65 (66 (67 (68
87.69 5. Interior Jan Metabol 88.28 Lighting 14.49 Appliand 153.88 Cooking 31.83	ral gains Feb lic gains, 88.28 gains 12.87 ces gains 155.47 gains 31.83	83.45 Mar Watts 88.28 10.46 31.83	77.00 Apr 88.28 7.92 142.88	77.04 May 88.28 5.92	71.11 Jun 88.28 5.00	Jul 88.28 5.40 115.12	Aug 88.28 7.02 113.52	Sep 88.28 9.43 117.55	Oct 88.28 11.97	Nov 88.28 13.97	B6.32 Dec	(65 (66 (67 (68
5. Interior Jan Metabol 88.28 Lighting 14.49 Appliand 153.88 Cooking 31.83 Pumps	ral gains Feb lic gains, 88.28 gains 12.87 ces gains 155.47 g gains	83.45 Mar Watts 88.28 10.46 31.83	77.00 Apr 88.28 7.92 142.88	77.04 May 88.28 5.92 132.07	71.11 Jun 88.28 5.00	Jul 88.28 5.40 115.12	Aug 88.28 7.02 113.52 31.83	Sep 88.28 9.43 117.55	Oct 88.28 11.97 126.11 31.83	Nov 88.28 13.97 136.93	86.32 Dec	(65 (66 (67 (68 (69
5. Interior Jan Metabol 88.28 Lighting 14.49 Appliand 153.88 Cooking 31.83 Pumps a	ral gains Feb lic gains, 88.28 gains 12.87 ces gains 155.47 gains 31.83 and fans 0.00	83.45 Mar Watts 88.28 10.46 31.83 gains 0.00	77.00 Apr 88.28 7.92 142.88 31.83	77.04 May 88.28 5.92 132.07 31.83	Jun 88.28 5.00 121.91 31.83	Jul 88.28 5.40 115.12	Aug 88.28 7.02 113.52	Sep 88.28 9.43 117.55	Oct 88.28 11.97	Nov 88.28 13.97	B6.32 Dec	(65 (66 (67 (68 (69
5. Interior Jan Metabol 88.28 Lighting 14.49 Appliant 153.88 Cooking 31.83 Pumps 50.00 Losses	ral gains Feb lic gains, gains 12.87 ces gains 155.47 g gains 31.83 and fans 0.00 e.g. evar	83.45 Mar Watts 88.28 10.46 31.83 gains 0.00 poration (77.00 Apr 88.28 7.92 142.88 31.83 0.00 (negative	77.04 May 88.28 5.92 132.07 31.83 0.00 e values)	71.11 Jun 88.28 5.00 121.91 31.83	Jul 88.28 5.40 115.12 31.83	Aug 88.28 7.02 113.52 31.83	Sep 88.28 9.43 117.55 31.83 0.00	Oct 88.28 11.97 126.11 31.83 0.00	Nov 88.28 13.97 136.93 31.83	86.32 Dec	(65 (66 (67 (68 (69
5. Interior Jan Metabol 88.28 Lighting 14.49 Appliance 153.88 Cooking 31.83 Pumps 50.00 Losses -70.62	r77.96 mal gains Feb lic gains, 88.28 gains 12.87 ces gains 155.47 gains 31.83 and fans 0.00 e.g. evap	83.45 Mar Watts 88.28 10.46 31.83 gains 0.00 poration (77.00 Apr 88.28 7.92 142.88 31.83	77.04 May 88.28 5.92 132.07 31.83	Jun 88.28 5.00 121.91 31.83	Jul 88.28 5.40 115.12	Aug 88.28 7.02 113.52 31.83	Sep 88.28 9.43 117.55	Oct 88.28 11.97 126.11 31.83	Nov 88.28 13.97 136.93	86.32 Dec	(65 (66 (67 (68 (69
5. Interior Jan Metabol 88.28 Lighting 14.49 Appliand 153.88 Cooking 31.83 Pumps 0.00 Losses -70.62 Water h	ral gains Feb lic gains, 88.28 gains 12.87 ces gains 155.47 gains 31.83 and fans 0.00 e.g. evap -70.62 leating gains	83.45 Mar Watts 88.28 10.46 31.83 gains 0.00 coration (-70.62 ains	77.00 Apr 88.28 7.92 142.88 31.83 0.00 (negative -70.62	77.04 May 88.28 5.92 132.07 31.83 0.00 e values) -70.62	71.11 Jun 88.28 5.00 121.91 31.83 0.00 -70.62	Jul 88.28 5.40 115.12 31.83 0.00	Aug 88.28 7.02 113.52 31.83 0.00	Sep 88.28 9.43 117.55 31.83 0.00 -70.62	Oct 88.28 11.97 126.11 31.83 0.00 -70.62	Nov 88.28 13.97 136.93 31.83 0.00	B6.32 Dec	(65 (66 (67 (68 (69 (70
87.69 5. Interior Jan Metabol 88.28 Lighting 14.49 Appliand 153.88 Cooking 31.83 Pumps 0.00 Losses -70.62 Water h 117.86	77.96	83.45 Mar Watts 88.28 10.46 31.83 gains 0.00 poration (-70.62 ains 112.17	77.00 Apr 88.28 7.92 142.88 31.83 0.00 (negative	77.04 May 88.28 5.92 132.07 31.83 0.00 e values) -70.62	71.11 Jun 88.28 5.00 121.91 31.83 0.00 -70.62	Jul 88.28 5.40 115.12 31.83	Aug 88.28 7.02 113.52 31.83	Sep 88.28 9.43 117.55 31.83 0.00	Oct 88.28 11.97 126.11 31.83 0.00	Nov 88.28 13.97 136.93 31.83	B6.32 Dec	(65
87.69 5. Interior Jan Metabol 88.28 Lighting 14.49 Appliand 153.88 Cooking 31.83 Pumps 0.00 Losses -70.62 Water h 117.86	r77.96 ral gains Feb lic gains, 88.28 gains 12.87 ces gains 31.83 and fans 0.00 e.g. evap -70.62 neating gains 116.01 ternal gains	83.45 Mar Watts 88.28 10.46 31.83 gains 0.00 poration (-70.62 ains 112.17	77.00 Apr 88.28 7.92 142.88 31.83 0.00 (negative) -70.62 106.94	77.04 May 88.28 5.92 132.07 31.83 0.00 e values) -70.62	Jun 88.28 5.00 121.91 31.83 0.00 -70.62	Jul 88.28 5.40 115.12 31.83 0.00 -70.62 94.71	Aug 88.28 7.02 113.52 31.83 0.00	Sep 88.28 9.43 117.55 31.83 0.00 -70.62 101.76	Oct 88.28 11.97 126.11 31.83 0.00 -70.62 107.17	Nov 88.28 13.97 136.93 31.83 0.00 -70.62 113.28	B6.32 Dec	(65 (66 (67 (68 (69 (70

6. Solai	r gains (calculat	ion for J	lanuary)		۰. تا		. ==		S1 11	0 .	
Window	ı - Doubl	e-alazed	. air-filled	d. low-E.		a & Flux x 3.795		g & FF 0.63 x 0.8		Shading 0.77	Gains 14.0944	
En=0.1,	soft coa	t (North)						0100 X 010		,,,,		
	External							0.000.0	00 0	\ 77	11.0100	
	or - Double soft coa			ı, ıow-⊨,	0.9	x 3.136	10.63	0.63 x 0.8	30 ().77	11.6469	
	External			ound Flo	or Unit E	38 2.06						
1 : - 4:		_4:										
Lignting	g calcul	ations			Area	а		a	F	F x Shad	dina	
	ı - Doubl			d, low-E,		x 3.79		g 0.80		0.80 x 0.8		
	soft coa			منتما الم	الجامالييم	20.000	م ماندا					
	External / - Doubl					38 ∠.06_ x 3.14	Living	0.80	(0.80 x 0.8	3 1.50	
	soft coa			л, 10 11 ш,	0.0	χ σ. ι ι		0.00		7.00 X 0.0	1.00	
2013 E	External	Window	New, Gr	ound Flo	or Unit E	38 2.06						
7 Mear	n interna	l temne	rature									
Temper	ature du	ring heat	ting perio	ds in the	e living a	rea, Th1	(℃)				21.00	(85)
Heating	system	responsi	veness			_	. ,		_		1.00	, ,
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau							1			_		
112.54	113.51	114.50	119.68	120.78	126.57	126.57	127.7	9 124.19	120.78	118.61	116.52	
alpha	T	T	T=	1	T	1	T = = =	1	1	1	T	
8.50	8.57	8.63	8.98	9.05	9.44	9.44	9.52	9.28	9.05	8.91	8.77	
	on factor			-	0.00	0.00	0.00	0.50	0.04	0.07	0.00	(06)
0.99	0.98 Iternal te	0.94	0.80	0.59	0.39	0.28	0.32	0.53	0.84	0.97	0.99	(86)
20.64	20.72	20.85	20.97	21.00	21.00	21.00	21.00	21.00	20.97	20.81	20.64	(87)
	ature du	1						21.00	20.97	20.01	20.04	(67)
20.41	20.42	20.42	20.45	20.45	20.48	20.48	20.48	20.47	20.45	20.44	20.43	(88)
	on factor	1	l .			20.40	20.40	20.47	20.43	20.44	20.40	(00)
0.99	0.97	0.93	0.77	0.56	0.36	0.25	0.28	0.49	0.81	0.96	0.99	(89)
	ternal te						10.20		10.0	10.00	0.00	()
19.93	20.05	20.24	20.42	20.45	20.48	20.48	20.48	20.47	20.42	20.21	19.96	(90)
	rea fract					1					0.30	(91)
_	iternal te	. '				,			_			
20.14	20.25	20.42	20.58	20.61	20.63	20.63	20.64		20.58	20.39	20.16	(92)
Apply a	djustmer	it to the i	mean int	ernal ten	nperatur	e, where	appro	priate				

20.25 | 20.42 | 20.58 | 20.61 | 20.63 | 20.63 | 20.64 | 20.63 | 20.58 | 20.39 | 20.16

(93)

20.14

8. 5	Space	heatina	requirement	,
------	-------	---------	-------------	---

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jtilisatio	on factor	for gains	3	!		•		!	Į.	•	
0.98	0.97	0.93	0.78	0.57	0.37	0.26	0.29	0.51	0.82	0.96	0.99
Jseful (gains	•	!	!		•	·	!	ij.	•	
355.87	372.32	378.80	344.93	268.68	173.98	116.31	121.00	191.64	288.39	330.74	344.30
Monthly	average	externa	temper	ature	•	•		-		•	
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heat los	ss rate fo	r mean i	nternal te	emperati	ure		•	•			
513.83	493.67	443.69	356.30	269.40	173.99	116.31	121.00	191.81	301.64	409.02	500.02
Fraction	n of mont	h for hea	ting					•			
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space h	neating re	quireme	nt for ea	ch mont	h, kWh/ı	month		!	II.	•	
117.52	81.54	48.28	8.18	0.54	-	-	-	-	9.86	56.36	115.86
	pace heat neating re					ar) (Oct	ober to N	/lay)		•	438.15
o Cna	aa aaali		iromont								
Jan	rce cooli Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	l tempera		Αρι	iviay	Juli	Jui	Aug	оер	OCI	1407	Dec
_			l_	1_	14.60	16.60	16.40	_	l_	_	_
- Heat Ind	∃⁻ ss rate W	-			14.00	10.00	10.40				-
- Tout lot			l_	I_	271.08	213.40	217.07		-	-	-
Itilicati	on factor	for loss		I	271.00	213.40	217.07				
-		_	1_	I_	1.00	1.00	1.00	l_	I_	-	_
Jseful I	oss W				1.00	1.00	1.00				
-	T_	_	l <u>-</u>	1_	271.00	213.39	217.05	_	-	-	-
Internal	gains W				27 1.00	210.00	217.00				
0.00	0.00	0.00	0.00	0.00	375.89	362.70	369.57	0.00	0.00	0.00	0.00
Solar ga		0.00	0.00	0.00	070.00	002.70	000.07	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	226.32	211.30	167.64	0.00	0.00	0.00	0.00
Gains V		0.00	10.00	10.00		1 - 1 - 1 - 1	107.10	0.00	0.00	10.00	0.00
_	-	-	-	-	602.21	574.00	537.21	_	_	-	_
Fraction	n of mont	h for coo	ling	1		1		l .	1	I	
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
	neating k		1	1	1	1		1	1	1	
-	-	-	-	-	12.46	2.15	0.00	-	-	-	-
Space o	 cooling k\			1	1	1 =	1		1		
-	-	-	-	I-	238.47	268.29	238.20	-	I -	I -	_
Total											744.97
Cooled	fraction	tor									0.80
	Tency tac	101									
_	tency fac	-	_	-	0.25	0.25	0.25	_	-	-	_

47.69

53.66

47.64

(107) (108)

148.99 2.83

Space cooling (June to August)
Space cooling requirement per m² (kWh/m²/year)

Space cooling requirement for month

9b. Energy requirements

gy		kWh/year	
Fraction of space heat from secondary system	0.00	_	(301)
Fraction of space heat from community system	1.00		(302)
Fraction of community heat from Boilers	1.00		(303a)
Fraction of total space heat from Boilers	1.00		(304a)
Factor for control and charging method for community space heating	g 1.00 1.00		(305)
Factor for charging method for community water heating Distribution loss factor	1.05		(305a) (306)
Space heating	1.05		(300)
Annual space heating requirement	438.15		(98)
Space heat from Boilers	400.10	460.06	(307a)
Efficiency of secondary heating system	0.00	100.00	(308)
Space heating fuel for secondary system		0.00	(309)
Water heating			()
Annual water heating requirement	1911.75		(64)
Water heat from Boilers		2007.34	(310a)
Other energy			
Cooling system energy efficiency ratio	5.81%		(314)
Space cooling		25.63	(315)
Electrical energy for heat distribution		24.67	(313)
Electricity for pumps and fans within dwelling:			
Electricity for pumps, fans and electric keep-hot	haida (CED, 0.00)	115.01	(000-)
mechanical ventilation - balanced, extract or positive input from out	ISIDE (SFP=0.60)	115.81 0.00	(330a) (330b)
warm air heating system fans pump for solar water heating		0.00	(330g)
pump for waste water heat recovery		0.00	(330h)
Total electricity for the above, kWh/year		115.81	(331)
Electricity for lighting (100.00% fixed LEL)		255.85	(332)
Energy saving/generation technologies			(00-)
Appendix Q -			
Energy saved or generated ():		0.000	(336a)
Energy used ():		0.000	(337a)
Total delivered energy for all uses		2863.73	(338)

10a. Does not apply

11a. Does not apply

12b. Carbon dioxide emissions

1251 Galbon alexide emicelene	Energy kWh/year	Emission factor kg CO2/kWh	Emissions	
Efficiency of Boilers - 97.90%	-	_		(367a)
CO2 emissions from Boilers	2520.32	0.2160	544.39	(368)
Electrical energy for heat distribution	24.67	0.5190	12.81	(372)
Total CO2 associated with community systems			557.20	(373)
Total CO2 associated with space and water heating			557.20	(376)
Space cooling	25.63	0.519	13.30	(377)
Electricity for pumps and fans	115.81	0.519	60.10	(378)
Electricity for lighting	255.85	0.519	132.79	(379)
Electricity generated - PVs	0.00	0.519	0.00	(380)
Electricity generated - μCHP	0.00	0.000	0.00	(380)
Appendix Q -				, ,
Energy saved ():	0.00	0.000	0.00	(381)
Energy used ():	0.00	0.000	0.00	(382)
Total CO2, kg/year			763.39	(383)
			kg/m²/yea	r
Dwelling Carbon Dioxide Emission Rate (DER)			14.52	(384)

Project InformationBuilding type Mid-floor flat

Reference

8 April 2016 NW1 Date

Project

1	Overall	dwelling	dimension	
1.	Overaii	aweiiina	aimension	ıs

-	Area (m²)	Av. Storey height (m)	Volume (m³)	
Ground floor (2)	52.00	3.00	156.00	(3a)
Total floor area	52.00			(4)
Dwelling volume (m³)			156.00	(5)

2. Ventilation rate m³ per hour												our
Number	of open of interr of pass		3				main + se heating 0 + 0 + 0 0 + 0 + 0 2 0 0	eonda	x 40 x 20 x 10 x 10 x 40	r	0.00 0.00 20.00 0.00 0.00	(6a) (6b) (7a) (7b) (7c)
Pressur Air perm Number Shelter Infiltration	e test, reneability of sides factor on rate ir	chimne esult q50 on which ncorpora nodified t	ch shelte	red ter facto	r				5.00		0.13 0.38 2.00 0.85 0.32	(8) (17) (18) (19) (20) (21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
Wind Fa	actor						·		·		52.50	(22)
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
Adjusted	d infiltrat	ion rate	(allowing	for shel	ter and v	wind sp	eed)				13.13	(22a)
0.41	0.40	0.39	0.35	0.35	0.31	0.31	0.30	0.32	0.35	0.36	0.38	
		ıral venti nge rate		ıtermitteı	nt extrac	t fans					4.22	(22b)
0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat Element		Gross		ramete l enings	Net are		-value	AxU				
air-filled	, low-E,				A, m ² 4.83		[/] /m²K 33 (1.40)	W/K 6.4	40			(27)
Floor l	External Jnit B15	Window	New, Gr I,	ound	4.83	0 1.	33 (1.40)	6.4	40			(27)
	t (North) External) Window	New, Gr	ound								
Window air-filled soft coa	, low-E, t (North)	e-glazed En=0.1,)			2.53	0 1.	33 (1.40)	3.0	35			(27)
	External Jnit B15		New, Gr	ound								
Pitched 2013 F	roofs in: Roof Ne	sulated b	etween j Id Floor l		13.7	2	0.13	1.7	78			(30)
2013 F	roofs in		etween j d Floor l		15.8	5	0.13	2.0	06			(30)
3.03 Walls					13.2	9	0.18	2.3	39			(29)
	-xternal 15 3.03_		w, Groun	d Floor								
Walls 2013 E	External	Wall Ne	w, Groun	d Floor	27.7	9	0.18	5.0	00			(29)
Internal		Partition	Ground	Eloor	38.3	7	0.00	0.0	00			
	15 3.03		Ciround	1 1001	55.3	7	0.00	0.0	00			
2013 I		Partition,	Ground	Floor								
Internal 2013 I	floor nternal (loor, Gro	und	23.3	7	0.00	0.0	00			
Internal	floor	3.03_Li	ving loor, Gro	und	88.3	9	0.00	0.0	00			
	Jnit B15		•		9.6	5	0.00	0.0	00			
2013 I	nternal (Ceiling/F 3.03_Li	loor, Gro ving	und								
			ements S	igma A,	m²						82.8	
	l mass p	aramete	er, kJ/m²ł	د (user-s	pecified	TMP)					27.4 250.0	00 (35)
Total fal	oric hea										4.1 31.5	` ,
			culated m		100.44	100.44	100.00	00.40	100.04	00.44	100.44	(00)
30.06 Heat tra	29.90	29.73 efficient,	28.96 W/K	28.81	28.14	28.14	28.02	28.40	28.81	29.11	29.41	(38)
61.61	61.44	61.27	60.50	60.36	59.68	59.68	59.56	59.94	60.36	60.65	60.95	
			.P), W/m	1							60.5	50 (39)
1.18	1.18	1.18	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.17	1.17	
HLP (av	erage)	1	h (Table	1	10	10	10	10	10	1,	1.1	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	
		1	1		1				1			

	losses a						volue	A v. 1.1				
Elemen	ı	Gross area, m		enings	Net are A, m ²		value /m²K	A x U W/K				
Fabric h Therma Effect o Total fa	rea of ext neat loss al mass p of therma bric heat ion heat	, W/K aramete I bridges Ioss	r, kJ/m²l	≺ (user-s		TMP)					82.84 27.40 250.00 4.14 31.54	(31) (33) (35) (36) (37)
30.06	29.90	29.73	28.96	28.81	28.14	28.14	28.02	28.40	28.81	29.11	29.41	(38)
	ansfer co			20.01	20.14	20.14	20.02	20.40	20.01	23.11	23.41	(00)
61.61	61.44	61.27	60.50	60.36	59.68	59.68	59.56	59.94	60.36	60.65	60.95	
	-	1	1	1	33.00	00.00	00.00	00.04	00.00	00.00	60.50	(39)
	ss param		, '	1	T	1		Т	T			
1.18	1.18	1.18	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.17	1.17	
HLP (av Number	verage) r of days	in month	n (Table	1a)							1.16	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	
	l	I	1	1	L			L	ı			
	er heatin		y requir	ements							kWh/yea	
	ed occup		r 110000	in litron	oor dow \	/d avere					1.75 75.74	(42)
	average						·	Con	0-4	Nevi		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
83.31	er usage	77.26	· ·			CO 17	71.00	74.00	77.00	00.00	00.01	(44)
	80.28 content of	1	74.23	71.20	68.17	68.17	71.20	74.23	77.26	80.28	83.31	(44)
					00.40	74.50	05 50	00.00	100.04	110.10	110.05	
	108.06 content (97.22	93.28	80.49	74.59	85.59	86.62	100.94	110.19	119.65	(45)
	tion loss											(45)
18.53	16.21	16.73	14.58	13.99	12.07	11.19	12.84	12.99	15.14	16.53	17.95	(46)
	r volume				(1.14.1)		150.00					(47)
	cturer's o ature Fa		cylinder	loss fact	or (kWh	/day)	1.39 0.5400					(48) (49)
	lost from		er cylind	er (kWh/	dav)		0.5400				0.75	(55)
	orage los		o. 0,a	01 (11111)	uu,						0.70	(00)
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
Net stor	rage loss		1									
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
Primary	loss		1						1			
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Total he	at requir	ed for w	ater hea	ting calc	ulated fo	r each n	nonth					
170.15	150.15	158.10	142.31	139.88	125.59	121.18	132.19	131.71	147.54	155.28	166.25	(62)
Output 1	from wat	er heate	r for eac	h month,	kWh/m	onth		1	1			
170.15	150.15	158.10	142.31	139.88	125.59	121.18	132.19	131.71	147.54	155.28	166.25	(64)
Heat na	ins from	water h	eating k	Wh/mon	th	1					1740.31	(64)
78.36	69.60	74.35	68.40	68.29	62.84	62.08	65.74	64.87	70.84	72.71	77.06	(65)
, 0.50	09.00	1 7.00	100.40	00.29	02.04	102.00	00.74	07.07	7 0.04	1 4.1 1	11.00	(00)

_		
_	Intorno	I agine
. J.	Interna	i uaiiis

	iai gaiii											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	ic gains,											
87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	(66)
Lighting	gains											
13.59	12.07	9.82	7.43	5.55	4.69	5.07	6.59	8.84	11.23	13.10	13.97	(67)
Appliance	ces gains	5	•					•	•	•		
152.43	154.01	150.02	141.54	130.83	120.76	114.03	112.45	116.44	124.92	135.63	145.70	(68)
Cooking	gains	•	•	•				•	•	•		
31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	(69)
Pumps a	and fans	gains	•	•	•	•	•	1	1	•		
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses	e.g. evap	oration	negative	values)		1	1					
-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	(71)
Water h	eating g	ains										, ,
105.32	103.57	99.94	95.00	91.79	87.27	83.44	88.35	90.10	95.21	100.99	103.58	(72)
Total int	ernal gai	ins										, ,
			296.20	280.41	264.96	254.77	259.63	267.61	283.60	301.96	315.48	(73)
							1					
En=0.1, 2013 E Window En=0.1, 2013 E Window En=0.1, 2013 E	soft coa External ' - Double soft coa External ' - Double soft coa	t (North) Window e-glazed t (North) Window e-glazed t (North) Window	New, Gro , air-filled New, Gro , air-filled New, Gro	ound Flod, low-E, ound Flod, low-E,	oor Unit E 0.9 oor Unit E 0.9	315 3.03 x 4.830 315 3.03 x 2.530	10.63 C	0.63 x 0.7 0.63 x 0.7 0.63 x 0.7	70 0	.77 .77 .77	15.6961 15.6961 8.2217 39.61	7
Solar ga	ins		-									
39.61 Total ga	75.70	128.64	206.63	278.35	297.98	278.20	220.72	154.67	90.12	48.87	33.02	(83)
		440.65	502.83	558.75	562.94	532.97	480.35	422.28	373.71	350.83	348.50	(84)
000.10	007.00	1.0.00	002.00	000.70	002.01	002.07	100.00	122.20	0.0	000.00	0.0.00	(-1)
	g calcula			–	Area		g	!		F x Shac		
			, air-fillec	d, Iow-E,	0.9	x 4.83	C	0.80	0	.70 x 0.8	3 2.02	2
2013 E Window En=0.1,	- Double soft coa	Window e-glazed t (North)	New, Gro , air-filled	d, low-E,	0.9	x 4.83	C	0.80	0	.70 x 0.8	3 2.02	2
Window En=0.1,	- Double soft coa	e-glazed t (North)	New, Gro , air-filled New, Gro	d, low-E,	0.9	x 2.53	C	0.80	0	.70 x 0.8	3 1.06	6

	system i	responsi	veness				(℃)				1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau											
58.62	58.78	58.93	59.69	59.83	60.51	60.51	60.63	60.24	59.83	59.54	59.24
alpha	•			·	·	1		1		l	
4.91	4.92	4.93	4.98	4.99	5.03	5.03	5.04	5.02	4.99	4.97	4.95
Utilisatio	on factor	for gains	for livin	g area							
1.00	0.99	0.98	0.95	0.83	0.64	0.49	0.56	0.82	0.97	0.99	1.00
Mean in	iternal tei	mperatui	re in livin	g area T	1		•	•	•	•	
19.80	19.93	20.18	20.54	20.83	20.97	20.99	20.99	20.88	20.52	20.11	19.78
Temper	ature du	ring heat	ing perio	ds in res	t of dwe	lling Th2		•	•	•	
19.93	19.93	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94
Utilisatio	on factor	for gains	for rest	of dwelli	ng						
0.99	0.99	0.98	0.93	0.78	0.55	0.37	0.44	0.75	0.95	0.99	1.00
Mean in	iternal tei	mperatui	re in the	rest of d	welling T	2					
18.35	18.54	18.90	19.41	19.79	19.94	19.96	19.96	19.87	19.40	18.81	18.33
	rea fracti Iternal tei				dwelling))					0.45
19.00	19.17	19.48	19.92	20.26	20.40	20.42	20.42	20.32	19.90	19.39	18.98
Apply a	diustmen	t to the r	nean inte	arnal ton	noratur	<u> </u>					
	,	t to the i	iicaii iiit	erriai leri	iperature	e, where	appropr	iate			
19.00	19.17	19.48	19.92	20.26	20.40	e, wnere 20.42	appropr 20.42	iate 20.32	19.90	19.39	18.98
•	19.17	19.48 g requir	19.92 rement	20.26	20.40	20.42	20.42	20.32			
<i>8. Spac</i> Jan	19.17	19.48 g requir Mar	19.92 rement Apr						19.90 Oct	19.39 Nov	18.98 Dec
<i>8. Spac</i> Jan Utilisatio	19.17 ee heatin Feb on factor	19.48 g requir Mar for gains	19.92 rement Apr	20.26 May	20.40 Jun	20.42 Jul	20.42 Aug	20.32 Sep	Oct	Nov	Dec
8. Spac Jan Utilisatio 0.99	19.17 Tee heating Feb on factor 0.99	19.48 g requir Mar	19.92 rement Apr	20.26	20.40	20.42	20.42	20.32			
<i>8. Spac</i> Jan Utilisatio 0.99 Useful g	19.17 ee heatin Febon factor 0.99 gains	g require Mar for gains 0.97	19.92 rement Apr 5 0.93	May 0.80	Jun 0.59	Jul 0.42	20.42 Aug	20.32 Sep 0.78	Oct	Nov 0.99	Dec 0.99
8. Spac Jan Utilisatio 0.99 Useful g 360.72	Feb on factor 0.99 gains 393.10	9 requir Mar for gains 0.97	### 19.92 ### ### 19.92 ### ### Apr	May 0.80 446.23	Jun 0.59	20.42 Jul	20.42 Aug	20.32 Sep 0.78	Oct	Nov 0.99	Dec
8. Spac Jan Utilisatio 0.99 Useful g 360.72	19.17 ee heatin Febon factor 0.99 gains	g requirement Mar for gains 0.97	19.92 Tement Apr 3 0.93 465.60 I temper	May 0.80 446.23	Jun 0.59	Jul 0.42	20.42 Aug	20.32 Sep 0.78	Oct	Nov 0.99	Dec 0.99
8. Spac Jan Utilisatio 0.99 Useful g 360.72 Monthly 4.30	re heating Feb on factor 0.99 gains 393.10 average	g requirement of the following mare for gains of the following for gains of	19.92 Tement Apr 5 0.93 465.60 I tempers 8.90	0.80 446.23 ature 11.70	Jun 0.59 334.02	Jul 0.42 226.39	20.42 Aug 0.49 235.83	Sep 0.78 328.58	Oct 0.95 355.75	Nov 0.99 346.39	Dec 0.99 346.56
8. Spac Jan Utilisatio 0.99 Useful g 360.72 Monthly 4.30 Heat los	re heating Feb on factor 0.99 gains 393.10 average 4.90	g requir Mar for gains 0.97 429.61 externa 6.50 r mean i	19.92 ement Apr 6 0.93 465.60 I tempera 8.90 Internal tempera	0.80 446.23 ature 11.70 emperati	Jun 0.59 334.02 14.60 ure	Jul 0.42 226.39 16.60	20.42 Aug 0.49 235.83	Sep 0.78 328.58	Oct 0.95 355.75	Nov 0.99 346.39 7.10	Dec 0.99 346.56 4.20
8. Spac Jan Utilisatio 0.99 Useful g 360.72 Monthly 4.30 Heat los 905.80	ree heating Feb on factor 0.99 gains 393.10 average 4.90 ss rate fo	g requir Mar for gains 0.97 429.61 externa 6.50 r mean i 795.27	19.92 Tement Apr 5 0.93 465.60 I temper: 8.90 Internal to 666.69	0.80 446.23 ature 11.70 emperati	Jun 0.59 334.02 14.60 ure	Jul 0.42 226.39 16.60	20.42 Aug 0.49 235.83	Sep 0.78 328.58	Oct 0.95 355.75	Nov 0.99 346.39 7.10	Dec 0.99 346.56 4.20
8. Spac Jan Utilisatio 0.99 Useful g 360.72 Monthly 4.30 Heat los 905.80	ree heating Feb con factor 0.99 gains 393.10 average 4.90 ss rate fo 876.52	g requir Mar for gains 0.97 429.61 externa 6.50 r mean i 795.27	19.92 Tement Apr 5 0.93 465.60 I temper: 8.90 Internal to 666.69	0.80 446.23 ature 11.70 emperati	Jun 0.59 334.02 14.60 ure	Jul 0.42 226.39 16.60	20.42 Aug 0.49 235.83	Sep 0.78 328.58	Oct 0.95 355.75	Nov 0.99 346.39 7.10	Dec 0.99 346.56 4.20
8. Space Jan Utilisation 0.99 Useful of 360.72 Monthly 4.30 Heat lose 905.80 Fraction	re heating Feb on factor 0.99 gains 393.10 average 4.90 ss rate fo 876.52 n of mont	g requir Mar for gains 0.97 429.61 externa 6.50 r mean i 795.27 h for hea	19.92 ement Apr 6.0.93 465.60 I tempera 8.90 Internal to 666.69 Iting 1.00	0.80 446.23 ature 11.70 emperate 516.46	Jun 0.59 334.02 14.60 ure 346.20	Jul 0.42 226.39 16.60 228.23	20.42 Aug 0.49 235.83	Sep 0.78 328.58	Oct 0.95 355.75 10.60 561.58	Nov 0.99 346.39 7.10 745.51	Dec 0.99 346.56 4.20 901.03
8. Spac Jan Utilisatio 0.99 Useful g 360.72 Monthly 4.30 Heat los 905.80 Fraction 1.00 Space h	ree heating Feb on factor 0.99 gains 393.10 average 4.90 as rate for 876.52 n of mont 1.00	g requirements g requirements g requirements g requirements g requirements 429.61 externa 6.50 r mean in 795.27 h for head 1.00 equirements	19.92 Pement Apr 3 0.93 465.60 I temper: 8.90 Internal to 666.69 Int	0.80 446.23 ature 11.70 emperatu 516.46 1.00 cch mont	Jun 0.59 334.02 14.60 ure 346.20	Jul 0.42 226.39 16.60 228.23	20.42 Aug 0.49 235.83	Sep 0.78 328.58	Oct 0.95 355.75 10.60 561.58	Nov 0.99 346.39 7.10 745.51	Dec 0.99 346.56 4.20 901.03

9a. Energy requirements

		uirement		aatad							kWh/year	
Fraction	of spac	eating sy e heat fro in heatino	om main	system((s)				1.0000 3.50%			(202) (206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space h	neating r	equireme	nt					<u> </u>	I			
405.54	324.86	272.05	144.79	52.25	-	-	-	-	153.13	287.37	412.53	(98)
Append	ix Q - m	onthly en	ergy sav	ed (mair	heating	system	1)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space h	neating for	uel (main	heating	system	1)							
433.73	347.44	290.96	154.85	55.88	-	-	-	-	163.78	307.35	441.20	(211)
Append	ix Q - m	onthly en	ergy sav	ed (mair	heating	system	2)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space h	neating for	uel (main	heating	system	2)		1					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Append	ix Q - m	onthly en	ergy sav	ed (seco	ndary he	eating sy	stem)		I			
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space h	neating for	uel (seco	ndary)				1					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water h												
		equireme										
		158.10	142.31	139.88	125.59	121.18	132.19	131.71	147.54	155.28		(64)
		er heate									79.80	(216)
87.05	86.82	86.25	84.86	82.45	79.80	79.80	79.80	79.80	84.91	86.43	87.14	(217)
Water h	eating fu	ıel										
195.46	172.94	183.31	167.70	169.65	157.38	151.86	165.65	165.05	173.75	179.65	190.78	(219)
Space h Water h	neating for neating for neating for	uel used, uel (seco uel mps, fan:	ndary)		en-hot						kWh/year 2195.20 0.00 2073.16	(211) (215) (219)
central boiler v Total ele Electrici	I heating with a far ectricity for light saving/g		d flue ove, kW 0.00% fix	'h/year ked LEL)							30.00 45.00 75.00 239.98	(230c) (230e) (231) (232)
Énerg		or genera):	ated ():								0.000 0.000	(236a) (237a)
Total de	elivered e	energy fo	r all uses	6							4583.34	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/ye	ear
Space heating, main system 1	2195.20	0.216	474.16	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	2073.16	0.216	447.80	(264)
Space and water heating			921.96	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	239.98	0.519	124.55	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - μCHP	0.00	0.000	0.00	(269)
Appendix Q -				, ,
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1085.44	(272)
			kg/m²/yea	
Emissions per m ² for space and water heating			17.73	(272a)
Emissions per m ² for lighting			2.40	(272b)
Emissions per m ² for pumps and fans			0.75	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.7301 x 1.00) + 2.3952 + 0.7486			20.87	(273)
= (17.7301 x 1.00) + 2.3332 + 0.7400				

Project InformationBuilding type Mid-floor flat

Reference

Date 8 April 2016 Project NW1

1. Over	all dwel	ling dim	ensions	;		Area		Av. Storey		\/ = l			
Total flo	floor (2) or area g volume	e (m³)					Area (m²) 52.00 52.00		height (i		Volume (m³) 156.00	(3a (4) (5)	
2. Vent	ilation ra	ate											
							main + s	eonda	ary + othe	er	m³ pe	er ho	ur
Number Number Number	of pass	flues mittent fa ive vents	6				heating 0 + 0 + 0 0 + 0 + 0 0 0		x 40 x 20 x 10 x 10 x 40		0 0 0	.00 .00 .00 .00	(6a) (6b) (7a) (7b) (7c)
Pressur Air pern Number Shelter	Number of flueless gas fires Infiltration due to chimneys, fans and flues Pressure test, result q50 Air permeability Number of sides on which sheltered Shelter factor Infiltration rate incorporating shelter factor								5.00		0 0 2 0	hang .00 .25 .00 .85 .21	(8) (17) (18) (19) (20) (21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	7	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	Ī	
Wind Fa	actor	•					-	•	•		52	.50	(22)
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	7	
Adiuste	d infiltrat	ion rate	(allowing	for shel	ter and v	vind sp	eed)		.		13	.13	(22a)
0.27	0.27	0.26	0.23	0.23	0.20	0.20	0.20	0.21	0.23	0.24	0.25	7	
air cha efficie Ventilati	through	se facto	-	0.50 79.90 recovery		ı			.79	(22b) (23a) (23c)			
0.37	0.37	0.36	0.33	0.33	0.30	0.30	0.30	0.31	0.33	0.34	0.35	7	(25)

3. Heat I Element		and hea Gross		a ramete enings	r Net are	ea U	l-value	AxU		kappa-val	ue A x K	
		area, m	² m ²	9-	A, m^2	V	√/m²K	W/K		kJ/m ² K	kJ/K	
Window air-filled,	low-E,	En=0.1,	,		2.53	0 1	.68 (1.80)	4.2	25			(27)
	xternal	Window	New, Gr	ound								
Floor U Window			l		4.83	0 1	.68 (1.80)	8.1	11			(27)
air-filled,			,		4.00	•	.00 (1.00)	0.				(=1)
soft coat			Na	امسيم								
Floor U		Window	New, Gr	ouna								
Window			,		4.83	0 1	.68 (1.80)	8.1	11			(27)
air-filled,							, ,					, ,
soft coat			Now Gr	ound								
Floor U		Window 3.03	new, Gi	ouria								
Pitched r	oofs in	sulated b			15.8	5	0.20	3.1	17	98.75	1565.29	(30)
	loof Nev	w, Groun	d Floor l	Jnit B15								
3.03 Pitched r	onte inc	sulated h	etween i	niete	13.7	2	0.20	2.7	74	98.75	1354.55	(30)
		w, Groun			13.7	_	0.20	2.1	-	30.73	1004.00	(50)
3.03_L		•										
Walls	vtornol	Mall No	w Group	d Elgar	13.2	9	0.14	1.8	36	21.95	291.65	(29)
Unit B1		Wall Nev	w, Groun	u Flooi								
Walls		_			27.7	9	0.14	3.8	39	21.95	610.06	(29)
		Wall Nev	w, Groun	d Floor								
Unit B1 Internal v					55.3	7	0.00	0.0	00	8.75	484.47	
		artition,	Ground	Floor	00.0	•	0.00	0.0	, ,	0.70	10 11 17	
Unit B1						_						
Internal v		Partition,	Ground	Floor	38.3	/	0.00	0.0)0	8.75	335.77	
Unit B1			around	1 1001								
Internal f	loor	_			23.3	7	0.00	0.0	00	95.00	2220.28	
		Ceiling/F 3.03 Liv		und								
Internal f		3.03_LI	virig		88.3	9	0.00	0.0	00	95.00	8396.71	
2013 lr	nternal (Ceiling/F	loor, Gro	und								
Floor U Internal o		3.03			9.6	E	0.00	0.0	20	95.00	917.14	
		Ceiling/F	loor. Gro	und	9.0	3	0.00	0.0	00	95.00	917.14	
		3.03_Li										
Tatalana				·:	2						00.04	(04)
Total are Fabric he			ements S	sigma A,	m²						82.84 32.13	(31) (33)
Thermal	mass p	aramete		د (user-s	pecified	TMP)					250.00	(35)
Effect of			i								0.08	(36)
Total fab Ventilation			culated m	onthly							32.21	(37)
	18.85	18.57	17.21	16.93	15.57	15.57	15.29	16.11	16.93	3 17.48	18.03	(38)
Heat tran												(/
51.33	51.06	50.79	49.42	49.15	47.78	47.78	47.51	48.33	49.15	5 49.69	50.24	
		1	_,		1	1		1	1	1	49.35	(39)
Heat loss			· · · · · · · · · · · · · · · · · · ·									
	0.98	0.98	0.95	0.95	0.92	0.92	0.91	0.93	0.95	0.96	0.97	(40)
HLP (ave Number		in montl	n (Table	1a)							0.95	(40)
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	28	31	30	31	30	31	31	30	31	30	31	
		10.	100	1	100	1 .		100	1.	100		

3. Heat Elemen		and hea Gross		a ramete l enings	r Net are	ıa U-¹	value	AxU	ka	ıppa-valı	ıе A х К	
	•	area, m		·····g	A, m ²		m²K	W/K		l/m²K	kJ/K	
Fabric h Therma Effect o Total fal	neat loss Il mass p f therma bric heat	aramete I bridges	r, kJ/m²ŀ	ζ (user-s		TMP)					82.8 32.1 250.0 0.0 32.2	3 (33) 0 (35) 8 (36)
19.12	18.85	18.57	17.21	16.93	15.57	15.57	15.29	16.11	16.93	17.48	18.03	(38)
		efficient,	W/K									
51.33	51.06	50.79	49.42	49.15	47.78	47.78	47.51	48.33	49.15	49.69	50.24	_ (==)
Heat los	ss param	eter (HL	P). W/m	²K							49.3	5 (39)
0.99	0.98	0.98	0.95	0.95	0.92	0.92	0.91	0.93	0.95	0.96	0.97	
HLP (av											0.9	5 (40)
_		in month	· `						I			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	
Assume Annual	ed occup average	hot wate	r usage	in litres p			<u> </u>				kWh/y o 1.7 79.7	5 (42)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
87.70	er usage 84.51	in litres 81.32	78.13	74.94		74 75	74.04	70.10	04.00	04.51	07.70	(44)
		of hot wa			71.75	71.75	74.94	78.13	81.32	84.51	87.70	(44)
		117.38			84.73	78.52	90.10	91.17	106.25	115.98	125.95	
Energy	content (1254.4	1 (45)
19.51	17.06	17.61	15.35	14.73	12.71	11.78	13.51	13.68	15.94	17.40	18.89	(46)
Hot wate Volume Temper Energy	er cylind factor ature fac	hot wate	actor (kŴ	/h/day)	day)						110.0 0.015 1.029 0.600 1.0	2 (51) 4 (52) 0 (53)
32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
Net stor	age loss	;				1						
32.01 Primary	28.92 loss	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Total he	at requi	ed for w	ater hea	ting calc	ulated fo	r each m	onth	I	I	1		
		172.65					145.37	144.67	161.53	169.48	181.23	(62)
		er heate										
		172.65	1	1	1	133.79	145.37	144.67	161.53	169.48	181.23 1905.2	(64) 5 (64)
		water he				I _	I -	T== · ·	T==	Ta	1	(0=)
87.46	77.76	83.25	76.82	76.87	70.97	70.33	74.18	73.11	79.55	81.36	86.10	(65)

_			
_	Into	rnal	aaine
-1-	mme	ıııaı	gains

Cooking gains 31.75 31.75	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains 13.59 12.07 9.82 7.43 5.55 4.69 5.07 6.59 8.84 11.23 13.10 13.97 Appliances gains 152.43 154.01 150.02 141.54 130.83 120.76 114.03 112.45 116.44 124.92 135.63 145.76 Cooking gains 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 Pumps and fans gains 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 Losses e.g. evaporation (negative values) -69.96 -	Metabol	ic gains,	Watts	,	•							
13.59 12.07 9.82 7.43 5.55 4.69 5.07 6.59 8.84 11.23 13.10 13.97 Appliances gains 152.43 154.01 150.02 141.54 130.83 120.76 114.03 112.45 116.44 124.92 135.63 145.76 Cooking gains 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 Pumps and fans gains 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 Losses e.g. evaporation (negative values) -69.96 -6	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45
Appliances gains 152.43 154.01 150.02 141.54 130.83 120.76 114.03 112.45 116.44 124.92 135.63 145.76 152.43 154.01 150.02 141.54 130.83 120.76 114.03 112.45 116.44 124.92 135.63 145.76 152.43 154.01 150.02 141.54 130.83 120.76 114.03 112.45 116.44 124.92 135.63 145.76 152.43 154.01 150.02 135.63 145.76 152.43 154.01 150.02 135.63 145.76 152.43 136.44 124.92 135.63 145.76 152.43 136.44 124.92 135.63 145.76 152.43 136.44 124.92 135.63 145.76 152.43 136.45 136.75 136.75 136.75 136.75 152.43 136.45 136.75 136.75 136.75 136.75 152.43 136.75 136.75 136.75 136.75 136.75 152.43 136.45 136.75 136.75 136.75 136.75 152.43 136.45 136.75 136.75 136.75 152.43 136.45 136.75 136.75 136.75 152.43 136.45 136.75 136.75 136.75 152.43 136.45 136.75 136.75 136.75 152.43 136.45 136.75 136.75 136.75 152.43 136.75 136.75 136.75 136.75 152.43 136.75 136.75 136.75 136.75 152.43 136.75 136.75 136.75 136.75 152.43 136.75 136.75 136.75 136.75 152.43 136.75 136.75 136.75 136.75 152.43 136.75 136.75 136.75 152.43 136.75 136.75 136.75 152.43 136.75 136.75 136.75 152.45 136.75 136.75 136.75 152.45 136.75 136.75 136.75 152.45 136.75 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 152.45 136.75 136.75 162.45 136.75 162.45 136.75 162.45 136.75 162.45	Lighting	gains	•				•	•			•	
152.43 154.01 150.02 141.54 130.83 120.76 114.03 112.45 116.44 124.92 135.63 145.70 Cooking gains 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 31.75 Pumps and fans gains 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 Losses e.g. evaporation (negative values) -69.96 -69.	13.59	12.07	9.82	7.43	5.55	4.69	5.07	6.59	8.84	11.23	13.10	13.97
Cooking gains 31.75 31.75	Applianc	es gains	3	•			•	•			•	
31.75 31.75	152.43	154.01	150.02	141.54	130.83	120.76	114.03	112.45	116.44	124.92	135.63	145.70
Pumps and fans gains 0.00 0	Cooking	gains										
0.00 0.00 <th< td=""><td>31.75</td><td>31.75</td><td>31.75</td><td>31.75</td><td>31.75</td><td>31.75</td><td>31.75</td><td>31.75</td><td>31.75</td><td>31.75</td><td>31.75</td><td>31.75</td></th<>	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75
Losses e.g. evaporation (negative values) -69.96 -69.9	Pumps a	and fans	gains	•								
-69.96 -69.96<	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water heating gains 117.56 115.72 111.89 106.70 103.32 98.57 94.53 99.70 101.54 106.92 113.00 115.73 Total internal gains	Losses	e.g. evap	oration	negative	values)					•		
117.56 115.72 111.89 106.70 103.32 98.57 94.53 99.70 101.54 106.92 113.00 115.73 Total internal gains	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96
Total internal gains	Water h	eating ga	ains			•			•	•		
	117.56	115.72	111.89	106.70	103.32	98.57	94.53	99.70	101.54	106.92	113.00	115.73
332.81 331.03 320.97 304.90 288.94 273.25 262.86 267.98 276.06 292.31 310.97 324.65	Total int	ernal gai	ns						•	•		
	332.81	331.03	320.97	304.90	288.94	273.25	262.86	267.98	276.06	292.31	310.97	324.63

6. Solar gains (calculation for January)

g&FF	Shading	Gains
63 0.63 x 0.80	0.77	9.3963
63 0.63 x 0.80	0.77	17.9384
63 0.63 x 0.80	0.77	17.9384
(63 0.63 x 0.80 63 0.63 x 0.80	63 0.63 x 0.80 0.77

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, air-filled, low-E,	0.9 x 2.53	0.80	0.80 x 0.83	1.21
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B15 3.03			
Window - Double-glazed, air-filled, low-E,	0.9 x 4.83	0.80	0.80 x 0.83	2.31
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B15 3.03			
Window - Double-glazed, air-filled, low-E,	0.9 x 4.83	0.80	0.80 x 0.83	2.31
En=0.1, soft coat (North)				

2013 External Window New, Ground Floor Unit B15 3.03

GL = 5.83 / 52.00 = 0.112 C1 = 0.500

C2 = 0.960

EI = 240

	system	responsi	veness		living a						1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
au	I .		,1	-	l		I				
70.34	70.72	71.10	73.07	73.48	75.58	75.58	76.01	74.72	73.48	72.67	71.88
alpha			1								
5.69	5.71	5.74	5.87	5.90	6.04	6.04	6.07	5.98	5.90	5.84	5.79
Jtilisati	on factor	for gains	for livin	g area	ļ	1		1		1	
0.99	0.99	0.97	0.89	0.71	0.49	0.36	0.42	0.70	0.94	0.99	1.00
Mean ir	nternal te	mperatu	re in livin	g area T	1		•	•			
20.10	20.24	20.47	20.79	20.95	21.00	21.00	21.00	20.97	20.74	20.39	20.10
Temper	rature du	ring heat	ing perio	ds in res	t of dwe	lling Th2					
20.09	20.10	20.10	20.12	20.13	20.15	20.15	20.16	20.14	20.13	20.12	20.11
Jtilisatio	on factor	for gains	for rest	of dwelli	ng	•			•	•	
0.99	0.99	0.96	0.86	0.66	0.43	0.29	0.34	0.63	0.92	0.98	0.99
Mean ir	iternal te	mperatu	re in the	rest of d	welling T	2					
18.91	19.10	19.45	19.89	20.09	20.15	20.15	20.16	20.12	19.84	19.34	18.91
	rea fracti nternal te				dwelling))					0.45
19.45	19.61	19.91	20.29	20.48	20.53	20.53	20.53	20.50	20.24	19.81	19.44
Apply a	djustmen	t to the r	nean into	ernal tem	perature	e, where	appropr	iate			
19.45	19.61	19.91	20.29	20.48	20.53	20.53	20.53	20.50	20.24	19.81	19.44
3. Spac	ce heatin Feb	<i>g requir</i> Mar	rement Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		IIVIGI	7701	iviay	Juli	Juui	- Auu	ОСР	OCL	INOV	
Jan				,			- 3				
Jan Utilisatio	on factor	for gains	\$		0.46	0.32		0.66	0.92	0.98	0 99
Jan Utilisatio 0.99	on factor			0.68	0.46	0.32	0.38	0.66	0.92	0.98	0.99
Jan Utilisatio 0.99 Useful (on factor 0.98 gains	for gains 0.96	0.87	0.68			0.38				
Jan Utilisatio 0.99 Useful (374.85	0.98 gains 410.96	for gains 0.96 449.51	0.87	0.68			0.38	0.66	0.92	0.98	0.99
Jan Utilisatio 0.99 Useful (374.85 Monthly	0.98 gains 410.96	for gains 0.96 449.51 externa	0.87 471.17 I tempera	0.68 412.99 ature	281.87	187.75	0.38	298.61	363.78	360.23	359.85
Jan Utilisatio 0.99 Useful o 374.85 Monthly	on factor 0.98 gains 410.96 average 4.90	0.96 449.51 externa 6.50	0.87 471.17 I tempera	0.68 412.99 ature 11.70	281.87		0.38				
Jan Utilisatio 0.99 Useful (374.85 Monthly 4.30 Heat los	on factor 0.98 gains 410.96 vaverage 4.90 ss rate fo	o.96 449.51 externa 6.50 r mean i	0.87 471.17 tempera 8.90 nternal te	0.68 412.99 ature 11.70 emperatu	281.87 14.60 ure	187.75	0.38	298.61	363.78	360.23	359.85
Jan Utilisatio 0.99 Useful o 374.85 Monthly 4.30 Heat los	on factor 0.98 gains 410.96 average 4.90	0.96 449.51 externa 6.50 r mean i	0.87 471.17 tempera 8.90 nternal te 562.93	0.68 412.99 ature 11.70 emperatu	281.87 14.60 ure	187.75	0.38	298.61	363.78	360.23	359.85
Jan Utilisatio 0.99 Useful o 374.85 Monthly 4.30 Heat los 777.48 Fractior	on factor 0.98 gains 410.96 average 4.90 ss rate fo	0.96 449.51 externa 6.50 r mean i	0.87 471.17 tempera 8.90 nternal te 562.93	0.68 412.99 ature 11.70 emperatu	281.87 14.60 ure	187.75	0.38	298.61	363.78 10.60 473.91	360.23	359.85
Jan Utilisation 0.99 Useful (374.85 Monthly 4.30 Heat los 777.48 Fraction	on factor 0.98 gains 410.96 vaverage 4.90 ss rate fo 751.32 n of mont 1.00	0.96 449.51 externa 6.50 r mean i 680.99 h for hea	0.87 471.17 tempera 8.90 nternal te 562.93 ating 1.00	0.68 412.99 ature 11.70 emperatu 431.38	281.87 14.60 ure 283.31	187.75 16.60 187.89	0.38	298.61 14.10 309.41	363.78	360.23 7.10 631.49	359.85 4.20 765.84
Jan Utilisation 0.99 Useful of 374.85 Monthly 4.30 Heat los 777.48 Fraction 1.00 Space h	on factor 0.98 gains 410.96 average 4.90 ss rate fo 751.32 n of mont	for gains 0.96 449.51 externa 6.50 r mean i 680.99 h for hea 1.00 equireme	0.87 471.17 temperal 8.90 nternal to 562.93 ating 1.00 ent for ea	0.68 412.99 ature 11.70 emperatu 431.38	281.87 14.60 ure 283.31	187.75 16.60 187.89	0.38	298.61 14.10 309.41	363.78 10.60 473.91	360.23 7.10 631.49	359.85 4.20 765.84

8c. Space cooling requirement

- I		3 - 1-									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Externa	l temper	aturers	•	•	•		•	•			
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-
Heat los	s rate W	,			1	•	•	•	1		
-	-	-	-	-	449.13	353.57	361.04	-	-	-	-
Utilisatio	on factor	for loss	•						'	<u> </u>	
-	-	-	-	-	0.98	0.99	0.99	-	-	-	-
Useful l	oss W	•	•	•	•				•		
-	-	-	-	-	441.78	351.28	356.81	-	-	-	-
Internal	gains W	<i>'</i>	•	•	•				•	•	
0.00	0.00	0.00	0.00	0.00	372.75	359.62	366.23	0.00	0.00	0.00	0.00
Solar ga	ains W				,		,		,	•	
0.00	0.00	0.00	0.00	0.00	398.04	371.62	294.84	0.00	0.00	0.00	0.00
Gains V	V		•		•		•		•		
-	-	-	-	-	770.79	731.24	661.07	-	-	-	-
Fraction	of mon	th for co	oling		•		•		•	•	
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Space h	neating k	Ŵh	•		•				•	•	
-	-	-	-	-	20.69	3.56	0.00	-	-	-	-
Space o	cooling k	Wh									
-	-	-	-	-	236.89	282.69	226.37	-	-	-	-
Total			•		,						745.95
Cooled	traction tency fac	etor									0.80
IIILEIIIIL	Tericy rac		1	Τ	0.25	0.25	0.25				
- Space (oooling r	- equireme	ont for m	onth	0.25	0.25	0.25	-	-	-	-
Space C		=quireille		1	47.00	EC E4	45.07				
- Space (ooding (lung to /	/manat/	-	47.38	56.54	45.27	-	-	-	149.19
		June to A		ո² (kWh/	m²/vear)						2.87
Space C		oquii oi ii	on por ii	. (1.4411/	/ your)						2.07

9b. Energy requirements

3, 4, 5		kWh/year	
Fraction of space heat from secondary system	0.00	•	(301)
Fraction of space heat from community system	1.00		(302)
Fraction of community heat from Boilers	1.00		(303a)
Fraction of total space heat from Boilers	1.00		(304a)
Factor for control and charging method for community space heating			(305)
Factor for charging method for community water heating	1.00		(305a)
Distribution loss factor	1.05		(306)
Space heating			
Annual space heating requirement	1359.53		(98)
Space heat from Boilers		1427.51	(307a)
Efficiency of secondary heating system	0.00		(308)
Space heating fuel for secondary system		0.00	(309)
Water heating	1005.05		(0.4)
Annual water heating requirement	1905.25	0000 50	(64)
Water heat from Boilers		2000.52	(310a)
Other energy	E 040/		(04.4)
Cooling system energy efficiency ratio	5.81%	05.07	(314)
Space cooling		25.67	(315)
Electrical energy for heat distribution		34.28	(313)
Electricity for pumps and fans within dwelling:			
Electricity for pumps, fans and electric keep-hot	:d- (CED, 0.00)	11157	(000-)
mechanical ventilation - balanced, extract or positive input from out	Side (SFP=0.60)	114.57	(330a)
warm air heating system fans		0.00	(330b)
pump for solar water heating		0.00	(330g)
pump for waste water heat recovery		0.00	(330h)
Total electricity for the above, kWh/year		114.57	(331)
Electricity for lighting (100.00% fixed LEL)		239.98	(332)
Energy saving/generation technologies			
Appendix Q -		0.000	(2260)
Energy saved or generated ():		0.000 0.000	(336a)
Energy used ():		0.000	(337a)
Total delivered energy for all uses		3816.86	(338)

10a. Does not apply

11a. Does not apply

12b. Carbon dioxide emissions

125. Galbon Gloxide emissions	Energy kWh/year	Emission factor kg CO2/kWh	Emissions	_
Efficiency of Boilers - 97.90%	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	3	3 7	(367a)
CO2 emissions from Boilers	3501.56	0.2160	756.34	(368)
Electrical energy for heat distribution	34.28	0.5190	17.79	(372)
Total CO2 associated with community systems			774.13	(373)
Total CO2 associated with space and water heating			774.13	(376)
Space cooling	25.67	0.519	13.32	(377)
Electricity for pumps and fans	114.57	0.519	59.46	(378)
Electricity for lighting	239.98	0.519	124.55	(379)
Electricity generated - PVs	0.00	0.519	0.00	(380)
Electricity generated - μCHP	0.00	0.000	0.00	(380)
Appendix Q -				, ,
Ėnergy saved ():	0.00	0.000	0.00	(381)
Energy used ():	0.00	0.000	0.00	(382)
Total CO2, kg/year			971.46	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			kg/m²/yea 18.68	r (384)
				` ' /

Project InformationBuilding type Mid-floor flat

Reference

Date 8 April 2016

Project NW1

1	Overall	dwelling	dimension	
1.	Overaii	aweiiina	aimension	ıs

J	Area (m²)	Av. Storey height (m)	Volume (m³)	
Ground floor (2)	` 51.00	3.00 ′	`153.00	(3a)
Total floor area	51.00			(4)
Dwelling volume (m³)			153.00	(5)

2. Vent	ilation r	ate									m³ per ho	our
							main + s	eondar	y + othe	r	po	
Number of chimneys Number of open flues Number of intermittent fans Number of passive vents Number of flueless gas fires							heating 0+0+0 0+0+0 2 0		x 40 x 20 x 10 x 10 x 40		0.00 0.00 20.00 0.00 0.00	(6a) (6b) (7a) (7b) (7c)
Infiltration due to chimneys, fans and flues Pressure test, result q50 Air permeability Number of sides on which sheltered Shelter factor Infiltration rate incorporating shelter factor Infiltration rate modified for monthly wind speed									5.00		0.13 0.38 2.00 0.85 0.32	(8) (17) (18) (19) (20) (21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
\\\/: \[52.50	(22)
Wind Fa	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	(22a)
Adjuste	d infiltrat	ion rate	(allowing	for shel	ter and v	wind sp	eed)					,
0.41	0.40	0.40	0.36	0.35	0.31	0.31	0.30	0.32	0.35	0.36	0.38	
	4.25 (2 Ventilation : natural ventilation, intermittent extract fans Effective air change rate											(22b)
0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

0 11			_			
3. Heat losses Element	Gross	Ss paramete Openings	r Net area	U-value	AxU	
Liement	area, m ²	m ²	A, m ²	W/m ² K	W/K	
Window - Doul	•	111-	1.580	1.33 (1.40)	2.09	(27)
air-filled, low-E			1.500	1.55 (1.40)	2.03	(21)
soft coat (North						
2013 Externa		w Ground				
Floor Unit B2		w, around				
Window - Doul			1.580	1.33 (1.40)	2.09	(27)
air-filled, low-E			1.560	1.33 (1.40)	2.09	(21)
soft coat (North						
2013 Externa		w Ground				
Floor Unit B2		w, around				
Window - Doul			0.350	1 22 /1 /0\	0.46	(27)
	-		0.330	1.33 (1.40)	0.40	(27)
air-filled, low-E						
soft coat (North 2013 Externa		w Ground				
Floor Unit B2		w, Ground				
			1 020	1 22 /1 40\	1 62	(27)
Window - Doul	-		1.230	1.33 (1.40)	1.63	(27)
air-filled, low-E						
soft coat (North		w Cround				
2013 Externa		w, Ground				
Floor Unit B2			1 500	1 22 /1 40\	2.00	(27)
Window - Doul	-		1.580	1.33 (1.40)	2.09	(27)
air-filled, low-E						
soft coat (North		w Ground				
2013 Externa Floor Unit B2		w, Ground				
			1 000	1 22 (1 40)	1.45	(27)
Window - Doul	-		1.090	1.33 (1.40)	1.45	(27)
air-filled, low-E						
soft coat (North	,	w Ground				
2013 Externa Floor Unit B2		w, Ground				
Window - Doul			1.090	1.33 (1.40)	1.45	(27)
air-filled, low-E			1.090	1.33 (1.40)	1.45	(21)
soft coat (North						
2013 Externa		w Ground				
Floor Unit B2		w, around				
Rooflight at 70			0.670	1.59 (1.70)	1.07	(27)
Double-glazed			0.070	1.55 (1.70)	1.07	(27)
low-E, En=0.1,						
(n/a)	John Jour					
2013 Roofligh	nt New Groun	nd Floor I Init				
B20 4.02 Liv						
Rooflight at 70	•		0.670	1.59 (1.70)	1.07	(27)
Double-glazed			0.070	1.00 (1.70)	1.07	(=1)
low-E, En=0.1,						
(n/a)	0011 0041					
2013 Rooflig	nt New. Groui	nd Floor Unit				
B20 4.02		2				
Rooflight at 70	° or less -		0.670	1.59 (1.70)	1.07	(27)
Double-glazed						(/
low-E, En=0.1,						
(n/a)						
2013 Rooflig	nt New, Groui	nd Floor Unit				
B20 4.02	,					
-						

3. Heat losses and heat loss parameter Element Gross Openings area, m² m² Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)	r Net area A, m² 0.670	U-value W/m²K 1.59 (1.70)	A x U W/K 1.07	(27)
2013 Rooflight New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit	1.570	1.59 (1.70)	2.50	(27)
B20 4.02				
Pitched roofs insulated between joists 2013 Roof New, Ground Floor Unit B20 4.02_Living	18.25	0.13	2.37	(30)
Pitched roofs insulated between joists 2013 Roof New, Ground Floor Unit B20 4.02	20.48	0.13	2.66	(30)
Pitched roofs insulated between joists 2013 Roof New, Ground Floor Unit B20 4.02	34.62	0.13	4.50	(30)
Walls 2013 External Wall New, Ground Floor	52.14	0.18	9.38	(29)
Unit B20 4.02 Walls 2013 External Wall New, Ground Floor	16.39	0.18	2.95	(29)
Unit B20 4.02 Walls 2013 External Wall New, Ground Floor	40.88	0.18	7.36	(29)
Unit B20 4.02_Living Walls 2013 External Wall New, Ground Floor Unit B20 4.02	10.64	0.18	1.92	(29)
Internal wall 2013 Internal Partition, Ground Floor	128.23	0.00	0.00	
Unit B20 4.02 Internal wall 2013 Internal Partition, Ground Floor	21.01	0.00	0.00	
Unit B20 4.02_Living Internal floor 2013 Internal Ceiling/Floor, Ground	198.74	0.00	0.00	
Floor Unit B20 4.02 Internal floor 2013 Internal Ceiling/Floor, Ground Floor Unit B20 4.03 Living	17.77	0.00	0.00	
Floor Unit B20 4.02_Living Internal ceiling 2013 Internal Ceiling/Floor, Ground Floor Unit B20 4.02	6.03	0.00	0.00	

3. Heat Elemen	losses a	and hea Gross		aramete enings	r Net are	a II.	value	AxU				
Licinion		area, m		crinigo	A, m ²		/m²K	W/K				
Fabric h Therma Effect o Total fal	ea of ext neat loss Il mass p f therma bric heat ion heat	, W/K aramete I bridges Ioss	r, kJ/m²l	≺ (user-s		TMP)					206.14 49.18 250.00 10.31 59.48	3 (33) 0 (35) (36)
29.54	29.38	29.21	28.44	28.30	27.63	27.63	27.51	27.89	28.30	28.59	28.90	(38)
Heat tra	nsfer co	efficient,	W/K	1	-1	1		1	ı			
89.03	88.86	88.70	87.93	87.78	87.11	87.11	86.99	87.37	87.78	88.07	88.38	
Heat los	ss param	eter (HL	.P), W/m	²K			•				87.93	3 (39)
1.75	1.74	1.74	1.72	1.72	1.71	1.71	1.71	1.71	1.72	1.73	1.73	
HLP (av Number	verage) r of days	in month	n (Table	1a)	1	•	1	1		•	1.72	2 (40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	
		I	1						I	1		
4 Wate	er heatin	a enera	v requir	ements							kWh/ye	ar
Assume	ed occup average	ancy, N			per day \	∕d,avera	ıge				1.72 75.04	2 (42)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	` ,
Hot wat	er usage	in litres	<u> </u>		month			'				
82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	(44)
Energy	content of	of hot wa	ter used									
122.41	107.06	110.48	96.32	92.42	79.75	73.90	84.80	85.81	100.01	109.17	118.55	
	content (1	1	1		-1	1	1	1	1180.67	(45)
18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15.00	16.37	17.78	(46)
Cylinde	r volume	, I	1				150.00					(47)
	cturer's o		cylinder	loss fac	tor (kWh	/day)	1.39					(48)
Energy	ature Fa lost from orage los	hot wat	er cylind	er (kWh	day)		0.5400				0.75	(49) 5 (55)
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
	age loss		22.36	23.33	22.36	23.33	23.33	22.36	23.33	22.36	23.33	(30)
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
Primary		25.55	22.30	20.00	22.30	20.00	23.33	22.30	20.00	22.30	20.00	(37)
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
	eat requir							22.51	20.20	22.51	25.20	(00)
	149.15							130.91	146.60	154.26	165.14	(62)
	from wat						101.40	100.01	140.00	104.20	100.14	(02)
							131.40	130 91	146 60	154 26	165.14	(64)
	ins from	I	I			1.20.70	101.40	1.00.01	1 10.00	10 1.20	1729.29	. ,
77.98	69.27	74.01	68.10	68.00	62.59	61.85	65.47	64.61	70.53	72.37	76.69	(65)
11.90	09.27	/ 4 .U I	00.10	00.00	02.39	01.00	05.47	04.01	10.55	12.31	70.09	(00)

_	1 1	
^	Internal	ı naine
v.	michia	ganis

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabol	ic gains,	Watts	,	•			,	•		•	
85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98
Lighting	gains					•					
13.36	11.86	9.65	7.30	5.46	4.61	4.98	6.47	8.69	11.03	12.88	13.73
Applianc	es gains	3									
149.83		147.47	139.13	128.60	118.70	112.09	110.54	114.45	122.80	133.32	143.22
Cooking	gains	•	•		•	•	•		•	•	
31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60
Pumps a	and fans	gains	,				,				
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g. evap	oration	negative	values)		•				•	
-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78
Water h	eating ga	ains									
104.81	103.07	99.48	94.58	91.40	86.93	83.13	88.00	89.73	94.80	100.52	103.08
Total int	ernal gai	ns									
319.79	318.12	308.38	292.81	277.26	262.04	251.99	256.80	264.67	280.42	298.51	311.82

6. Solar gains (calculation for January)

3 (Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, air-filled, low-E,	0.9 x 1.580 10.63	0.63 x 0.70	0.77	5.1345
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor				
Window - Double-glazed, air-filled, low-E,	0.9 x 1.580 10.63	0.63 x 0.70	0.77	5.1345
En=0.1, soft coat (North)	L !: Doo 4 oo			
2013 External Window New, Ground Floor		0.00 0.70	0.77	4 4074
Window - Double-glazed, air-filled, low-E,	0.9 x 0.350 10.63	0.63 x 0.70	0.77	1.1374
En=0.1, soft coat (North)	L-1. D00. 4.00			
2013 External Window New, Ground Floor		0.00 0.70	0.77	0.0074
Window - Double-glazed, air-filled, low-E,	0.9 x 1.230 10.63	0.63 X 0.70	0.77	3.9971
En=0.1, soft coat (North)	In: 1 DOO 4 OO			
2013 External Window New, Ground Floor		0.60 v 0.70	0.77	E 104E
Window - Double-glazed, air-filled, low-E,	0.9 x 1.580 10.63	0.63 X 0.70	0.77	5.1345
En=0.1, soft coat (North) 2013 External Window New, Ground Floor	Init D20 4 02			
Window - Double-glazed, air-filled, low-E,	0.9 x 1.090 10.63	0.63 × 0.70	0.77	3.5422
En=0.1, soft coat (North)	0.9 X 1.090 10.03	0.03 X 0.70	0.77	3.3422
2013 External Window New, Ground Floor	Init R20 4 02			
Window - Double-glazed, air-filled, low-E,	0.9 x 1.090 10.63	0.63 x 0.70	0.77	3.5422
En=0.1, soft coat (North)	0.0 X 1.000 10.00	0.00 X 0.7 0	0.77	0.0 122
2013 External Window New, Ground Floor	Init B20 4 02			
Rooflight at 70° or less - Double-glazed,	0.9 x 0.670 26.61	0.63 x 0.70	1.00	7.0755
air-filled, low-E, En=0.1, soft coat (n/a)	0.0 % 0.07 0 20.0	0.00 / 0.70		
2013 Rooflight New, Ground Floor Unit B20	4.02 Living			
Rooflight at 70° or less - Double-glazed,	0.9 x 0.670 26.61	0.63 x 0.70	1.00	7.0755
air-filled, low-E, En=0.1, soft coat (n/a)				
2013 Rooflight New, Ground Floor Unit B20	4.02			
Rooflight at 70° or less - Double-glazed,	0.9 x 0.670 26.61	0.63 x 0.70	1.00	7.0755
air-filled, low-E, En=0.1, soft coat (n/a)				
2013 Rooflight New, Ground Floor Unit B20	4.02			
Rooflight at 70° or less - Double-glazed,	0.9 x 0.670 26.61	0.63 x 0.70	1.00	7.0755
air-filled, low-E, En=0.1, soft coat (n/a)				
2013 Rooflight New, Ground Floor Unit B20	4.02			

6. Solar gains (calculation for January)					
	Area & Flux		Shading	Gains	
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B2	0.9 x 1.570 2 20 4.02	26.61 0.63 x 0.70	1.00	16.5798	
Total solar gains, January				72.50	(83-1)
Solar gains					
72.50 143.53 246.48 384.35 498.92 5	24.43 493.56	404.28 293.97 172	2.43 90.56	59.60	(83)
Total gains					(- 1)
392.29 461.64 554.87 677.16 776.18 7	86.47 745.56	661.09 558.64 452	2.85 389.08	371.42	(84)
Lighting calculations					
	Area	g 0.80	FF x Shadi		
Window - Double-glazed, air-filled, low-E,	0.9 x 1.58	0.80	0.70×0.83	0.66	
En=0.1, soft coat (North)	. I I = 1 DOO 4 OO				
2013 External Window New, Ground Floor			0.70 v 0.00	0.66	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 1.58	0.80	0.70 x 0.83	0.66	
2013 External Window New, Ground Floor	. I Init B20 4 02				
Window - Double-glazed, air-filled, low-E,	0.9×0.35	0.80	0.70 x 0.83	0.15	
En=0.1, soft coat (North)	0.0 X 0.00	0.00	0.7 0 X 0.00	0.10	
2013 External Window New, Ground Floor	Unit B20 4.02				
Window - Double-glazed, air-filled, low-E,	0.9 x 1.23	0.80	0.70 x 0.83	0.51	
En=0.1, soft coat (North)					
2013 External Window New, Ground Floor	Unit B20 4.02				
Window - Double-glazed, air-filled, low-E,	0.9 x 1.58	0.80	0.70×0.83	0.66	
En=0.1, soft coat (North)					
2013 External Window New, Ground Floor					
Window - Double-glazed, air-filled, low-E,	0.9 x 1.09	0.80	0.70×0.83	0.46	
En=0.1, soft coat (North)	. I I . 'I DOO 4 00				
2013 External Window New, Ground Floor			0.70 v 0.00	0.46	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 1.09	0.80	0.70 x 0.83	0.46	
2013 External Window New, Ground Floor	LInit R20 4 02				
Rooflight at 70° or less - Double-glazed,	0.9×0.67	0.80	0.70 x 1.00	0.34	
air-filled, low-E, En=0.1, soft coat (n/a)	0.0 X 0.07	0.00	0.70 X 1.00	0.01	
2013 Rooflight New, Ground Floor Unit B2	0 4.02 Living				
Rooflight at 70° or less - Double-glazed,	0.9×0.67	0.80	0.70 x 1.00	0.34	
air-filled, low-E, En=0.1, soft coat (n/a)					
2013 Rooflight New, Ground Floor Unit B2					
Rooflight at 70° or less - Double-glazed,	0.9 x 0.67	0.80	0.70 x 1.00	0.34	
air-filled, low-E, En=0.1, soft coat (n/a)					
2013 Rooflight New, Ground Floor Unit B2		0.00	0.70 1.00	0.04	
Rooflight at 70° or less - Double-glazed,	0.9 x 0.67	0.80	0.70 x 1.00	0.34	
air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B2	0 4 02				
Rooflight at 70° or less - Double-glazed,	0.9 x 1.57	0.80	0.70 x 1.00	0.79	
air-filled, low-E, En=0.1, soft coat (n/a)	0.5 X 1.57	0.00	0.70 X 1.00	0.75	
2013 Rooflight New, Ground Floor Unit B2	0 4.02				
GL = 5.70 / 51.00 = 0.112					
C1 = 0.500					
C2 = 0.960					
EI = 236					

leating	ature dui system i				Ü	•	,				1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
au			-								
39.78	39.86	39.93	40.28	40.35	40.66	40.66	40.71	40.54	40.35	40.21	40.07
alpha											
3.65	3.66	3.66	3.69	3.69	3.71	3.71	3.71	3.70	3.69	3.68	3.67
Jtilisatio	on factor	for gains	for livin	g area			•		•	•	
0.99	0.99	0.97	0.92	0.81	0.64	0.49	0.56	0.82	0.96	0.99	1.00
Mean in	ternal te	nperatur	re in livin	g area T	1				•		
19.18	19.38	19.76	20.27	20.68	20.91	20.97	20.95	20.75	20.20	19.60	19.14
Temper	ature du	ing heat	ing perio	ds in res	t of dwe	lling Th2					
19.51	19.51	19.51	19.52	19.53	19.54	19.54	19.54	19.53	19.53	19.52	19.52
Jtilisatio	on factor	for gains	for rest	of dwelli	ng						
0.99	0.99	0.96	0.89	0.74	0.52	0.34	0.40	0.72	0.94	0.99	0.99
Mean in	ternal te	mperatur	re in the	rest of d	welling T	2					
17.16	17.46	18.00	18.72	19.24	19.48	19.53	19.52	19.35	18.65	17.79	17.12
	rea fracti Iternal tei				dwelling))					0.35
17.86	18.13	18.62	19.26	19.74	19.98	20.03	20.02	19.84	19.19	18.42	17.82
Apply a	djustmen	t to the r	nean inte	ernal ten	perature	e, where	appropr	iate			
17.86	18.13	18.62	19.26	19.74	19.98	20.03	20.02	19.84	19.19	18.42	17.82
<i>3. Spac</i> Jan	e heatin	<i>g requir</i> Mar	rement Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	on factor			, may	l Gair	-	ı, tağ	СОР	001	1101	200
0.99	0.98	0.95	0.89	0.75	0.56	0.39	0.46	0.74	0.93	0.98	0.99
Useful g		1	10100			10.00		1		10100	
	452.33	529.87	599.52	580.69	438.11	292.76	304.17	415.12	422.53	381.55	367.99
	average										
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
مما امما	s rate fo			- emperati	ıre						
Teal los	1175.39	1074.57	910.71	706.21	468.46	298.87	315.01	501.64	754.21	996.96	1203.97
				I	l	l .	l		I.	I.	
1207.5	of mont					1	_	-	1.00	1.00	1.00
1207.5	of mont	1.00	1.00	1.00	-	-	-			1.00	1.00
1207.59 Fraction 1.00		1.00	1		- h, kWh/ı	nonth		1	1	1.00	1.00
1207.55 Fraction 1.00 Space h	1.00	1.00 equireme	ent for ea	ch mont	- h, kWh/r -	nonth -	-	-	246.77	443.10	

9a. Energy requirements

sa. Energy requ	ın emem	15								kWh/year	
No secondary he Fraction of space Efficiency of main	e heat fr	om main	system((s)				1.0000 3.50%		-	(202) (206)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating re	quireme	nt	l								
609.81 485.90	405.26	224.06	93.39	-	-	-	-	246.77	443.10	621.97	(98)
Appendix Q - mo	nthly en	ergy sav	ed (mair	heating	system	1)	·	1	1		
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fu	iel (main	heating	system	1)		1				•	
652.20 519.67	433.43	239.63	99.88	-	-	-	-	263.93	473.90	665.21	(211)
Appendix Q - mo	nthly en	ergy sav	ed (mair	heating	system	2)		'			
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fu	iel (main	heating	system	2)							
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - mo	onthly en	ergy sav	ed (seco	ndary he	eating sy	stem)			•		
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fu	iel (seco	ndary)			•				•		
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating											
Water heating re			T	T	T	T	I	T	T . =	I	(0.4)
169.00 149.15		141.41	139.01	124.84	120.49	131.40	130.91	146.60	154.26	165.14	(64)
Efficiency of wat			T	T=	T=	T=	T	T	T	79.80	(216)
87.94 87.74	87.23	86.04	83.78	79.80	79.80	79.80	79.80	86.19	87.47	88.02	(217)
Water heating fu		1		1	1	1		1	1		(0.1.0)
192.18 169.99	180.06	164.36	165.93	156.44	151.00	164.66	164.04	170.09	176.35	187.61	(219)
Annual totals Space heating for Space heating for Water heating for Electricity for pure	uel (seco uel	ndary) Î		on hot						kWh/year 3347.86 0.00 2042.71	(211) (215) (219)
Electricity for pur central heating boiler with a far Total electricity f Electricity for ligh Energy saving/g Appendix Q -	pump n-assiste or the ab nting (10	d flue oove, kW 0.00% fix	h/year ked LEL)							30.00 45.00 75.00 235.90	(230c) (230e) (231) (232)
Energy saved Energy used ()):	v								0.000	(236a) (237a)
Total delivered e	energy fo	r all uses	6							5701.46	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	s
	kWh/year	kg CO2/kWh	kg CO2/ye	ear
Space heating, main system 1	3347.86	0.216	723.14	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	2042.71	0.216	441.22	(264)
Space and water heating			1164.36	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	235.90	0.519	122.43	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				, ,
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1325.72	(272)
			kg/m²/yea	r
Emissions per m ² for space and water heating			22.83	(272a)
Emissions per m ² for lighting			2.40	(272b)
Emissions per m ² for pumps and fans			0.76	(272c)
Target Carbon Dioxide Emission Rate (TER) = (22.8306 x 1.00) + 2.4006 + 0.7632			25.99	(273)

Project InformationBuilding type Mid-floor flat

Reference

Date 8 April 2016 Project NW1

1. Over	1. Overall dwelling dimensions						A		A., Ota.,		Values.		
Total flo	floor (2) oor area g volume	e (m³)					Area (m²) 51.00 51.00	Av. Storey height (m) 3.00			Volume (m³) 153.00	(3a (4) (5)	
2. Vent	ilation ra	ate											
								seonda	ary + othe	r	m³ pe	er ho	ur
Number Number Number	r of chim r of open r of interi r of pass r of fluele	flues mittent fa ive vents	6				heating 0 + 0 + 0 0 + 0 + 0 0 0)	x 40 x 20 x 10 x 10 x 40		0. 0. 0.	.00 .00 .00 .00	(6a) (6b) (7a) (7b) (7c)
Infiltration due to chimneys, fans and flues Pressure test, result q50 Air permeability Number of sides on which sheltered Shelter factor Infiltration rate incorporating shelter factor Infiltration rate modified for monthly wind speed									5.00		0. 0. 2. 0.	hang .00 .25 .00 .85 .21	(8) (17) (18) (19) (20) (21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	7	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	Ī	
Wind Fa	actor	•					•				52.	.50	(22)
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	7	
Adiuste	d infiltrat	ion rate	(allowing	for shel	ter and v	vind sp	eed)		l		13.	.13	(22a)
0.27	0.27	0.26	0.23	0.23	0.20	0.20	0.20	0.21	0.23	0.24	0.25	7	
efficie Ventilati	inge rate ncy in % ion : bala e air cha	allowing anced wh	g for in-u nole hous			ith heat	0.50 79.90 t recovery	,	l	1		.79	(22b) (23a) (23c)
0.37	0.37	0.36	0.33	0.33	0.30	0.30	0.30	0.31	0.33	0.34	0.35	7	(25)

area, m² m² A, m² Wi/m²K Wi/K kJ/m²K kJ/K Wi/nak kJ/K Window Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 1.45 (1.54) 2.98 (27) 2.98 (27) 2.00 2.013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 1.45 (1.54) 6.99 (27) 2.00 2.013 Rooflight New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 1.45 (1.54) 6.99 (27) 2.00 2.013 Rooflight New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 1.45 (1.54) 6.99 (27) 2.00 2.013 Rooflight New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 1.45 (1.54) 6.99 (27) 2.00 2.01 2.01 2.01 2.01 2.01 2.01 2.01	3. Heat losses a				Harakia	A I I	lanna valvy	- A I/	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 4.830 1.33 (1.40) 1.43 (27) air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 4.830 1.33 (1.40) 4.42 (27) air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 2.054 1.45 (1.54) 2.98 (27) 2.013 External Window New, Ground Floor Unit B20 4.02 2.02 2.054 2.054 2.054 2.098 (27) 2.004 2.004 2.005 2.		Gross	Openings m ²	Net area	U-value W/m²K	A x U w/k			
air-filled, low-E, En=0.1, sostic coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, sostic coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, sostic coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, sostic coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, sostic coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, sostic coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, sostic coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, sostic coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less -			111-	•			NJ/III-IX	NO/IX	(27)
soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit				0.701	1100 (1110)				(=,)
2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, Ene_0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, Ene_0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, Ene_0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, Ene_0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, Ene_0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, Ene_0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, Ene_0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, Ene_0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, Ene_0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less -	· · · · · · · · · · · · · · · · · · ·	- ,							
Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit		Window Nev	w, Ground						
air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 1.45 (1.54) 2.98 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - 2.054 1.45 (1.54) 6.99 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit R20 4.02 Living Rooflight New,									
soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living	Window - Double	e-glazed,		1.076	1.33 (1.40)	1.43			(27)
2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit R20 4.02 Living	· · · · · · · · · · · · · · · · · · ·	∃n=0.1,							
Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit	soft coat (North)								
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02			w, Ground						
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2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 2.054 1.45 (1.54) 2.98 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - 4.817 1.45 (1.54) 6.99 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit		=n=0.1,							
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Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 4.830 1.33 (1.40) 6.40 (27) soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 3.335 1.33 (1.40) 4.42 (27) window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 3.335 1.33 (1.40) 4.42 (27) window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 4.830 1.33 (1.40) 6.40 (27) window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 2.054 1.45 (1.54) 2.98 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2.054 1.45 (1.54) 2.98 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit 4.817 1.45 (1.54) 6.99 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit 4.817 1.45 (1.54) 6.99 (27)			w, Ground						
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soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit		-		4.000	1.55 (1.40)	0.40			(21)
2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Alato	· · · · · · · · · · · · · · · · · · ·								
Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit Rooflight New, Ground Floor Unit Rooflight New, Ground Floor Unit		Window Nev	w. Ground						
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soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, 3.335 1.33 (1.40) 4.42 (27) Window - Double-glazed, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (In/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (In/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (In/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight At 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (In/a) 2013 Rooflight New, Ground Floor Unit	Window - Double	e-glazed,		3.335	1.33 (1.40)	4.42			(27)
2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, 3.335 1.33 (1.40) 4.42 (27) air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, 4.830 1.33 (1.40) 6.40 (27) air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 1.45 (1.54) 2.98 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - 4.817 1.45 (1.54) 6.99 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight A1 70° or less - 4.817 1.45 (1.54) 6.99	air-filled, low-E, E	En=0.1,							
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soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 1.45 (1.54) 2.98 (27) 2.98 (27) 2.013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - 2.013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - 2.013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - 2.013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight New, Ground Floor Unit		-		3.335	1.33 (1.40)	4.42			(27)
2013 External Window New, Ground Floor Unit B20 4.02 Window - Double-glazed, 4.830 1.33 (1.40) 6.40 (27) air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - 2.054 1.45 (1.54) 2.98 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02 Living Rooflight at 70° or less - 4.817 1.45 (1.54) 6.99 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit Rooflig		=n=0.1,							
Floor Unit B20 4.02 Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit	, ,	Mindou No	Очанная						
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit			w, Ground						
air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit				4 830	1 33 (1 40)	6.40			(27)
soft coat (North) 2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit		-		4.030	1.55 (1.40)	0.40			(21)
2013 External Window New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight At 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit		_11-0.1,							
Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.817 4.817 4.817 4.817 4.817 4.817 4.817 4.817 4.817	, ,	Window Nev	w. Ground						
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit 2013 Rooflight New, Ground Floor Unit			,						
Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit	Rooflight at 70°	or less -		2.054	1.45 (1.54)	2.98			(27)
(n/a) 2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit									
2013 Rooflight New, Ground Floor Unit B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit		oft coat							
B20 4.02_Living Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit									
Rooflight at 70° or less - 4.817 1.45 (1.54) 6.99 (27) Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit			nd Floor Unit						
Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit				4.047	4 4 5 (4 5 4)	0.00			(07)
low-E, En=0.1, soft coat (n/a) 2013 Rooflight New, Ground Floor Unit				4.81 <i>7</i>	1.45 (1.54)	6.99			(27)
(n/a) 2013 Rooflight New, Ground Floor Unit									
2013 Rooflight New, Ground Floor Unit		on coal							
· · · · · · · · · · · · · · · · · · ·		New Groun	nd Floor Unit						
B20 4.02	B20 4.02	rtott, aroar	10 1 1001 01111						
Rooflight at 70° or less - 2.054 1.45 (1.54) 2.98 (27)		or less -		2.054	1.45 (1.54)	2.98			(27)
Double-glazed, air-filled,	-				- ()				(')
low-E, En=0.1, soft coat									
(n/a)	(n/a)								
2013 Rooflight New, Ground Floor Unit		New, Grour	nd Floor Unit						
B20 4.02	B20 4.02								

3. Heat losses and heat loss parameter Element Gross Openings area, m² m² Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)	r Net area A, m² 2.054	U-value W/m²K 1.45 (1.54)	A x U W/K 2.98	kappa-value kJ/m²K	e A x K kJ/K	(27)
2013 Rooflight New, Ground Floor Unit B20 4.02 Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)	2.054	1.45 (1.54)	2.98			(27)
2013 Rooflight New, Ground Floor Unit						
B20 4.02 Pitched roofs insulated between joists 2013 Roof New, Ground Floor Unit B20 4.02_Living	18.25	0.20	3.65	98.75	1801.99	(30)
Pitched roofs insulated between joists 2013 Roof New, Ground Floor Unit B20 4.02	34.62	0.20	6.92	98.75	3418.92	(30)
Pitched roofs insulated between joists 2013 Roof New, Ground Floor Unit B20	20.48	0.20	4.10	98.75	2022.10	(30)
4.02 Walls 2013 External Wall New, Ground Floor	52.14	0.14	7.30	21.95	1144.43	(29)
Unit B20 4.02 Walls 2013 External Wall New, Ground Floor	10.64	0.14	1.49	21.95	233.59	(29)
Unit B20 4.02 Walls 2013 External Wall New, Ground Floor	40.88	0.14	5.72	21.95	897.21	(29)
Unit B20 4.02_Living Walls 2013 External Wall New, Ground Floor	16.39	0.14	2.29	21.95	359.72	(29)
Unit B20 4.02 Internal wall 2013 Internal Partition, Ground Floor	128.23	0.00	0.00	8.75	1122.05	
Unit B20 4.02 Internal wall 2013 Internal Partition, Ground Floor	21.01	0.00	0.00	8.75	183.88	
Unit B20 4.02_Living Internal floor 2013 Internal Ceiling/Floor, Ground	17.77	0.00	0.00	95.00	1688.18	
Floor Unit B20 4.02_Living Internal floor 2013 Internal Ceiling/Floor, Ground	198.74	0.00	0.00	95.00	18880.52	
Floor Unit B20 4.02 Internal ceiling 2013 Internal Ceiling/Floor, Ground Floor Unit B20 4.02	6.03	0.00	0.00	95.00	572.68	

Selection	3. Heat Elemen	losses a	and hea Gross			, Net are	a II-	valuo	A x U	ka	nna-valı	10 A v K	
Fabric Sat S	Lieilleii	ι		•	eriirigs								
Total fabric heat loss Saculusted monthly 18.75	Fabric h Therma	neat loss Il mass p	, W/K aramete				TMP)					84.83 250.00	3 (33) 0 (35)
Heat transfer coefficient, W/K 103.67 103.40 103.13 101.79 101.52 100.18 100.18 99.91 100.72 101.52 102.06 102.59 101.72 (39) Heat loss parameter (HLP), W/m²K 2.03 2.02 2.00 1.99 1.96 1.96 1.96 1.97 1.99 2.00 2.01 HLP (average) 1.99 1.96 1.96 1.96 1.97 1.99 2.00 2.01 HLP (average) 1.99 1.96 1.96 1.96 1.97 1.99 2.00 2.01 HLP (average) 1.99 1.96 1.96 1.96 1.96 1.97 1.99 2.00 2.01 HLP (average) 1.99 1.96 1.96 1.96 1.97 1.99 2.00 2.01 May	Total fal	bric heat	loss	ulated m	onthly								` '
103.67 103.40 103.13 101.79 101.52 100.18 100.18 99.91 100.72 101.52 102.06 102.59 101.72 103.92 101.72 103.92 101.72 103.92 101.72 103.92 101.72 103.92 101.72 103.92 101.72 103.92 101.72 103.92 101.72 103.92 101.72 103.92 101.72 103.92 101.72 103.92 101.99 100.72 101.52 102.06 102.59 102.06 102.59 102.03 102.03 103.92 102.03 102.03 102.03 103.92 102.03 102.03 102.03 103.92 102.03 102.03 102.03 103.92 102.03 102.03 102.03 103.93 10			1	I	16.61	15.27	15.27	15.00	15.80	16.61	17.14	17.68	(38)
Heat loss parameter (HLP), W/m²K 2.03 2.02 2.00 1.99 1.96 1.96 1.96 1.97 1.99 2.00 2.01 HLP (average) 1.99 1.96 1.96 1.96 1.97 1.99 2.00 2.01 HLP (average) 1.99					101 50	100 10	100 10	00.01	100.72	101 50	102.06	102.50	
Heat loss parameter (HLP), W/m²K 2.03 2.02 2.00 1.99 1.96 1.96 1.96 1.97 1.99 2.00 2.01 2.01 1.99	103.67	103.40	103.13	101.79	101.52	100.18	100.18	99.91	100.72	101.52	102.06		2 (39)
HLP (average 1.99 1.99 1.99 Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 31 28 31 30												,	()
Number of days in month (Table 1a) Jun			2.02	2.00	1.99	1.96	1.96	1.96	1.97	1.99	2.00		(40)
### A: Water heating energy requirements ### Assumed occupancy, N Annual average hot water usage in litres per day Vd, average			in month	ı (Table	1a)							1.99	(40)
A. Water heating energy requirements Cassume Cocupanicy, N Cassume Cocupanicy, N Cassume	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy, N	31	28	31	30	31	30	31	31	30	31	30	31	
Hot water usage in litres per day for each month 86.89 83.73 80.57 77.41 74.25 71.09 71.09 74.25 77.41 80.57 83.73 86.89 (44) Energy content of hot water used 128.85 112.70 116.29 101.39 97.28 83.95 77.79 89.26 90.33 105.27 114.91 124.79 Energy content (annual)	Assume	Assumed occupancy, N 1.72 (Annual average hot water usage in litres per day Vd,average 78.99 ((42)	
Ref. 89 83.73 80.57 77.41 74.25 71.09 71.09 74.25 77.41 80.57 83.73 86.89 Ref. 89 Ref. 89 Ref. 80.57 Re	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content of hot water used 128.85 112.70 116.29 101.39 97.28 83.95 77.79 89.26 90.33 105.27 114.91 124.79 Energy content (annual) 1242.81 (45) Energy content (annual) 1242.81 (46) Energy content (annual) 124.81 (46) (46) Energy content (annual) 124.81 (46) Energy content (annual) 124.81 (46) (46) Energy content (annual) 124.81 (46) (46) Energy content (annual) 124.81 (46) (46) Energy content (annual) 124.81 (4								1	T	1			
128.85 112.70 116.29 101.39 97.28 83.95 77.79 89.26 90.33 105.27 114.91 124.79 Energy content (annual) 1242.81 (45) Distribution loss 1242.81 (45) 19.33 16.90 17.44 15.21 14.59 12.59 11.67 13.39 13.55 15.79 17.24 18.72 (46) Hot water storage volume (litres) 110.00 (50) Hot water cylinder loss factor (kWh/day) 0.0152 (51) Volume factor 1.0294 (52) Temperature factor 0.6000 (53) Energy lost from hot water cylinder (kWh/day) 1.03 (55) Total storage loss 32.01 28.92 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 Primary loss 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 22.51 23.26 (59) Total heat required for water heating calculated for each month 184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 (64) Heat gains from water heating, kWh/month 1893.65 (64)					74.25	71.09	71.09	74.25	77.41	80.57	83.73	86.89	(44)
Energy content (annual) Distribution loss 19.33 16.90 17.44 15.21 14.59 12.59 11.67 13.39 13.55 15.79 17.24 18.72 (46) Hot water storage volume (litres)					97.28	83 95	77 70	80.26	90.33	105 27	11/ 01	124 70	
19.33 16.90 17.44 15.21 14.59 12.59 11.67 13.39 13.55 15.79 17.24 18.72 (46)	Energy	content ((annual)	101.00	37.20	00.00	177.75	03.20	00.00	100.27	114.51		(45)
Hot water cylinder loss factor (kWh/day) Volume factor Temperature factor Temperature factor Total storage loss 32.01 28.92 32.01 30.98	_			15.21	14.59	12.59	11.67	13.39	13.55	15.79	17.24	18.72	(46)
32.01 28.92 32.01 30.98 32.01 30.9	Hot wate Volume Temper	er cylind factor ature fac	er loss fa ctor	actor (kŴ	•	day)						0.0152 1.0294 0.6000	(51) (52) (53)
Net storage loss 32.01 28.92 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 (57) Primary loss 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 (59) Total heat required for water heating calculated for each month 184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 (62) Output from water heater for each month, kWh/month 184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 (64) Heat gains from water heating, kWh/month								1					4
32.01 28.92 32.01 30.98				30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
Primary loss 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 22.51 23.26 (59) Total heat required for water heating calculated for each month 184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 (62) Output from water heater for each month, kWh/month 184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 (64) Heat gains from water heating, kWh/month		<u> </u>		30.08	32.01	30.08	32.01	32.01	30.08	32.01	30.08	32.01	(57)
Total heat required for water heating calculated for each month 184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 Output from water heater for each month, kWh/month 184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 1893.65 1893.			02.01	30.30	32.01	30.30	02.01	32.01	30.30	52.01	30.30	32.01	(07)
184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 (62) Output from water heater for each month, kWh/month 184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 (64) Heat gains from water heating, kWh/month	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Output from water heater for each month, kWh/month 184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 (64) Heat gains from water heating, kWh/month (64)													
184.13 162.62 171.57 154.88 152.56 137.44 133.07 144.54 143.82 160.55 168.41 180.06 (64) Heat gains from water heating, kWh/month								144.54	143.82	160.55	168.41	180.06	(62)
Heat gains from water heating, kWh/month 1893.65 (64)								14454	142.00	160 FF	160 41	100.06	(64)
						1	133.07	144.54	143.02	160.33	100.41		
							70.09	73.90	72.83	79.22	81.00	85.71	(65)

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_	Intorno	I agine
. J.	Interna	i uaiiis

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metaboli	ic gains,	Watts	,				,			•		
85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66
Lighting	gains					•						
13.36	11.86	9.65	7.30	5.46	4.61	4.98	6.47	8.69	11.03	12.88	13.73	(67
Applianc	es gains	;	•		•	•	•		•			
149.83	151.39	147.47	139.13	128.60	118.70	112.09	110.54	114.45	122.80	133.32	143.22	(68
Cooking	gains		•		•	•	•		•	•		
31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	(69
Pumps a	and fans	gains					•					
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70
Losses	e.g. evap	oration	negative	values)			,			•		
-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71
Water h	eating ga	ains			•	•			•	•		
117.02	115.20	111.41	106.26	102.91	98.20	94.20	99.33	101.15	106.48	112.50	115.21	(72
Total int	ernal gai	ns				•						
329.00	327.24	317.32	301.48	285.77	270.31	260.07	265.13	273.09	289.11	307.50	320.95	(73

6. Solar gains (calculation for January)

or colui game (carearanon for cariaary)	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, air-filled, low-E,	0.9 x 3.754 10.63	0.63 x 0.80	0.77	13.9422
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor				
Window - Double-glazed, air-filled, low-E,	0.9 x 1.076 10.63	0.63 x 0.80	0.77	3.9962
En=0.1, soft coat (North)	II. !: Doo 4 oo			
2013 External Window New, Ground Floor				.=
Window - Double-glazed, air-filled, low-E,	0.9 x 4.830 10.63	0.63 x 0.80	0.77	17.9384
En=0.1, soft coat (North)	II. 'I Boo 4 oo			
2013 External Window New, Ground Floor		0.00 0.00	0.77	17.0004
Window - Double-glazed, air-filled, low-E,	0.9 x 4.830 10.63	0.63 X 0.80	0.77	17.9384
En=0.1, soft coat (North)	U-: D00 4 00			
2013 External Window New, Ground Floor		0.00 × 0.00	0.77	10.0000
Window - Double-glazed, air-filled, low-E,	0.9 x 3.335 10.63	0.63 X 0.60	0.77	12.3860
En=0.1, soft coat (North) 2013 External Window New, Ground Floor	Hait B20 4 02			
Window - Double-glazed, air-filled, low-E,	0.9 x 3.335 10.63	0 63 v 0 80	0.77	12.3860
En=0.1, soft coat (North)	0.9 X 3.333 10.03	0.03 X 0.00	0.77	12.3000
2013 External Window New, Ground Floor	I Init R20 4 02			
Window - Double-glazed, air-filled, low-E,	0.9 x 4.830 10.63	0.63 x 0.80	0.77	17.9384
En=0.1, soft coat (North)	0.0 X 4.000 10.00	0.00 X 0.00	0.77	17.5004
2013 External Window New, Ground Floor	Unit B20 4 02			
Rooflight at 70° or less - Double-glazed,	0.9 x 2.054 26.61	0.63 x 0.80	1.00	24.7874
air-filled, low-E, En=0.1, soft coat (n/a)	0.0 % =.00 · =0.0 ·	0.00 % 0.00		
2013 Rooflight New, Ground Floor Unit B20	4.02 Living			
Rooflight at 70° or less - Double-glazed,	0.9 x 4.817 26.61	0.63 x 0.80	1.00	58.1329
air-filled, low-E, En=0.1, soft coat (n/a)				
2013 Rooflight New, Ground Floor Unit B20	4.02			
Rooflight at 70° or less - Double-glazed,	0.9 x 2.054 26.61	0.63 x 0.80	1.00	24.7874
air-filled, low-E, En=0.1, soft coat (n/a)				
2013 Rooflight New, Ground Floor Unit B20	4.02			
Rooflight at 70° or less - Double-glazed,	0.9 x 2.054 26.61	0.63 x 0.80	1.00	24.7874
air-filled, low-E, En=0.1, soft coat (n/a)				
2013 Rooflight New, Ground Floor Unit B20	4.02			

6. Solar gains (calculation for January)	Area & Flux	g & FF	Shading	Gains
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)	0.9 x 2.054 26.61		1.00	24.7874
2013 Rooflight New, Ground Floor Unit B20	0 4.02			
Lighting calculations	A			
Window - Double-glazed, air-filled, low-E,	Area 0.9 x 3.75	g 0.80	FF x Shadi 0.80 x 0.83	
En=0.1, soft coat (North)	H=# D00 4 00			
2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E,	0.9 x 1.08	0.80	0.80 x 0.83	0.51
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E,	Unit B20 4.02 0.9 x 4.83	0.80	0.80 x 0.83	2.31
En=0.1, soft coat (North)		0.00	0.00 X 0.00	2.01
2013 External Window New, Ground Floor		0.00	0.000.00	0.04
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 4.83	0.80	0.80 x 0.83	2.31
2013 External Window New, Ground Floor	Unit B20 4.02			
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 3.33	0.80	0.80 x 0.83	1.59
2013 External Window New, Ground Floor	Unit B20 4.02			
Window - Double-glazed, air-filled, low-E,	0.9 x 3.33	0.80	0.80 x 0.83	1.59
En=0.1, soft coat (North) 2013 External Window New, Ground Floor	I Init R20 4 02			
Window - Double-glazed, air-filled, low-E,	0.9 x 4.83	0.80	0.80 x 0.83	2.31
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit B20 4.02 0.9 x 2.05	0.80	0.80 x 1.00	1.18
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)	0.9 X 2.05	0.80	0.80 X 1.00	1.10
2013 Rooflight New, Ground Floor Unit B20				
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)	0.9 x 4.82	0.80	0.80 x 1.00	2.77
2013 Rooflight New, Ground Floor Unit B20	0 4.02			
Rooflight at 70° or less - Double-glazed,	0.9 x 2.05	0.80	0.80 x 1.00	1.18
air-filled, low-E, En=0.1, soft coat (n/a)	1 4 00			
2013 Rooflight New, Ground Floor Unit B20 Rooflight at 70° or less - Double-glazed,	0.9 x 2.05	0.80	0.80 x 1.00	1.18
air-filled, low-E, En=0.1, soft coat (n/a)				
2013 Rooflight New, Ground Floor Unit B20		0.00	0.00 v 1.00	1 10
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)	0.9 x 2.05	0.80	0.80 x 1.00	1.18
2013 Rooflight New, Ground Floor Unit B20	4.02			

Heating	system	responsi	veness		•		, ,				1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau			I				-3	1 1-			
34.16	34.25	34.34	34.79	34.89	35.35	35.35	35.45	35.16	34.89	34.70	34.52
alpha					1						
3.28	3.28	3.29	3.32	3.33	3.36	3.36	3.36	3.34	3.33	3.31	3.30
Utilisati	on factor	for gains	for livin	g area							
0.98	0.95	0.85	0.65	0.44	0.30	0.22	0.27	0.50	0.83	0.96	0.99
Mean ir	nternal te	mperatui	re in livin	g area T	1	1	•	•	•	•	
19.16	19.60	20.21	20.74	20.93	20.99	21.00	20.99	20.93	20.50	19.70	19.09
Tempei	rature du	ring heat	ing peric	ds in res	st of dwe	lling Th2					
19.31	19.32	19.32	19.34	19.34	19.36	19.36	19.36	19.35	19.34	19.33	19.33
Utilisati	on factor	for gains	for rest	of dwell	ing	_					
0.97	0.93	0.81	0.58	0.37	0.23	0.14	0.18	0.39	0.77	0.95	0.98
	nternal te		re in the	rest of d		[2					
17.02	17.64	18.46	19.09	19.29	19.35	19.36	19.36	19.31	18.86	17.80	16.92
	rea fracti nternal te				dwelling)					0.35
17.76	18.33	19.07	19.67	19.87	19.92	19.93	19.93	19.88	19.43	18.46	17.67
Apply a	djustmen	it to the r	nean inte	ernal ten	peratur	e, where	appropr	iate	•	•	
17.76	18.33	19.07	19.67	19.87	19.92	19.93	19.93	19.88	19.43	18.46	17.67
<i>3. Spac</i> Jan	ce heatin Feb	<i>g requir</i> Mar	ement Apr	May	Jun	Jul	Λυα	Sep	Oct	Nov	Dec
	on factor			iviay	Juli	Jui	Aug	Seb	OCI	INOV	Dec
0.97	0.92	0.80	0.60	0.40	0.25	0.17	0.21	0.43	0.77	0.94	0.97
Useful (0.00	0.00	0.40	0.23	0.17	0.21	0.40	0.77	0.54	0.57
	760.46	946 01	981 33	803 54	529.11	332.70	351.07	559.43	687.89	584.67	515.60
	average				1020111	10020	00	1000.10	007.00	100	0.0.00
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
	ss rate fo					1.0.00	1	1	10100		
	6 1388.20			•		333.39	352.53	581.87	896.73	1159.33	1382.41
	n of mont										
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
	neating re	equireme			h, kWh/	month	<u> </u>		<u>I</u>	<u>I</u>	1
•	421.84			18.89	-	_	-	-	155.37	413.76	644.90
	pace heat			per year	(kWh/ye	ar) (Oct	ober to N	Лау)	<u>I</u>	<u> </u>	2617.65
											51.33
pace I	neating re	equirerne	in per ii	1- (KVVII/I	II-/yeai)						31.3

8c. Space cooling requirement

•											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
External	temper	aturers	4	•		•	1		1	•	-
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-
Heat los	s rate W	İ	.1								
-	-	-	-	-	941.69	741.33	759.33	-	-	-	-
Utilisatic	n factor	for loss									
-	-	-	-	-	0.97	0.98	0.97	-	-	-	-
Useful lo	ss W	1	-	-	1	•	1		1	•	
-	-	-]-	-	914.25	728.42	737.06	-	-	-	-
Internal	gains W	•		•	•				•	•	
0.00	0.00	0.00	0.00	0.00	368.32	355.38	361.92	0.00	0.00	0.00	0.00
Solar ga	ins W	•		•	•	•			•	•	
0.00	0.00	0.00	0.00	0.00	1958.34	1842.16	1506.03	0.00	0.00	0.00	0.00
Gains W	Ĭ	•			•				•	•	
-	-	-	-	-	2326.7	2197.5	1867.95	-	-	-	-
Fraction	of mont	h for coo	ling		•				•	•	
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Space h	eating k	Wh			•				•	•	
-	-	-	-	-	43.78	7.48	0.05	-	-	-	-
Space c	ooling k	Wh		•	•	•			•	•	
-	-	-	-	-	1016.94	1093.03	841.39	-	-	-	-
Total					•				•	•	2951.35
Cooled f Intermitt		ntor.									0.80
memmu	ency rac	loi	1		0.05	0.05	0.05			1	
- Cnasa a	-	-	-	- onth	0.25	0.25	0.25	-	-	-	-
opace c	John 19 re	-quireine	ent for m	UIIIII	000.00	010.01	100.00			1	
- Cnass =	-	- 	- \t\	-	203.39	218.61	168.28	-	-	-	- - -
		June to A	August) ent per m	n² (kWh/i	m²/vear\						590.27 11.57
	- J 9 10	- 400	po	. (, 5001)						

9b. Energy requirements

		kWh/year	
Fraction of space heat from secondary system	0.00	•	(301)
Fraction of space heat from community system	1.00		(302)
Fraction of community heat from Boilers	1.00		(303a)
Fraction of total space heat from Boilers	1.00		(304a)
Factor for control and charging method for community space heating	1.00		(305)
Factor for charging method for community water heating	1.00		(305a)
Distribution loss factor	1.05		(306)
Space heating	2617.65		(98)
Annual space heating requirement Space heat from Boilers	2017.00	2748.53	(307a)
Efficiency of secondary heating system	0.00	2740.33	(307a) (308)
Space heating fuel for secondary system	0.00	0.00	(309)
Water heating		0.00	(000)
Annual water heating requirement	1893.65		(64)
Water heat from Boilers		1988.33	(310a)
Other energy			,
Cooling system energy efficiency ratio	5.81%		(314)
Space cooling		101.55	(315)
Electrical energy for heat distribution		47.37	(313)
Electricity for pumps and fans within dwelling:			
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outs	ide (SFP=0.60)	112.37	(330a)
warm air heating system fans		0.00	(330b)
pump for solar water heating		0.00	(330g)
pump for waste water heat recovery		0.00	(330h)
Total electricity for the above, kWh/year		112.37	(331)
Electricity for lighting (100.00% fixed LEL)		235.90	(332)
Energy saving/generation technologies Appendix Q -			
Energy saved or generated ():		0.000	(336a)
Energy saved or generated (). Energy used ():		0.000	(337a)
Lifety assa (/.		0.000	(001a)
Total delivered energy for all uses		5132.50	(338)

10a. Does not apply

11a. Does not apply

12b. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions	_
Efficiency of Boilers - 97.90%	•	· ·	,	(367a)
CO2 emissions from Boilers	4838.47	0.2160	1045.11	(368)
Electrical energy for heat distribution	47.37	0.5190	24.58	(372)
Total CO2 associated with community systems			1069.69	(373)
Total CO2 associated with space and water heating			1069.69	(376)
Space cooling	101.55	0.519	52.71	(377)
Electricity for pumps and fans	112.37	0.519	58.32	(378)
Electricity for lighting	235.90	0.519	122.43	(379)
Electricity generated - PVs	0.00	0.519	0.00	(380)
Electricity generated - μCHP	0.00	0.000	0.00	(380)
Appendix Q -				, ,
Ėnergy saved ():	0.00	0.000	0.00	(381)
Energy used ():	0.00	0.000	0.00	(382)
Total CO2, kg/year			1303.15	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			kg/m²/yea 25.55	r (384)

Project InformationBuilding type Top-floor flat

Reference

8 April 2016 NW1 Date

Project

SAP 2012 worksheet for notional dwelling - calculation of target emissions

7.	Overai	ı awe	ilina	aıme	ensions

-	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	/ - \
Second floor	60.94	3.00	182.82	(3a)
Total floor area	60.94			(4)
Dwelling volume (m³)			182.82	(5)

0.58

0.57

0.57

2. Ventilation rate													
							main + seondary + other				m³ per hour		
Number of chimneys Number of open flues Number of intermittent fans Number of passive vents Number of flueless gas fires							heating 0 + 0 + 0 0 + 0 + 0 2 0 0		x 40 x 20 x 10 x 10 x 40		0.00 0.00 20.00 0.00 0.00)))	(6a) (6b) (7a) (7b) (7c)
Infiltration due to chimneys, fans and flues Pressure test, result q50 Air permeability Number of sides on which sheltered Shelter factor Infiltration rate incorporating shelter factor Infiltration rate modified for monthly wind speed									5.00		Air cha 0.11 0.36 2.00 0.85 0.31)) 5	(8) (17) (18) (19) (20) (21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70		
52.50 Wind Factor)	(22)
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18		
13.13 Adjusted infiltration rate (allowing for shelter and wind speed)												}	(22a)
0.39	0.38	0.37	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.34	0.36		
Ventilation : natural ventilation, intermittent extract fans Effective air change rate												(22b)	

0.56

0.55

0.54

0.54

0.54

0.55

0.55

0.56

0.56

(25)

3. Heat losses and heat loss parameter Element Gross Openings area, m ² m ²	r Net area A, m²	U-value W/m²K	A x U W/K	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	3.090	1.33 (1.40)	4.10	(27)
2013 External Window New, Ground Floor Unit D1 1.13_Living Window - Double-glazed,	3.090	1.33 (1.40)	4.10	(27)
air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground		` ,		` ,
Floor Unit D1 1.13_Living Window - Double-glazed, air-filled, low-E, En=0.1,	3.090	1.33 (1.40)	4.10	(27)
soft coat (North) 2013 External Window New, Ground Floor Unit D1 1.13				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	3.090	1.33 (1.40)	4.10	(27)
2013 External Window New, Ground Floor Unit D1 1.13 Window - Double-glazed,	2.890	1.33 (1.40)	3.83	(27)
air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground				
Floor Unit D1 1.13 Walls 2013 External Wall New, Ground Floor	23.57	0.18	4.24	(29)
Unit D1 1.13_Living Walls 2013 External Wall New, Ground Floor	26.78	0.18	4.82	(29)
Unit D1 1.13 Walls 2013 External Wall New, Ground Floor	0.98	0.18	0.18	(29)
Unit D1 1.13 Internal wall 2013 Internal Partition, Ground Floor	33.50	0.00	0.00	
Unit D1 1.13 Internal wall 2013 Internal Partition, Ground Floor	33.50	0.00	0.00	
Unit D1 1.13_Living Internal floor 2013 Internal Ceiling/Floor, Ground	52.69	0.00	0.00	
Floor Unit D1 1.13_Living Internal floor 2013 Internal Ceiling/Floor, Ground Floor Unit D1 1.13	35.47	0.00	0.00	
Internal ceiling 2013 Internal Ceiling/Floor, Ground Floor Unit D1 1.13	33.72	0.00	0.00	

3. Heat Element	losses a	and hea Gross		arametei enings	, Net are	ıa II.	value	AxU				
Liemen		area, m		eriirigs	A, m ²		/m²K	W/K				
Fabric h Therma Effect of Total fal	ea of ext neat loss Il mass p f therma bric heat ion heat	, W/K aramete I bridges loss	r, kJ/m²ł	ζ (user-s		TMP)					66.56 29.46 250.00 3.33 32.79	6 (33) 0 (35) 3 (36)
34.74	34.56	34.39	33.57	33.42	32.71	32.71	32.57	32.98	33.42	33.73	34.05	(38)
	nsfer co			33.42	02.71	32.71	02.07	32.30	00.42	00.70	04.00	(00)
67.53	67.35	67.18	66.36	66.20	65.49	65.49	65.36	65.77	66.20	66.51	66.84	
	1	1	1	1	00.40	00.40	00.00	00.77	00.20	00.51	66.3	6 (39)
	ss param				1	1	Г	1	T			
1.11	1.11	1.10	1.09	1.09	1.07	1.07	1.07	1.08	1.09	1.09	1.10	
HLP (av Number	verage) r of days	in month	n (Table	1a)							1.09	9 (40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	
	I		1	L	l	1		1	l			
	r heatin		y requir	ements							kWh/ye	
	ed occup average		r ucado	in litros r	or day \	/d avora	100				2.0° 81.89	` ,
Jan	Feb	Mar	Apr			Jul	·	Con	Oct	Nov	Dec	9 (43)
	⊥reb er usage			May for each	Jun	Jui	Aug	Sep	Oct	INOV	Dec	
90.08	86.81	83.53	80.25	76.98	73.70	73.70	76.98	80.25	83.53	86.81	90.08	(44)
	content of	1	1		73.70	73.70	70.90	00.23	03.33	00.01	90.00	(++)
	116.84			100.86	97.02	80.65	92.54	93.65	100 14	119.13	129.37	
	content (1	103.11	100.00	07.03	00.03	32.34	93.03	103.14	119.13	1288.4	8 (45)
Distribut	tion loss	•				_						,
20.04	17.53	18.08	15.77	15.13	13.05	12.10	13.88	14.05	16.37	17.87	19.41	(46)
	r volume		. P.d.	1 (// ۱۸//-	/-I \	150.00					(47)
	cturer's o ature Fa		cylinder	loss fact	or (kwn	/day)	1.39 0.5400					(48) (49)
	lost from		er cylind	er (kWh/	dav)		0.5400				0.7	
	orage los		,	(,							(00)
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
Net stor	age loss		1			1			l			
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
Primary	loss					1						
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Total he	at requir	ed for w	ater hea	ting calci	lated fo	r each n	nonth					
180.18	158.92	167.16	150.20	147.45	132.12	127.24	139.14	138.74	155.73	164.23	175.97	(62)
Output f	from wat	er heate	r for eac	h month,	kWh/m	onth						
180.18	158.92	167.16	150.20	147.45	132.12	127.24	139.14	138.74	155.73	164.23	175.97	(64)
Heat as	ins from	water he	ating M	Mh/mon	th	1	1	1	1	1	1837.1	. ,
81.69	72.52	77.36	71.02	70.81	65.01	64.09	68.05	67.21	73.56	75.69	80.29	(65)
01.09	12.32	11.30	11.02	10.01	00.01	04.09	00.05	07.21	13.30	75.09	00.29	(00)

5. Interi	nal gains	s									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
/letabol	ic gains,	Watts			1	1		· ·			
100.40	100.40	100.40	100.40	100.40	100.40	100.40	100.40	100.40	100.40	100.40	100.40
ighting	gains	1	-		1	-	1	1	1	1	
15.63	13.88	11.29	8.55	6.39	5.39	5.83	7.58	10.17	12.91	15.07	16.06
	ces gains										
175.31	177.13	172.55	162.79	150.47	138.89	131.15	129.33	133.92	143.68	156.00	167.58
Cooking	gains										
33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04
Pumps a	and fans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
osses	e.g. evap	oration									
-80.32			-80.32	-80.32	-80.32	-80.32	-80.32	-80.32	-80.32	-80.32	-80.32
	eating ga										
	107.91		98.64	95.18	90.29	86.14	91.46	93.35	98.88	105.12	107.92
	ernal gai		1	1	1	1	1		1	1 - 5	
	355.05		326.10	308.15	290.70	279.25	284.49	293.56	311.59	332.31	347.68
En=0.1, 2013 E Window En=0.1, 2013 E Window En=0.1, 2013 E Window En=0.1, 2013 E	r - Double soft coa External V - Double soft coa External V - Double soft coa External V - Soft coa	t (North) Window e-glazed t (North) Window e-glazed t (North) Window e-glazed t (North) Window e-glazed t (North)	New, Gr , air-filled New, Gr , air-filled New, Gr , air-filled	ound Flo d, low-E, ound Flo d, low-E, ound Flo d, low-E,	oor Unit [0.9 oor Unit [0.9 oor Unit [0.9	D1 1.13_ x 3.090 D1 1.13 x 3.090 D1 1.13 x 2.890 D1 1.13	Living 10.63 0	0.63 x 0.7 0.63 x 0.7 0.63 x 0.7 0.63 x 0.7	70 0 70 0	.77 .77 .77	10.0416 10.0416 10.0416 9.3916
	lar gains	, Januar	У								49.56
Solar ga 49.56 Total ga	94.71	160.93	258.50	348.22	372.78	348.04	276.12	193.49	112.74	61.14	41.31
406.42	449.75	504.87	584.60	656.37	663.48	627.28	560.62	487.05	424.32	393.44	388.99
l ! = . l - * !		-4! - ··									
Lightin	g calcula	ations			۸۲۵	2	_		г	E v Char	dina
Vindow	r - Double	e-alazed	. air-filled	d. low-F	Area	a x 3.09	0	J).80		F x Shad .70 x 0.8	
En=0.1, 2013 E Vindow En=0.1,	soft coa External V - Double soft coa External V	t (North) Window e-glazed t (North)	New, Gr , air-filled	ound Flo d, low-E,	or Unit I 0.9	D1 1.13_ x 3.09	Living C).80		.70 x 0.8	
Window En=0.1,	- Double soft coat	e-glazed t (North)	, air-filled	d, low-E,	0.9	x 3.09		0.80	0	.70 x 0.8	3 1.29

2013 External Window New, Ground Floor Unit D1 1.13

Lighting calculations

	Area	g	FF x Shading	
Window - Double-glazed, air-filled, low-E,	0.9 x 3.09	0.80	0.70 x 0.83	1.29
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit D1 1.13			
Window - Double-glazed, air-filled, low-E,	0.9 x 2.89	0.80	0.70×0.83	1.21
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit D1 1.13			

GL = 6.38 / 60.94 = 0.105 C1 = 0.500 C2 = 0.960 EI = 276

Tempe	n interna ature du system	ring heat	ing perio	ds in the	e living a	rea, Th1	(°C)				21.00 1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	1		1					<u>'</u>			
62.67	62.84	63.00	63.78	63.92	64.62	64.62	64.75	64.35	63.92	63.63	63.32
alpha	•			•				•			
5.18	5.19	5.20	5.25	5.26	5.31	5.31	5.32	5.29	5.26	5.24	5.22
Utilisati	on factor	for gains	for livin	g area			•	•			
1.00	0.99	0.98	0.94	0.81	0.61	0.46	0.53	0.81	0.97	0.99	1.00
Mean ir	ternal te	mperatu	re in livin	g area T	1		•	•			
19.88	20.01	20.26	20.61	20.87	20.98	21.00	20.99	20.91	20.57	20.17	19.86
Tempe	ature du	ring heat	ing perio	ds in res	st of dwe	lling Th2				•	
19.99	20.00	20.00	20.01	20.01	20.02	20.02	20.02	20.02	20.01	20.01	20.00
Utilisati	on factor	for gains	for rest	of dwell	ing	•	•			•	
1.00	0.99	0.98	0.92	0.76	0.53	0.36	0.42	0.73	0.95	0.99	1.00
Mean ir	iternal te	mperatu	re in the	rest of d	welling T	2					
18.50	18.70	19.06	19.55	19.89	20.01	20.02	20.02	19.95	19.51	18.94	18.48
	rea fracti						•	•		•	0.43
	ternal te		. `								
19.10	19.27	19.58	20.01	20.32	20.43	20.44	20.44	20.36	19.97	19.47	19.07
	djustmen							1			
19.10	19.27	19.58	20.01	20.32	20.43	20.44	20.44	20.36	19.97	19.47	19.07

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisatio	n factor	for gains	3			•				•	
0.99	0.99	0.98	0.92	0.78	0.56	0.40	0.47	0.76	0.95	0.99	1.00
Useful g	ains					•				•	
404.13	445.19	492.42	537.82	509.35	372.74	250.44	261.50	371.64	404.28	389.10	387.22
Monthly	average	externa	tempera	ature							
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heat los	s rate fo	r mean ii	nternal te	emperati	ire						
999.27	967.48	878.47	737.17	570.37	381.62	251.63	264.07	411.79	620.25	822.80	994.20
Fraction	of mont	h for hea	iting								
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space h	eating re	quireme	nt for ea	ch mont	h, kWh/r	nonth			•		
442.79	350.98	287.23	143.53	45.40	-	-	-	-	160.69	312.26	451.59
	ace heat leating re					ar) (Octo	ober to N	lay)			2194.45 36.01

9a. Energy requirements

9a. Energy requirements kWh/year												
Fraction	ondary he of space by of mai	e heat fro	om main	system(s)				1.0000 3.50%		KWIII year	(202) (206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	, ,
Space h	eating re	quireme	ent						I			
442.79	350.98	287.23	143.53	45.40	-	-	-	-	160.69	312.26	451.59	(98)
Append	ix Q - mo	nthly en	ergy sav	ed (mair	heating	system	1)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space h	eating fu	iel (main	heating	system	1)							
	375.38				-	-	-	-	171.86	333.97	482.98	(211)
Append	ix Q - mo	nthly en	ergy sav	ed (mair	heating	system	2)		•			
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space h	eating fu	iel (main	heating	system	2)	•						
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Append	ix Q - mo	nthly en	ergy sav	ed (seco	ndary he	eating sy	stem)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space h	eating fu	iel (seco	ndary)	•	•	•		•	•			
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water h			_		•	•	•		•			
	eating re			ı	1	1		ı	1			(- 1)
	158.92			147.45	132.12	127.24	139.14	138.74	155.73	164.23	175.97	(64)
	cy of wat			ı	1	1		T	1		79.80	(216)
87.12	86.87	86.25	84.69	82.08	79.80	79.80	79.80	79.80	84.90	86.50	87.22	(217)
	eating fu		T	T . —	T	T	T . =	T . —	I	T	I 1	(0.4.0)
206.82	182.94	193.82	177.35	179.63	165.57	159.45	174.36	173.86	183.44	189.85	201.75	(219)
Space h Water h	neating fu neating fu eating fu	iel (seco el	ndary)		on hot						kWh/year 2347.01 0.00 2188.85	(211) (215) (219)
boiler with a fan-assisted flue 45.00 (230 Total electricity for the above, kWh/year 75.00 (231											(230c) (230e) (231) (232)	
Energ Energ	y saved () y used () elivered e	:		3							0.000 0.000 4886.87	(236a) (237a) (238)
i otal de	voica c	c.gy io	. un usca	•							-1000.01	(200)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/ye	ear
Space heating, main system 1	2347.01	0.216	506.95	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	2188.85	0.216	472.79	(264)
Space and water heating			979.75	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	276.02	0.519	143.25	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - μCHP	0.00	0.000	0.00	(269)
Appendix Q -				. ,
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1161.92	(272)
			kg/m²/yea	
Emissions per m ² for space and water heating			16.08	(272a)
Emissions per m² for lighting			2.35	(272b)
Emissions per m² for pumps and fans			0.64	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0772 x 1.00) + 2.3507 + 0.6387			19.07	(273)

Project InformationBuilding type Top-floor flat

Reference

Date 8 April 2016 Project NW1

1. Over	all dwel	ling dim	ensions	;			A		A Otau		Valores		
Second Total flo Dwelling		e (m³)					Area (m²) 60.94 60.94		Av. Stor height (i 3.00		Volume (m³) 182.82 182.82	(3a (4) (5)	
2. Vent	ilation ra	ate											
							main + s	eonda	ry + othe	r	m³ pe	er ho	ur
Number Number Number	r of chim r of open r of interi r of pass r of fluele	flues mittent fa ive vents	6				heating 0 + 0 + 0 0 + 0 + 0 0 0		x 40 x 20 x 10 x 10 x 40		0 0 0	.00 .00 .00 .00	(6a) (6b) (7a) (7b) (7c)
Pressur Air pern Number Shelter Infiltration	on due to re test, re neability r of sides factor on rate in	esult q50 s on whic ncorpora	ch shelte	red ter facto	r				5.00		0 0 2 0	hang .00 .25 .00 .85 .21	(8) (17) (18) (19) (20) (21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	7	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70		
Wind Fa	actor	•	•		•	•			·	·	52	.50	(22)
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	7	
Adjuste	d infiltrat	ion rate	(allowing	for shel	ter and v	vind sp	eed)		I		13	.13	(22a)
0.27	0.27	0.26	0.23	0.23	0.20	0.20	0.20	0.21	0.23	0.24	0.25		
efficie Ventilati	inge rate ncy in % ion : bala e air cha	allowing anced wh	g for in-u nole hous			th heat	0.50 79.90 recovery	ı	ı	ı	2	.79	(22b) (23a) (23c)
0.37	0.37	0.36	0.33	0.33	0.30	0.30	0.30	0.31	0.33	0.34	0.35		(25)

3. Heat losses and heat loss parameter. Element Gross Openings area, m ² m ²	r Net area A, m²	U-value W/m²K	A x U W/K	kappa-valu kJ/m²K	e A x K kJ/K	
Window - Double-glazed, air-filled, low-E, En=0.1,	4.480	1.33 (1.40)	5.94	NO/III IX	NO/IX	(27)
soft coat (North) 2013 External Window New, Ground Floor Unit D1 1.13 Window - Double-glazed,	4.480	1.33 (1.40)	5.94			(27)
air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground	4.400	1.55 (1.40)	3.34			(21)
Floor Unit D1 1.13 Window - Double-glazed,	4.200	1.33 (1.40)	5.57			(27)
air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Unit D1 1.13						
Window - Double-glazed, air-filled, low-E, En=0.1,	4.480	1.33 (1.40)	5.94			(27)
soft coat (North) 2013 External Window New, Ground Floor Unit D1 1.13_Living	4 400	1 00 (1 40)	5.04			(07)
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	4.480	1.33 (1.40)	5.94			(27)
2013 External Window New, Ground Floor Unit D1 1.13_Living						
Walls 2013 External Wall New, Ground Floor Unit D1 1.13	26.78	0.15	4.02	21.95	587.82	(29)
Walls 2013 External Wall New, Ground Floor Unit D1 1.13	0.98	0.15	0.15	21.95	21.51	(29)
Walls 2013 External Wall New, Ground Floor Unit D1 1.13_Living	23.57	0.15	3.54	21.95	517.30	(29)
Internal wall 2013 Internal Partition, Ground Floor Unit D1 1.13_Living	33.50	0.00	0.00	8.75	293.13	
Internal wall 2013 Internal Partition, Ground Floor Unit D1 1.13	33.50	0.00	0.00	8.75	293.13	
Internal floor 2013 Internal Ceiling/Floor, Ground Floor Unit D1 1.13_Living	52.69	0.00	0.00	95.00	5005.81	
Internal floor 2013 Internal Ceiling/Floor, Ground	35.47	0.00	0.00	95.00	3369.59	
Floor Unit D1 1.13 Internal ceiling 2013 Internal Ceiling/Floor, Ground Floor Unit D1 1.13	33.72	0.00	0.00	95.00	3203.60	

3. Heat Elemen	<i>losses i</i> t	and hea Gross		arametei enings	r Net are	ea U-	value	AxU	ka	ıppa-valı	ue A x K	
		area, m	² m ²	-	A, m ²	W	/m²K	W/K	kJ	l/m²K	kJ/K	
Fabric h Therma Effect o Total fa	ea of ext neat loss Il mass p If therma bric heat ion heat	, W/K aramete I bridges : loss	r, kJ/m²ŀ	ζ (user-s		TMP)					73.45 37.02 250.00 0.08 37.10	2 (33) (35 3 (36
22.41	22.09	21.77	20.17	19.84	18.24	18.24	17.92	18.88	19.84	20.49	21.13	(38
	nsfer co											
59.51	59.19	58.87	57.27	56.95	55.35	55.35	55.03	55.99	56.95	57.59	58.23	, (00
Heat los	ss param	eter (HL	P), W/m	²K							57.19	9 (39
0.98	0.97	0.97	0.94	0.93	0.91	0.91	0.90	0.92	0.93	0.95	0.96	
HLP (av		,	(T 11	4 \							0.94	4 (40
Jan	r of days Feb	In month	`	, '	Lun	Jul	Διια	Con	Oct	Nov	Doo	
31	28	31	Apr 30	May 31	Jun 30	31	Aug 31	Sep 30	Oct 31	30	Dec 31	
31	20	0 1	100	0 1	100	0 1	0 1	30	0 1	100	01	
Assume Annual	er heatin ed occup average	ancy, N hot wate	r usage	in litres p			Ť			1	kWh/ye 2.01 86.20	l (42
Jan	Feb er usage	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
94.82	91.37	87.93	84.48	81.03	77.58	77.58	81.03	84.48	87.93	91.37	94.82	(44
	content		l .		17.50	177.50	01.00	04.40	07.55	31.07	34.02	(' '
	122.99				91.61	84.89	97.42	98.58	114.88	125.41	136.18	
	content tion loss				1		1		1	1	1356.29	9 (45
21.09	18.45	19.04	16.60	15.92	13.74	12.73	14.61	14.79	17.23	18.81	20.43	(46
Hot wat Volume Temper Energy	er storager cylind factor fact	er loss fa ctor i hot wat	actor (kW	,	day)						110.00 0.0152 1.0294 0.6000 1.03	2 (51 4 (52) (53
32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56
Net stor	rage loss											
32.01 Primary	28.92 loss	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59
Total he	at requi	ed for w	ater hea	ting calc	ulated fo	r each r	nonth					
	172.91						152.69	152.07	170.16	178.90	191.46	(62
· · · · · · · · · · · · · · · · · · ·	from wat						_	1				,_,
	172.91		1	1		140.17	152.69	152.07	170.16	178.90	191.46 2007.13	(64 3 (64
	ins from					70.45	70.04	75 57	00.40	04.40	00.50	/05
90.98	80.83	86.42	79.58	79.52	73.26	72.45	76.61	75.57	82.42	84.49	89.50	(65

_		
_	Intorna	laging
-1-	Internal	uanis

o. IIILerriai y	airis									
Jan Feb		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
etabolic ga	ins, Watts						_			
00.40 100	0.40 100.40	100.40	100.40	100.40	100.40	100.40	100.40	100.40	100.40	100.40
ighting gain	IS									
15.63 13.8	88 11.29	8.55	6.39	5.39	5.83	7.58	10.17	12.91	15.07	16.06
ppliances g	gains	•				•				
75.31 177	'.13 172.55	162.79	150.47	138.89	131.15	129.33	133.92	143.68	156.00	167.58
ooking gair	าร	1				•	1	•	•	
33.04 33.0	04 33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04
umps and t	fans gains									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
osses e.g.	evaporation	(negative	values)							
-80.32 -80	.32 -80.32	-80.32	-80.32	-80.32	-80.32	-80.32	-80.32	-80.32	-80.32	-80.32
ater heatir	ng gains	1	l	l	ı	l	1	1	1	
122.28 120	0.29 116.15	110.53	106.88	101.74	97.38	102.97	104.96	110.78	117.35	120.30
otal interna	l gains	1	ı	1	1	I	1			
366.34 364	.42 353.11	334.99	316.86	299.15	287.48	293.00	302.17	320.49	341.54	357.06
n=0.1, soft	ouble-glazed coat (North) nal Window			0.9			g & FF 0.63 x 0.8		hading .77	Gains 16.6385
Vindow - Do	ouble-glazed coat (North)	, air-filled				10.63	0.63 x 0.8	80 0.	.77	16.6385
Vindow - Do	nal Window ouble-glazed	, air-filled			01 1.13 x 4.200 1	10.63	0.63 x 0.8	30 0.	.77	15.5986
	coat (North) nal Window		ound Flo	or I Init F	11 1 12					
Vindow - Do	ouble-glazed coat (North)	, air-filled				10.63	0.63 x 0.8	80 0.	.77	16.6385
2013 Exter Vindow - Do	nal Window ouble-glazed	New, Gro					0.63 x 0.8	BO 0.	.77	16.6385
	coat (North)			au Hait F		1 :- :				
2013 Exter	nal Window	new, Gr	ouna Fio	or Unit L	1.13_	Living				
ighting ca	lculations									
				Area		9	g		F x Shac	
n=0.1, soft	ouble-glazed coat (North)				x 4.48	(0.80	0.	.80 x 0.8	3 2.14
Vindow - Do	nal Window ouble-glazed	, air-filled			x 4.48	(0.80	0.	.80 x 0.8	3 2.14
	coat (North) nal Window		ound Flo	or Unit E	01 1.13					
n=0.1, soft	ouble-glazed coat (North)				x 4.20	(0.80	0.	.80 x 0.8	3 2.01
Vindow - Do	nal Window puble-glazed	, air-filled			01 1.13 x 4.48	(0.80	0.	.80 x 0.8	3 2.14
2013 Exter Vindow - Do	coat (North) nal Window ouble-glazed	New, Gro			01 1.13_ x 4.48		0.80	0.	.80 x 0.8	3 2.14
	coat (North) nal Window		ound Flo	or Unit E	01 1.13_	Living				

⊣eating	system i	responsi	veness								1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	1				,				,		
71.11	71.49	71.88	73.89	74.31	76.46	76.46	76.91	75.59	74.31	73.48	72.67
alpha	1										
5.74	5.77	5.79	5.93	5.95	6.10	6.10	6.13	6.04	5.95	5.90	5.84
Utilisatio	n factor	for gains	for livin	g area							
0.99	0.99	0.95	0.81	0.58	0.39	0.28	0.34	0.61	0.91	0.99	1.00
Mean in	ternal ter	nperatui	re in livin	g area T	1				•		
20.13	20.30	20.58	20.88	20.98	21.00	21.00	21.00	20.99	20.79	20.42	20.11
Temper	ature du	ing heat	ing perio	ds in res	t of dwe	lling Th2					
20.10	20.11	20.11	20.13	20.14	20.16	20.16	20.16	20.15	20.14	20.13	20.12
	n factor	for gains		of dwelli	ng						
0.99	0.98	0.94	0.77	0.53	0.34	0.23	0.28	0.54	0.88	0.98	0.99
	ternal ter	. '									
18.95	19.20	19.60	20.01	20.13	20.16	20.16	20.16	20.14	19.92	19.39	18.94
	rea fracti ternal ter				dwelling))					0.43
19.46	19.68	20.02	20.39	20.50	20.52	20.52	20.53	20.51	20.30	19.83	19.45
Apply ad	djustmen	t to the r	nean inte	ernal tem	perature	e, where	appropr	iate			
19.46	19.68	20.02	20.39	20.50	20.52	20.52	20.53	20.51	20.30	19.83	19.45
<i>3. Spac</i> Jan	e <i>heatin</i> Feb	<i>g requir</i> Mar	ement Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	n factor			iviay	ouri	Jour	Aug	ОСР	Out	1404	DCC
0.99	0.98	0.94	0.78	0.55	0.36	0.25	0.30	0.57	0.89	0.98	0.99
Useful g		J.0 T	1 3.7 0	0.00	1 3.00	1 3.20	1 3.00	3.07	1 3.00	0.00	3.00
	510.42	580.47	599.34	493.84	327.41	217.12	226.93	353.19	451.44	433.64	422.52
	average					· · · · <u>-</u>	1 == 3.00	1 2 2 3	1	1	
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
	s rate fo					1	1	1	1		
	874.67					217.15	227.03	358.73	552.13	733.35	887.93
	of mont			1	1	1	1		1		
1.00	1.00	1.00	1.00	1.00	_	-	-	-	1.00	1.00	1.00
	eating re				h, kWh/r	nonth		l			
•	244.78			5.30	-	-	-	-	74.92	215.79	346.27
				l					_		
	ace heat					ear) (Oct	ober to N	Лау)			1430.19
	ace heat neating re					ear) (Octo	ober to N	/lay)			1430.1 23.4

8c. Space cooling requirement

1											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
External	tempera	aturers	•			•			•		
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-
Heat los	s rate W										
-	-	-	-	-	520.26	409.57	418.20	-	-	-	-
Utilisatio	n factor	for loss									
-	-	-	-	-	1.00	1.00	1.00	-	-	-	-
Useful lo	ss W										
-	-	-	-	-	517.82	408.85	416.57	-	-	-	-
Internal	gains W	1		1	1	•	1		1	1	
0.00	0.00	0.00	0.00	0.00	411.74	396.92	404.17	0.00	0.00	0.00	0.00
Solar ga	ins W			•	•	•			•	•	
0.00	0.00	0.00	0.00	0.00	722.29	674.35	535.01	0.00	0.00	0.00	0.00
Gains W			•	•	•				•	•	
-	-	-	-	-	1134.03	1071.27	939.18	-	-	-	-
Fraction	of mont	h for coo	oling	•	•	•			•	•	
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Space h	eating k	Wh		•	•				•		
-	-	-	-	-	23.92	4.12	0.00	-	-	-	-
Space c	ooling k\	Wh		•					•		
-	-	-	-	-	443.67	492.84	388.82	-	-	-	-
Total	_		•		•				•	•	1325.33
Cooled f		tor									0.80
Intermitt	ency rac	I	Ι	1	0.05	0.05	0.05	1	1		
-	-	-	-	-	0.25	0.25	0.25	-	-	-	-
	builing re	quireme	int lot III	UTILITI	88.73	98.57	77.76	_	_	T-	_
opace c											

9b. Energy requirements

3, 4, 4		kWh/year	
Fraction of space heat from secondary system	0.00	-	(301)
Fraction of space heat from community system	1.00		(302)
Fraction of community heat from Boilers	1.00		(303a)
Fraction of total space heat from Boilers	1.00		(304a)
Factor for control and charging method for community space heating	1.00		(305)
Factor for charging method for community water heating	1.00		(305a)
Distribution loss factor	1.05		(306)
Space heating			()
Annual space heating requirement	1430.19		(98)
Space heat from Boilers		1501.70	(307a)
Efficiency of secondary heating system	0.00		(308)
Space heating fuel for secondary system		0.00	(309)
Water heating	2227.42		(0.4)
Annual water heating requirement	2007.13	0407.40	(64)
Water heat from Boilers		2107.49	(310a)
Other energy	E 040/		(01.1)
Cooling system energy efficiency ratio	5.81%	45.00	(314)
Space cooling		45.60	(315)
Electrical energy for heat distribution		36.09	(313)
Electricity for pumps and fans within dwelling:			
Electricity for pumps, fans and electric keep-hot	do (CED 0.60)	104.07	(2200)
mechanical ventilation - balanced, extract or positive input from outside	de (SFP=0.60)	134.27	(330a)
warm air heating system fans		0.00	(330b)
pump for solar water heating		0.00	(330g)
pump for waste water heat recovery		0.00 134.27	(330h)
Total electricity for the above, kWh/year		276.02	(331)
Electricity for lighting (100.00% fixed LEL)		2/0.02	(332)
Energy saving/generation technologies			
Appendix Q -		0.000	(2260)
Energy saved or generated (): Energy used ():		0.000 0.000	(336a) (337a)
Ellelgy used ().		0.000	(337a)
Total delivered energy for all uses		4055.56	(338)

10a. Does not apply

11a. Does not apply

12b. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions	_
Efficiency of Boilers - 97.90%	•	· ·	,	(367a)
CO2 emissions from Boilers	3686.61	0.2160	796.31	(368)
Electrical energy for heat distribution	36.09	0.5190	18.73	(372)
Total CO2 associated with community systems			815.04	(373)
Total CO2 associated with space and water heating			815.04	(376)
Space cooling	45.60	0.519	23.67	(377)
Electricity for pumps and fans	134.27	0.519	69.69	(378)
Electricity for lighting	276.02	0.519	143.25	(379)
Electricity generated - PVs	0.00	0.519	0.00	(380)
Electricity generated - μCHP	0.00	0.000	0.00	(380)
Appendix Q -				, ,
Ėnergy saved ():	0.00	0.000	0.00	(381)
Energy used ():	0.00	0.000	0.00	(382)
Total CO2, kg/year			1051.64	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			kg/m²/yea 17.26	r (384)

Project InformationBuilding type Mid-floor flat

Reference

Date 8 April 2016

Project NW1

1	Overall	dwelling	dimension	
1.	Overaii	aweiiina	aimension	ıs

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Third floor	61.09	3.83	233.97	(3a)
Total floor area	61.09			(4)
Dwelling volume (m³)			233.97	(5)

2. Vent	ilation r	ate											
							main + s heating	eonda	ry + othe	r	m³ per	hou	ır
Numbe	r of chim	neys					0 + 0 + 0		x 40		0.00	0	(6a)
	r of oper						0 + 0 + 0		x 20		0.00		(6b)
	r of inter						2		x 10		20.00		(7a)
	r of pass						0		x 10		0.00		(7b)
Numbe	r of fluele	ess gas i	ires				0		x 40		0.00	U	(7c)
											Air cha	nge	s per hour
Infiltration	on due to	chimne	ys, fans	and flue	S						0.09		(8)
	re test, re	esult q50	1						5.00				(17)
	neability										0.34	-	(18)
	r of sides	s on whic	ch shelte	red							2.00		(19)
Shelter			tina ahal	tor footo	~						0.89		(20)
	on rate ii on rate n										0.29	9	(21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70		
								1			52.50	0	(22)
Wind Fa	actor												
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18		
Adjuste	d infiltrat	ion rate	(allowing	for shel	ter and v	wind spe	eed)				13.1	3	(22a)
0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.29	0.31	0.32	0.34		
											3.74	4	(22b)
	ion : nati e air cha			ntermitte	nt extrac	t fans							- /
0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56		(25)

3. Heat losses and heat loss parameter	er				
Element Gross Openings	Net area	U-value	AxU		
area, m ² m ²	A, m ²	W/m ² K	W/K		(07)
Window - Double-glazed, air-filled, low-E, En=0.1,	3.100	1.33 (1.40)	4.11	((27)
soft coat (North)					
2013 External Window New, Ground					
Floor Unit D2 2.10					
Window - Double-glazed,	2.770	1.33 (1.40)	3.67		(27)
air-filled, low-E, En=0.1,		(1110)			()
soft coat (North)					
2013 External Window New, Ground					
Floor Unit D2 2.10_living					
Window - Double-glazed,	2.770	1.33 (1.40)	3.67	((27)
air-filled, low-E, En=0.1,					
soft coat (North)					
2013 External Window New, Ground					
Floor Unit D2 2.10_living Window - Double-glazed,	3.310	1.33 (1.40)	4.39		(27)
air-filled, low-E, En=0.1,	3.310	1.33 (1.40)	4.55	·	(27)
soft coat (North)					
2013 External Window New, Ground					
Floor Unit D2 2.10					
Window - Double-glazed,	3.310	1.33 (1.40)	4.39		(27)
air-filled, low-E, En=0.1,		, ,			` '
soft coat (North)					
2013 External Window New, Ground					
Floor Unit D2 2.10	07.00	0.40	4.04		(00)
Pitched roofs insulated between joists	37.80	0.13	4.91	•	(30)
2013 Roof New, Ground Floor Unit D2 2.10					
Pitched roofs insulated between joists	32.81	0.13	4.27		(30)
2013 Roof New, Ground Floor Unit D2	32.01	0.10	4.27	· · · · · · · · · · · · · · · · · · ·	(30)
2.10_living					
Walls	0.98	0.18	0.18		(29)
2013 External Wall New, Ground Floor					` ,
Unit D2 2.10					
Walls	18.69	0.18	3.36	((29)
2013 External Wall New, Ground Floor					
Unit D2 2.10	14.04	0.10	0.00		(00)
Walls 2013 External Wall New, Ground Floor	14.64	0.18	2.63	((29)
Unit D2 2.10 living					
Walls	10.44	0.18	1.88		(29)
2013 External Wall New, Ground Floor		0.10	1.00	· ·	(23)
Unit D2 2.10 living					
Walls	12.34	0.18	2.22		(29)
2013 External Wall New, Ground Floor					` ,
Unit D2 2.10					
Internal wall	52.06	0.00	0.00		
2013 Internal Partition, Ground Floor					
Unit D2 2.10_living Internal wall	E0 07	0.00	0.00		
2013 Internal Partition, Ground Floor	52.27	0.00	0.00		
Unit D2 2.10					
Internal floor	27.15	0.00	0.00		
2013 Internal Ceiling/Floor, Ground	_,	2.00	2.00		
Floor Unit D2 2.10_living					

3. neat iosse	es ano neat io	ss paramete	er
Element	Gross	Openings	Net area
	area, m²	m²	A, m ²

U-value $A \times U$ W/m^2K W/K 0.22 0.00 0.00

2013 Internal Ceiling/Floor, Ground

Floor Unit D2 2.10

Internal floor

Internal floor 33.72 0.00 0.00

2013 Internal Ceiling/Floor, Ground

Floor Unit D2 2.10

Total area of external elements Sigma A, m ²	142.97	(31)
Fabric heat loss, W/K	39.69	(33)
Thermal mass parameter, kJ/m ² K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	7.15	(36)
Total fabric heat loss	46.84	(37)
Ventilation heat loss calculated monthly		` '

43.71	43.51	43.32	42.40	42.23	41.44	41.44	41.29	41.75	42.23	42.58	42.94	(38)
Heat tra	ansfer co	efficient,	W/K	•	•	•						•
90.54	90.35	90.15	89.24	89.07	88.27	88.27	88.13	88.58	89.07	89.41	89.78]

89.24 (39)

Heat loss parameter (HLP), W/m²K

1.48	1.48	1.48	1.46	1.46	1.44	1.44	1.44	1.45	1.46	1.46	1.47
HLP (av	erage)										1.4

1.46 (40)

Number of days in month (Table 1a)

Number	or days		(l'able	ia)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

	r heatinged occup	<i>g energ</i> y	y require	ements							kWh/year 2.01	(42
		hot wate	r usage	in litres p	er day V	d,avera	ge				81.99	(43
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	usage	in litres						<u>'</u>				
90.19	86.91	83.63	80.35	77.07	73.79	73.79	77.07	80.35	83.63	86.91	90.19	(44)
		of hot wa				1				1		` '
	116.98		105.24		87.14	80.75	92.66	93.76	109.27	119.28	129.53	
	content (1.00.2			100.70	02.00			1.0.20	1290.05	(45)
Distribut		, ,										(- ,
20.06	17.55	18.11	15.79	15.15	13.07	12.11	13.90	14.06	16.39	17.89	19.43	(46)
Cylinder	volume	, I					150.00					(47)
		declared	cylinder	loss fact	or (kWh		1.39					(48)
	ature Fa			/L \A /I- /	-I - \		0.5400				0.75	(49)
	ost from orage los	hot wate	er cyllnae	er (Kvvn/	day)						0.75	(55)
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
	age loss		22.30	23.33	22.30	23.33	25.55	22.30	25.55	22.50	23.33	(50
23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57
Primary		23.33	22.56	23.33	22.36	23.33	23.33	22.30	23.33	22.56	23.33	(37
23.26		00.00	00.51	00.00	00.51	00.00	00.00	00.51	00.00	00.51	00.00	/ E0
	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59
		ed for wa						100.00	455.07	10107	170.10	(00
		167.31		147.57			139.25	138.86	155.87	164.37	176.12	(62
		er heater					400.05	400.00		1.01.0=	1.70.10	(0.4
180.35	159.06	167.31	150.33	147.57	132.23	127.34	139.25	138.86	155.87	164.37	176.12	(64)
Heat na	ins from	water he	eating k\	Nh/mont	h						1838.67	(64)
81.75	72.56	77.41	71.07	70.85	65.05	64.12	68.08	67.25	73.61	75.73	80.34	
01.73	72.50	17.41	71.07	70.03	05.05	04.12	100.00	01.20	7 3.0 1		100.04	(65)
										1.0		(65)
										1.0		(65)
5. Interi	nal gain	s					l		I	1.0.70		(65)
<i>5. Interi</i> Jan	nal gain	s Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(65)
Jan		Mar	Apr	May	Jun	Jul			Oct			(65)
Jan Metabol	Feb ic gains,	Mar					Aug	Sep	l	Nov	Dec	
Jan Metabol 100.61	Feb ic gains, 100.61	Mar Watts		May 100.61			Aug	Sep	l	Nov	Dec	
Jan Metabol 100.61 Lighting	Feb ic gains, 100.61 gains	Mar Watts 100.61	100.61	100.61	100.61	100.61	Aug	Sep	100.61	Nov 100.61	Dec 100.61	(66)
Jan Metabol 100.61 Lighting 15.66	Feb ic gains, 100.61 gains 13.91	Mar Watts 100.61					Aug	Sep	l	Nov	Dec	(66)
Jan Metabol 100.61 Lighting 15.66 Appliance	Feb ic gains, 100.61 gains 13.91 ces gains	Mar Watts 100.61	100.61	100.61	100.61	100.61	Aug 100.61 7.59	Sep 100.61 10.19	100.61	Nov 100.61 15.10	Dec 100.61 16.10	(66 (67
Jan Metabol 100.61 Lighting 15.66 Appliand	Feb ic gains, 100.61 gains 13.91 ces gains	Mar Watts 100.61	100.61	100.61	100.61	100.61	Aug	Sep	100.61	Nov 100.61	Dec 100.61 16.10	(66 (67
Jan Metabol 100.61 Lighting 15.66 Appliand 175.69 Cooking	Feb ic gains, 100.61 gains 13.91 ces gains 177.51 gains	Mar Watts 100.61 11.31 s 172.92	8.57 163.14	100.61 6.40 150.79	5.41 139.19	100.61 5.84 131.43	Aug 100.61 7.59 129.61	Sep 100.61 10.19 134.21	100.61 12.94 143.99	Nov 100.61 15.10 156.33	Dec 100.61 16.10 167.94	(66 (67 (68
Jan Metabol 100.61 Lighting 15.66 Applianc 175.69 Cooking 33.06	Feb ic gains, 100.61 gains 13.91 ces gains 177.51 gains 33.06	Mar Watts 100.61 11.31 s 172.92	100.61	100.61	100.61	100.61	Aug 100.61 7.59	Sep 100.61 10.19	100.61	Nov 100.61 15.10	Dec 100.61 16.10	(66 (67 (68
Jan Metabol 100.61 Lighting 15.66 Applianc 175.69 Cooking 33.06 Pumps a	Feb ic gains, 100.61 gains 13.91 ces gains 177.51 gains 33.06 and fans	Mar Watts 100.61 11.31 172.92 33.06 gains	8.57 163.14 33.06	100.61 6.40 150.79	100.61 5.41 139.19 33.06	100.61 5.84 131.43 33.06	Aug 100.61 7.59 129.61 33.06	Sep 100.61 10.19 134.21 33.06	100.61 12.94 143.99 33.06	Nov 100.61 15.10 156.33	Dec 100.61 16.10 167.94 33.06	(66 (67 (68 (69
Jan Metabol 100.61 Lighting 15.66 Applianc 175.69 Cooking 33.06 Pumps a	Feb ic gains, 100.61 gains 13.91 ces gains 177.51 gains 33.06 and fans 3.00	Mar Watts 100.61 11.31 s 172.92 33.06 gains 3.00	100.61 8.57 163.14 33.06	100.61 6.40 150.79 33.06	100.61 5.41 139.19 33.06 3.00	100.61 5.84 131.43	Aug 100.61 7.59 129.61	Sep 100.61 10.19 134.21	100.61 12.94 143.99	Nov 100.61 15.10 156.33	Dec 100.61 16.10 167.94	(66 (67 (68 (69
Jan Metabol 100.61 Lighting 15.66 Applianc 175.69 Cooking 33.06 Pumps a 3.00 Losses	Feb ic gains, 100.61 gains 13.91 ces gains 177.51 gains 33.06 and fans 3.00 e.g. evap	Mar Watts 100.61 11.31	100.61 8.57 163.14 33.06 3.00 (negative	100.61 6.40 150.79 33.06 3.00 e values)	100.61 5.41 139.19 33.06 3.00	100.61 5.84 131.43 33.06 3.00	Aug 100.61 7.59 129.61 33.06	Sep 100.61 10.19 134.21 33.06	100.61 12.94 143.99 33.06	Nov 100.61 15.10 156.33 33.06	Dec 100.61 16.10 167.94 33.06 3.00	(66 (67 (68 (69 (70
Jan Metabol 100.61 Lighting 15.66 Applianc 175.69 Cooking 33.06 Pumps a 3.00 Losses c -80.49	Feb ic gains, 100.61 gains 13.91 ces gains 177.51 gains 33.06 and fans 3.00 e.g. evap -80.49	Mar Watts 100.61 11.31	100.61 8.57 163.14 33.06	100.61 6.40 150.79 33.06	100.61 5.41 139.19 33.06 3.00	100.61 5.84 131.43 33.06	Aug 100.61 7.59 129.61 33.06	Sep 100.61 10.19 134.21 33.06	100.61 12.94 143.99 33.06	Nov 100.61 15.10 156.33	Dec 100.61 16.10 167.94 33.06	(66) (67) (68) (69) (70)
Jan Metabol 100.61 Lighting 15.66 Applianc 175.69 Cooking 33.06 Pumps a 3.00 Losses o -80.49 Water h	Feb ic gains, 100.61 gains 13.91 ces gains 177.51 gains 33.06 and fans 3.00 e.g. evap eating g	Mar Watts 100.61 11.31	100.61 8.57 163.14 33.06 3.00 (negative	100.61 6.40 150.79 33.06 3.00 e values) -80.49	100.61 5.41 139.19 33.06 3.00 -80.49	100.61 5.84 131.43 33.06 3.00 -80.49	Aug 100.61 7.59 129.61 33.06 3.00	Sep 100.61 10.19 134.21 33.06 3.00 -80.49	100.61 12.94 143.99 33.06 3.00	Nov 100.61 15.10 156.33 33.06 3.00	Dec 100.61 16.10 167.94 33.06 3.00 -80.49	(66) (67) (68) (69) (70) (71)
Jan Metabol 100.61 Lighting 15.66 Applianc 175.69 Cooking 33.06 Pumps a 3.00 Losses o -80.49 Water h	Feb ic gains, 100.61 gains 13.91 ces gains 177.51 gains 33.06 and fans 3.00 e.g. evap -80.49 eating gains	Mar Watts 100.61 11.31	100.61 8.57 163.14 33.06 3.00 (negative	100.61 6.40 150.79 33.06 3.00 e values)	100.61 5.41 139.19 33.06 3.00	100.61 5.84 131.43 33.06 3.00	Aug 100.61 7.59 129.61 33.06	Sep 100.61 10.19 134.21 33.06	100.61 12.94 143.99 33.06	Nov 100.61 15.10 156.33 33.06	Dec 100.61 16.10 167.94 33.06 3.00 -80.49	(66) (67) (68) (69) (70) (71)
Jan Metabol 100.61 Lighting 15.66 Applianc 175.69 Cooking 33.06 Pumps a 3.00 Losses o -80.49 Water h	Feb ic gains, 100.61 gains 13.91 ces gains 177.51 gains 33.06 and fans 3.00 e.g. evap -80.49 eating gains 107.98 ernal ga	Mar Watts 100.61 11.31	33.06 3.00 (negative -80.49	100.61 6.40 150.79 33.06 3.00 e values) -80.49	100.61 5.41 139.19 33.06 3.00 -80.49 90.34	100.61 5.84 131.43 33.06 3.00 -80.49 86.19	Aug 100.61 7.59 129.61 33.06 3.00	Sep 100.61 10.19 134.21 33.06 3.00 -80.49 93.40	100.61 12.94 143.99 33.06 3.00 -80.49 98.94	Nov 100.61 15.10 156.33 33.06 3.00	Dec 100.61 16.10 167.94 33.06 3.00 -80.49 107.99	(65) (66) (67) (68) (70) (71) (72) (73)

6. Solar gains (calculation for January)	Area 9 Flore	~ 0 ГГ	Chadina	Caina	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	Area & Flux 0.9 x 3.100 10.63	g & FF 0.63 x 0.70	Shading 0.77	Gains 10.0741	
2013 External Window New, Ground Floor U					
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 2.770 10.63	0.63 x 0.70	0.77	9.0017	
2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E,	Jnit D2 2.10_living 0.9 x 2.770 10.63	0.63 x 0.70	0.77	9.0017	
En=0.1, soft coat (North) 2013 External Window New, Ground Floor U	Init D2 2 10 living				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 3.310 10.63	0.63 x 0.70	0.77	10.7565	
2013 External Window New, Ground Floor U	Jnit D2 2.10				
Window - Double-glazed, air-filled, low-E,	0.9 x 3.310 10.63	0.63 x 0.70	0.77	10.7565	
En=0.1, soft coat (North)	L ' DO 0 40				
2013 External Window New, Ground Floor U Total solar gains, January	Jnit D2 2.10			49.59	(83-1)
Solar gains					
49.59 94.77 161.04 258.67 348.45 37 Total gains	3.02 348.27 276.3	30 193.62 112.	81 61.18	41.34	(83)
407.00 450.36 505.50 585.25 657.06 66	4.14 627.91 561.2	20 487.60 424.	86 393.98	389.55	(84)
107.00 100.00 000.00 000.20 007.00 00		20 107100 1211	00 000.00	000.00	(-1)
Lighting calculations			FF 01 1		
Window Double glazed oir filled low E	Area 0.9 x 3.10	g 0.80	FF x Shad 0.70 x 0.83		
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor U		0.00	0.70 X 0.63	1.30	
Window - Double-glazed, air-filled, low-E,	0.9 x 2.77	0.80	0.70 x 0.83	3 1.16	
En=0.1, soft coat (North)	0.0 X 2.77	0.00	0.70 X 0.00	1.10	
2013 External Window New, Ground Floor U	Jnit D2 2.10 living				
Window - Double-glazed, air-filled, low-E,	0.9 x 2.77	0.80	0.70×0.83	3 1.16	
En=0.1, soft coat (North)					
2013 External Window New, Ground Floor L		0.00	0.70		
Window - Double-glazed, air-filled, low-E,	0.9 x 3.31	0.80	0.70 x 0.83	3 1.38	
En=0.1, soft coat (North) 2013 External Window New, Ground Floor U	Init D2 2 10				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 3.31	0.80	0.70 x 0.83	3 1.38	
2013 External Window New, Ground Floor I GL = 6.38 / 61.09 = 0.104	Jnit D2 2.10				
C1 = 0.500					
C2 = 0.960					
El = 277					

	ı system I	responsi	veness								1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
au			<u>'</u>	,				<u>'</u>			
46.85	46.96	47.06	47.54	47.63	48.06	48.06	48.14	47.89	47.63	47.45	47.26
alpha		I	I		I		I		I	I	
4.12	4.13	4.14	4.17	4.18	4.20	4.20	4.21	4.19	4.18	4.16	4.15
Jtilisati	on factor	for gains	for livin	g area	•		•		•	•	
1.00	0.99	0.99	0.96	0.89	0.74	0.58	0.66	0.89	0.98	0.99	1.00
Mean ir	nternal te	mperatur	re in livin	g area T	1				•	•	
19.40	19.54	19.83	20.25	20.64	20.89	20.97	20.95	20.74	20.26	19.76	19.37
Temper	rature du	ring heat	ing peric	ds in res	st of dwe	lling Th2					
19.70	19.70	19.71	19.72	19.72	19.73	19.73	19.73	19.73	19.72	19.71	19.71
Utilisati	on factor			of dwelli	ing						
1.00	0.99	0.98	0.95	0.84	0.63	0.43	0.51	0.82	0.97	0.99	1.00
	nternal te										
17.60	17.81	18.23	18.84	19.37	19.66	19.72	19.71	19.51	18.86	18.14	17.57
	rea fracti nternal te				dwalling)						0.44
		18.94	19.47	19.94			20.26	20.06	10.40	18.86	10.07
18.40	18.58				20.21	20.27	20.26		19.48	10.00	18.37
18.40	djustmen 18.58	18.94	19.47	19.94	20.21	20.27	20.26	20.06	19.48	18.86	18.37
10.40	10.56	10.94	19.47	13.34	20.21	20.27	20.20	20.00	19.40	10.00	10.37
8. Spac	e heatin	g requir	ement								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan Utilisatio	Feb on factor	Mar for gains	Apr					Sep	Oct	Nov	
Jan Utilisatio	Feb on factor 0.99	Mar	Apr	May 0.85	Jun 0.67	Jul 0.50	Aug 0.57	Sep	Oct 0.96	Nov 0.99	Dec 0.99
Jan Utilisatio 0.99 Useful (Feb on factor 0.99 gains	Mar for gains 0.98	Apr 6 0.94	0.85	0.67	0.50	0.57	0.84	l		0.99
Jan Utilisatio 0.99 Useful (Feb on factor 0.99	Mar for gains 0.98	Apr 6 0.94		0.67			0.84	0.96		
Jan Utilisatio 0.99 Useful (404.51 Monthly	Feb on factor 0.99 gains 445.91 v average	Mar for gains 0.98 495.05 externa	Apr 0.94 552.04 tempera	0.85	0.67	0.50	0.57	0.84	0.96	0.99	0.99
Jan Utilisatio 0.99 Useful o 404.51 Monthly 4.30	Feb on factor 0.99 gains 445.91 v average 4.90	Mar for gains 0.98 495.05 externa 6.50	Apr 5.0.94 552.04 temper: 8.90	0.85 557.49 ature 11.70	0.67 448.11 14.60	0.50	0.57	0.84	0.96	0.99	0.99
Jan Utilisatio 0.99 Useful (404.51 Monthly 4.30 Heat los	Feb on factor 0.99 gains 445.91 average 4.90 ss rate fo	Mar for gains 0.98 495.05 externa 6.50 r mean in	Apr 0.94 552.04 I tempera 8.90 Internal to	0.85 557.49 ature 11.70 emperati	0.67 448.11 14.60 ure	0.50	0.57 322.64 16.40	0.84 408.55	0.96	0.99 389.82 7.10	0.99 387.56 4.20
Jan Utilisatio 0.99 Useful of 404.51 Monthly 4.30 Heat los	Feb on factor 0.99 gains 445.91 average 4.90 ss rate fo	Mar for gains 0.98 495.05 externa 6.50 r mean ii	552.04 I tempera 8.90 Internal to	0.85 557.49 ature 11.70 emperati	0.67 448.11 14.60 ure	0.50	0.57 322.64 16.40	0.84 408.55	0.96	0.99 389.82 7.10	0.99 387.56 4.20
Jan Utilisatio 0.99 Useful o 404.51 Monthly 4.30 Heat los 1276.5	Feb on factor 0.99 gains 445.91 vaverage 4.90 ss rate for of mont	Mar for gains 0.98 495.05 externa 6.50 r mean in for hear	Apr 0.94 552.04 I tempera 8.90 Internal to 942.96	0.85 557.49 ature 11.70 emperati	0.67 448.11 14.60 ure	0.50	0.57 322.64 16.40	0.84 408.55	0.96	0.99 389.82 7.10	0.99 387.56 4.20
Jan Utilisation 0.99 Useful of 404.51 Monthly 4.30 Heat lose 1276.5 Fraction	Feb on factor 0.99 gains 445.91 vaverage 4.90 ss rate for of mont 1.00	Mar for gains 0.98 495.05 externa 6.50 r mean in 1121.56 h for hea	552.04 tempera 8.90 nternal to 942.96 ating	0.85 557.49 ature 11.70 emperator 733.61 1.00	0.67 448.11 14.60 ure 494.82	0.50 314.23 16.60 324.31	0.57 322.64 16.40	0.84 408.55	0.96	0.99 389.82 7.10	0.99 387.56 4.20
Jan Utilisation 0.99 Useful of 404.51 Monthly 4.30 Heat lose 1276.5 Fraction	Feb on factor 0.99 gains 445.91 vaverage 4.90 ss rate for of mont	Mar for gains 0.98 495.05 externa 6.50 r mean in 1121.56 h for hea	552.04 tempera 8.90 nternal to 942.96 ating	0.85 557.49 ature 11.70 emperator 733.61 1.00	0.67 448.11 14.60 ure 494.82	0.50 314.23 16.60 324.31	0.57 322.64 16.40	0.84 408.55	0.96 409.58 10.60 791.15	0.99 389.82 7.10 1051.8	0.99 387.56 4.20 1272.39
Jan Utilisatio 0.99 Useful o 404.51 Monthly 4.30 Heat los 1276.5 Fractior 1.00 Space I 648.78	Feb on factor 0.99 gains 445.91 vaverage 4.90 ss rate for of mont 1.00	Mar for gains 0.98 495.05 externa 6.50 r mean ii 1121.56 h for hea 1.00 equireme 466.12	552.04 temper: 8.90 nternal to 942.96 atting 1.00 ent for ea 281.46	0.85 557.49 ature 11.70 emperator 733.61 1.00 ech mont 131.03	0.67 448.11 14.60 ure 494.82 - h, kWh/i	0.50 314.23 16.60 324.31 	0.57 322.64 16.40 340.23	0.84 408.55 14.10 527.64 -	0.96 409.58 10.60 791.15	0.99 389.82 7.10 1051.8	0.99 387.56 4.20 1272.39

9a. Energy requirements

sa. Energy requirements	kWh/year	
No secondary heating system selected Fraction of space heat from main system(s) Efficiency of main heating system 1.0000 93.50%	·	(202) (206)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov	Dec	
Space heating requirement		
648.78 530.87 466.12 281.46 131.03 - - - - 283.89 476.6	3 658.32	(98)
Appendix Q - monthly energy saved (main heating system 1)		
0.00 0.00 0.00 0.00 - - - - - 0.00 0.00	0.00	(210)
Space heating fuel (main heating system 1)		
693.88 567.78 498.52 301.03 140.14 - - - - 303.63 509.7	7 704.08	(211)
Appendix Q - monthly energy saved (main heating system 2)		
0.00 0.00 0.00 0.00 - - - - - 0.00 0.00	0.00	(212)
Space heating fuel (main heating system 2)		
0.00 0.00 0.00 0.00 - - - - - 0.00 0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)		
0.00 0.00 0.00 0.00 - - - - - 0.00 0.00	0.00	(214)
Space heating fuel (secondary)		
0.00 0.00 0.00 0.00 - - - - - 0.00 0.00	0.00	(215)
Water heating		
Water heating requirement		
180.35 159.06 167.31 150.33 147.57 132.23 127.34 139.25 138.86 155.87 164.3		(64)
Efficiency of water heater	79.80	(216)
87.94 87.79 87.40 86.46 84.50 79.80 79.80 79.80 79.80 86.39 87.49	88.01	(217)
Water heating fuel		
205.09 181.20 191.42 173.87 174.65 165.70 159.58 174.50 174.00 180.41 187.8	7 200.12	(219)
Annual totals Space heating fuel used, main system 1 Space heating fuel (secondary) Water heating fuel Electricity for pumps, fans and electric keep-hot	kWh/year 3718.83 0.00 2168.40	(211) (215) (219)
central heating pump boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting (100.00% fixed LEL) Energy saving/generation technologies Appendix Q -	30.00 45.00 75.00 276.61	(230c) (230e) (231) (232)
Energy saved or generated (): Energy used (): Total delivered energy for all uses	0.000 0.000 6238.84	(236a) (237a) (238)
. c.a. cc. cc. cc.g, i.c. a accc	0200.01	(_00)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	s
	kWh/year	kg CO2/kWh	kg CO2/ye	ear
Space heating, main system 1	3718.83	0.216	803.27	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	2168.40	0.216	468.38	(264)
Space and water heating			1271.64	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	276.61	0.519	143.56	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - μCHP	0.00	0.000	0.00	(269)
Appendix Q -				, ,
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1454.13	(272)
			kg/m²/yea	r
Emissions per m ² for space and water heating			20.82	(272a)
Emissions per m ² for lighting			2.35	(272b)
Emissions per m ² for pumps and fans			0.64	(272c)
Target Carbon Dioxide Emission Rate (TER) = (20.8159 x 1.00) + 2.3500 + 0.6372			23.80	(273)

Project InformationBuilding type Mid-floor flat

Reference

Date 8 April 2016 Project NW1

1. Over	all dwel	ling dim	ensions	;			A		A Ota		\/ = l		
Third flo Total flo Dwelling	-	e (m³)					Area (m²) 61.09 61.09		Av. Stor height (i 3.83		Volume (m³) 233.97 233.97	(3) (4) (5))
2. Vent	ilation ra	ate									_		
							main + s	eonda	ry + othe	r	m³ po	er ho	ur
Number Number Number	r of chim r of open r of interi r of pass r of fluele	flues mittent fa ive vents	6				heating 0 + 0 + 0 0 + 0 + 0 0 0		x 40 x 20 x 10 x 10 x 40		0 0 0	.00 .00 .00 .00	(6a) (6b) (7a) (7b) (7c)
Pressur Air pern Number Shelter Infiltration	on due to te test, re neability r of sides factor on rate in	esult q50 s on whic ncorpora	ch shelte	red ter facto	r				5.00		0 0 2 0	hang .00 .25 .00 .85 .21	(8) (17) (18) (19) (20) (21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70		
Wind Fa	actor	•	•		•	•			·		52	.50	(22)
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18		
Adjuste	d infiltrat	ion rate	(allowing	for shel	ter and v	vind sp	eed)				13	.13	(22a)
0.27	0.27	0.26	0.23	0.23	0.20	0.20	0.20	0.21	0.23	0.24	0.25		
efficie Ventilati	inge rate ncy in % ion : bala e air cha	allowing anced wh	g for in-u nole hous			th heat	0.50 79.90 recovery	ı	ı	1	2	.79	(22b) (23a) (23c)
0.37	0.37	0.36	0.33	0.33	0.30	0.30	0.30	0.31	0.33	0.34	0.35		(25)

3. Heat losses and he							
Element Gross		Net area	U-value	AxU	kappa-valu		
area,		A, m²	W/m^2K	W/K	kJ/m²K	kJ/K	
Window - Double-glaze		4.480	1.33 (1.40)	5.94			(27)
air-filled, low-E, En=0.	1,						
soft coat (North)	NaOuaal						
2013 External Windo	ow New, Ground						
Floor Unit D2 2.10	- d	4.400	4 00 (4 40)	F 0.4			(07)
Window - Double-glaze		4.480	1.33 (1.40)	5.94			(27)
air-filled, low-E, En=0.	١,						
soft coat (North)	w Now Ground						
2013 External Windo Floor Unit D2 2.10	ow New, Ground						
Window - Double-glaze	od	3.750	1.33 (1.40)	4.97			(27)
air-filled, low-E, En=0.		3.750	1.33 (1.40)	4.57			(21)
soft coat (North)	١,						
2013 External Windo	w New Ground						
Floor Unit D2 2.10_liv							
Window - Double-glaze		3.750	1.33 (1.40)	4.97			(27)
air-filled, low-E, En=0.		01700	1100 (1110)				(=,)
soft coat (North)	• ,						
2013 External Windo	w New. Ground						
Floor Unit D2 2.10_liv							
Window - Double-glaze		4.200	1.33 (1.40)	5.57			(27)
air-filled, low-E, En=0.1			(()
soft coat (North)	•						
2013 External Windo	w New, Ground						
Floor Unit D2 2.10							
Pitched roofs insulated	d between joists	37.80	0.20	7.56	98.75	3733.24	(30)
2013 Roof New, Grou	und Floor Unit D2						
2.10							
Pitched roofs insulated		32.81	0.20	6.56	98.75	3239.99	(30)
2013 Roof New, Grou	und Floor Unit D2						
2.10_living							()
Walls		18.69	0.15	2.80	21.95	410.27	(29)
2013 External Wall N	iew, Ground Floor						
Unit D2 2.10		10.04	0.15	1.05	01.05	070.00	(00)
Walls	low Cround Floor	12.34	0.15	1.85	21.95	270.88	(29)
2013 External Wall N	iew, Ground Floor						
Unit D2 2.10 Walls		14.64	0.15	2.20	21.95	321.28	(29)
2013 External Wall N	low Ground Floor	14.04	0.15	2.20	21.95	321.20	(29)
Unit D2 2.10_living	vew, around ridor						
Walls		10.44	0.15	1.57	21.95	229.22	(29)
2013 External Wall N	lew Ground Floor	10.44	0.15	1.57	21.00	225.22	(23)
Unit D2 2.10 living	ton, around ricor						
Walls		0.98	0.15	0.15	21.95	21.51	(29)
2013 External Wall N	lew, Ground Floor	0.00	00	00			(=0)
Unit D2 2.10	,						
Internal wall		52.27	0.00	0.00	8.75	457.36	
2013 Internal Partitio	n, Ground Floor						
Unit D2 2.10							
Internal wall		52.06	0.00	0.00	8.75	455.57	
2013 Internal Partitio	n, Ground Floor						
Unit D2 2.10_living							
Internal floor		27.15	0.00	0.00	95.00	2578.78	
2013 Internal Ceiling							
Floor Unit D2 2.10_liv	ving						

3. Heat	losses a	and hear	t loss pa	aramete	r							
Elemen	t	Gross		enings	Net are		value	$A \times U$		appa-val		
		area, m	² m ²		A, m^2		/m²K	W/K		J/m²K	kJ/K	
Internal					33.7	2	0.00	0.0	00	95.00	3203.60	
		Ceiling/Fl	oor, Gro	und								
	Unit D2 2	2.10										
Internal					0.2	2	0.00	0.0	00	95.00	21.03	
		Ceiling/FI	oor, Gro	und								
Floor	Unit D2 2	2.10										
Total or	oo of ove	مدمما مام	manta C	iama A	m²						140.07	(01)
	ea or ext leat loss	ernal ele	inenis s	ngma A,	111-						148.37 50.08	` ,
		aramete	r k.l/m²k	((IISAr-S	necified	TMP)					250.00	, ,
		l bridges		((doci o	pecifica	1 1011)					0.08	
	bric heat										50.16	()
		loss calc	ulated m	onthly								(-)
28.68	28.27	27.86	25.81	25.40	23.35	23.35	22.94	24.17	25.40	26.22	27.04	(38)
Heat tra	nsfer co	efficient,	W/K									
78.84	78.43	78.02	75.96	75.55	73.50	73.50	73.09	74.32	75.55	76.38	77.20	
		1									75.86	(39)
Heat los	s param	eter (HL	P), W/m	²K								` '
1.29	1.28	1.28	1.24	1.24	1.20	1.20	1.20	1.22	1.24	1.25	1.26	
HLP (av	rerage)	•	1				•	•	•	-	1.24	(40)
Number	of days	in month	ı (Table	1a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	

	r heatin		require	ements							kWh/year	(40)
	ed occupa average		r usage	in litres p	er day V	/d,avera	ge				2.01 86.31	(42) (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water	er usage	in litres	per day t	for each	month		!	!		!		
94.94	91.49	88.03	84.58	81.13	77.68	77.68	81.13	84.58	88.03	91.49	94.94	(44)
Energy	content c	f hot wa	ter used				I.		I	I		
140.79	123.14	127.07	110.78	106.29	91.72	85.00	97.53	98.70	115.02	125.56	136.35	
	content (annual)	ı				1				1357.94	(45)
21.12	18.47	19.06	16.62	15.94	13.76	12.75	14.63	14.80	17.25	18.83	20.45	(46)
Hot wate Volume Temper Energy	er storager cylinder factor ature factor lost from orage los	er loss fa ctor hot wate	ictor (kŴ	• /	day)						110.00 0.0152 1.0294 0.6000 1.03	(50) (51) (52) (53) (55)
32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
Net stor	age loss									•		
32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary	loss		•	•			•				<u> </u>	
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Total he	at requir	ed for wa	ater heat	ing calcu	lated fo	r each m	onth	!				
1	173.06 rom wat						152.81	152.19	170.30	179.05	191.62	(62)
196.07		182.34			145.22		152.81	152.19	170.30	179.05	191.62	(64)
190.07	173.00	102.34	104.27	101.57	145.22	140.27	132.01	132.19	170.30	179.03	2008.78	(64)
Heat ga	ins from	water he	atina. k\	Nh/mont	:h						2000.70	(04)
91.03	80.88	86.47	79.63	79.56	73.29	72.48	76.65	75.61	82.47	84.54	89.56	(65)
5. Interi	nal gains	s										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	ic gains,		1 1			1	1.109					
	-		100.61	100.61	100.61	100.61	100.61	100.61	100.61	100.61	100.61	(66)
Lighting												` ,
15.66	13.91	11.31	8.57	6.40	5.41	5.84	7.59	10.19	12.94	15.10	16.10	(67)
	ces gains		10.07	0		10.0.	1.100	10110			1.01.10	(-)
	177.51		163.14	150 79	139 19	131.43	129 61	134.21	143.99	156.33	167.94	(68)
Cooking	1	172.02	100	100.70	100.10	101110	120.01	101121	1 10.00	100.00	107101	()
33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06	(69)
	and fans		00.00	00.00	00.00	100.00	00.00	00.00	00.00	00.00	00.00	(00)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
	e.g. evar					0.00	0.00	0.00	0.00	0.00	0.00	(10)
-80.49	-80.49	-80.49	-80.49	-80.49	-80.49	-80.49	-80.49	-80.49	-80.49	-80.49	-80.49	(71)
	eating ga		-00.43	-00.43	-00.43	-00.43	-00.43	-00.43	-00.43	-00.43	-00.43	(11)
	120.36		110.60	106.94	101.80	07.40	103.03	105.02	110.84	117.42	120.37	(72)
	ernal gai		110.60	100.94	101.60	31.42	103.03	105.02	110.04	117.42	120.37	(12)
_	364.97		22E 40	217 22	200 57	207 00	202 41	202.60	220 OF	242.04	357.59	(73)
300.09	304.87	333.04	000.40	017.02	233.37	207.00	233.41	302.00	J20.93	042.04	331.38	(13)

6. Solar gains (calculation for January)				
	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, air-filled, low-E,	0.9 x 4.480 10.63	0.63 x 0.80	0.77	16.6385
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit D2 2.10			
Window - Double-glazed, air-filled, low-E,	0.9 x 4.480 10.63	0.63 x 0.80	0.77	16.6385
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit D2 2.10			
Window - Double-glazed, air-filled, low-E,	0.9 x 3.750 10.63	0.63 x 0.80	0.77	13.9273
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit D2 2.10 living			
Window - Double-glazed, air-filled, low-E,		0.63 x 0.80	0.77	13.9273
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit D2 2.10 living			
Window - Double-glazed, air-filled, low-E,	0.9 x 4.200 10.63	0.63 x 0.80	0.77	15.5986
En=0.1, soft coat (North)				
2013 External Window New, Ground Floor	Unit D2 2.10			
,				
Lighting calculations				
Lighting calculations	Area	g	FF x Shadir	ng
Lighting calculations Window - Double-glazed, air-filled, low-E,	Area 0.9 x 4.48	g 0.80	FF x Shadir 0.80 x 0.83	ng 2.14
		g 0.80		•
Window - Double-glazed, air-filled, low-E,	0.9 x 4.48	g 0.80		•
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 4.48	g 0.80 0.80		•
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor	0.9 x 4.48 Unit D2 2.10		0.80 x 0.83	2.14
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E,	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48		0.80 x 0.83	2.14
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48		0.80 x 0.83	2.14
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48 Unit D2 2.10	0.80	0.80 x 0.83 0.80 x 0.83	2.14
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E,	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48 Unit D2 2.10 0.9 x 3.75	0.80	0.80 x 0.83 0.80 x 0.83	2.14
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48 Unit D2 2.10 0.9 x 3.75	0.80	0.80 x 0.83 0.80 x 0.83	2.14
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48 Unit D2 2.10 0.9 x 3.75 Unit D2 2.10_living	0.80	0.80 x 0.83 0.80 x 0.83 0.80 x 0.83	2.14 2.14 1.79
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E,	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48 Unit D2 2.10 0.9 x 3.75 Unit D2 2.10_living 0.9 x 3.75	0.80	0.80 x 0.83 0.80 x 0.83 0.80 x 0.83	2.14 2.14 1.79
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48 Unit D2 2.10 0.9 x 3.75 Unit D2 2.10_living 0.9 x 3.75	0.80	0.80 x 0.83 0.80 x 0.83 0.80 x 0.83	2.14 2.14 1.79
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48 Unit D2 2.10 0.9 x 3.75 Unit D2 2.10_living 0.9 x 3.75 Unit D2 2.10_living	0.80 0.80 0.80	0.80 x 0.83 0.80 x 0.83 0.80 x 0.83 0.80 x 0.83	2.14 2.14 1.79 1.79
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North) 2013 External Window New, Ground Floor Window - Double-glazed, air-filled, low-E,	0.9 x 4.48 Unit D2 2.10 0.9 x 4.48 Unit D2 2.10 0.9 x 3.75 Unit D2 2.10_living 0.9 x 3.75 Unit D2 2.10_living 0.9 x 4.20	0.80 0.80 0.80	0.80 x 0.83 0.80 x 0.83 0.80 x 0.83 0.80 x 0.83	2.14 2.14 1.79 1.79

	system	responsi	veness		living a						1.00
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau			! '	,		1				1	
53.81	54.09	54.38	55.85	56.15	57.72	57.72	58.04	57.08	56.15	55.55	54.96
alpha			I						l		
4.59	4.61	4.63	4.72	4.74	4.85	4.85	4.87	4.81	4.74	4.70	4.66
Jtilisati	on factor	for gains	for livin	g area				•	l		-
1.00	0.99	0.97	0.90	0.74	0.52	0.39	0.46	0.76	0.96	0.99	1.00
Mean ir	nternal te	mperatur	re in livin	g area T	1				•		
19.69	19.87	20.18	20.62	20.89	20.98	21.00	20.99	20.91	20.53	20.05	19.68
Tempe	rature du	ring heat	ing perio	ds in res	t of dwe	lling Th2) -				
19.85	19.85	19.86	19.89	19.89	19.92	19.92	19.92	19.91	19.89	19.88	19.87
Utilisati	on factor	for gains	for rest	of dwelli	ng						
0.99	0.99	0.96	0.87	0.67	0.44	0.29	0.36	0.67	0.93	0.99	1.00
	nternal te		re in the	rest of d		2					
18.13	18.39	18.85	19.46	19.79	19.91	19.92	19.92	19.84	19.36	18.68	18.13
	rea fracti nternal te				dwelling))					0.44
18.82	19.04	19.44	19.97	20.28	20.39	20.40	20.40	20.32	19.88	19.29	18.82
Apply a	djustmen	t to the r	nean inte	ernal tem	perature	e, where	appropr	iate			
18.82	19.04	19.44	19.97	20.28	20.39	20.40	20.40	20.32	19.88	19.29	18.82
<i>3. Spac</i> Jan	ce heatin	<i>g requir</i> Mar	rement Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
oun				iviay	Ouri	Joan	/tug	ОСР	001	1404	DC0
Utilisati			-								
		0.96	0.88	0.70	0.48	0.34	0.40	0.70	0.93	0.98	0.99
0.99	0.98	0.96	0.88	0.70	0.48	0.34	0.40	0.70	0.93	0.98	0.99
0.99 Useful (0.98 gains										
0.99 Useful (440.09	0.98	579.13	644.20	595.62			290.01	0.70		0.98	0.99
Useful (440.09	0.98 gains 503.70	579.13	644.20	595.62							
0.99 Useful (440.09 Monthly 4.30	0.98 gains 503.70 average	579.13 externa 6.50	644.20 I tempera 8.90	595.62 ature 11.70	418.60	278.09	290.01	423.75	463.07	430.01	418.87
0.99 Useful (440.09 Monthly 4.30 Heat los	0.98 gains 503.70 average 4.90	579.13 externa 6.50 r mean i	644.20 I tempera 8.90 nternal te	595.62 ature 11.70 emperatu	418.60 14.60 ure	278.09	290.01	423.75	463.07	430.01 7.10	418.87
0.99 Useful (440.09 Monthly 4.30 Heat los	0.98 gains 503.70 average 4.90 ss rate fo	579.13 externa 6.50 r mean i	644.20 I tempera 8.90 nternal to	595.62 ature 11.70 emperatu	418.60 14.60 ure	278.09	290.01	423.75	463.07	430.01 7.10	418.87
0.99 Useful (440.09 Monthly 4.30 Heat los 1144.6	0.98 gains 503.70 vaverage 4.90 ss rate fo	579.13 externa 6.50 r mean i	644.20 I tempera 8.90 nternal to	595.62 ature 11.70 emperatu	418.60 14.60 ure	278.09	290.01	423.75	463.07	430.01 7.10	418.87
0.99 Useful (440.09 Monthly 4.30 Heat los 1144.6 Fraction 1.00	0.98 gains 503.70 vaverage 4.90 ss rate for 8 1109.22	579.13 externa 6.50 r mean ii 1009.47 h for hea	644.20 I tempera 8.90 Internal to 841.16 Iting	595.62 ature 11.70 emperatu 648.34	418.60 14.60 ure 425.26	278.09 16.60 279.05	290.01	423.75 14.10 462.12	463.07 10.60 701.10	7.10 930.72	418.87 4.20 1128.32
0.99 Useful (440.09 Monthly 4.30 Heat los 1144.6 Fraction 1.00 Space I	0.98 gains 503.70 vaverage 4.90 ss rate for 8 1109.22 n of mont	579.13 externa 6.50 r mean ii 1009.47 h for hea 1.00 equireme	644.20 I tempera 8.90 Internal te 841.16 Iting 1.00 Internal terms	595.62 ature 11.70 emperatu 648.34 1.00 ach mont	418.60 14.60 ure 425.26	278.09 16.60 279.05	290.01	423.75 14.10 462.12	463.07 10.60 701.10	7.10 930.72	418.87 4.20 1128.32

8c. Space cooling requirement

		3 - 1-									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Externa	l temper	aturers	•	•		•			•	•	
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-
Heat los	s rate W	İ	·!	ļ	•		!		1	•	
-	-	-	-	-	690.94	543.93	555.51	-	-	-	-
Utilisatio	n factor	for loss	•	•	•	•	•			•	
-	-	-	-	-	0.96	0.98	0.96	-	-	-	-
Useful lo	oss W			•	•				•	•	
-	-	-	-	-	660.82	531.91	534.34	-	-	-	-
Internal	gains W	•	•		•	•	•		•	•	
0.00	0.00	0.00	0.00	0.00	412.38	397.53	404.79	0.00	0.00	0.00	0.00
Solar ga	ains W		,				,		,	•	
0.00	0.00	0.00	0.00	0.00	674.62	629.84	499.70	0.00	0.00	0.00	0.00
Gains W	V								,		
-	-	-	-	-	1087.00	1027.37	904.49	-	-	-	-
Fraction	of mont	h for co	oling						,		
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Space h	eating k	Wh	,						,		
-	-	-	-	-	32.15	5.49	0.04	-	-	-	-
Space c	ooling k	Wh									
-	-	-	-	-	306.85	368.62	275.39	-	-	-	-
Total									•		950.86
Cooled 1	traction tency fac	otor									0.80
iiileiiiill	lency rac	101		1	0.25	0.25	0.25			1-	-
Space c	ooling r	oguirema	ent for m	onth	0.23	0.20	0.23	-	-		
opace c			1111 101 111		61.07	70.70	EE 00			1	
Space of	ا- cooling (د	- upo to /	-	-	61.37	73.72	55.08	-	-	-	190.17
			nt per m	ı² (kWh/ı	m²/vear)						3.11
-		- 40 0	201 11	. (, 5001)						0

9b. Energy requirements

our Energy requirements		kWh/year	
Fraction of space heat from secondary system	0.00	, ,	(301)
Fraction of space heat from community system	1.00		(302)
Fraction of community heat from Boilers	1.00		(303a)
Fraction of total space heat from Boilers	1.00		(304a)
Factor for control and charging method for community space heating	1.00		(305)
Factor for charging method for community water heating	1.00		(305a)
Distribution loss factor	1.05		(306)
Space heating			
Annual space heating requirement	2497.76		(98)
Space heat from Boilers		2622.64	(307a)
Efficiency of secondary heating system	0.00		(308)
Space heating fuel for secondary system		0.00	(309)
Water heating			
Annual water heating requirement	2008.78		(64)
Water heat from Boilers		2109.22	(310a)
Other energy			
Cooling system energy efficiency ratio	5.81%		(314)
Space cooling		32.72	(315)
Electrical energy for heat distribution		47.32	(313)
Electricity for pumps and fans within dwelling:			
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outs	ide (SFP=0.60)	171.84	(330a)
warm air heating system fans		0.00	(330b)
pump for solar water heating		0.00	(330g)
pump for waste water heat recovery		0.00	(330h)
Total electricity for the above, kWh/year		171.84	(331)
Electricity for lighting (100.00% fixed LEL)		276.61	(332)
Energy saving/generation technologies			
Appendix Q -			
Energy saved or generated ():		0.000	(336a)
Energy used ():		0.000	(337a)
Tatal delivered energy for all years		F007.00	(000)
Total delivered energy for all uses		5227.63	(338)

10a. Does not apply

11a. Does not apply

12b. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions	_
Efficiency of Boilers - 97.90%	•	· ·	,	(367a)
CO2 emissions from Boilers	4833.37	0.2160	1044.01	(368)
Electrical energy for heat distribution	47.32	0.5190	24.56	(372)
Total CO2 associated with community systems			1068.57	(373)
Total CO2 associated with space and water heating			1068.57	(376)
Space cooling	32.72	0.519	16.98	(377)
Electricity for pumps and fans	171.84	0.519	89.19	(378)
Electricity for lighting	276.61	0.519	143.56	(379)
Electricity generated - PVs	0.00	0.519	0.00	(380)
Electricity generated - μCHP	0.00	0.000	0.00	(380)
Appendix Q -				, ,
Energy saved ():	0.00	0.000	0.00	(381)
Energy used ():	0.00	0.000	0.00	(382)
Total CO2, kg/year			1318.29	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			kg/m²/yea 21.58	r (384)

Appendix E – Thermal Comfort Report





metropolis THERMAL COMFORT **REPORT**

44 Gloucester Avenue, Camden, London NW1 8JD

On behalf of **Project and Building Consultancy**

26/04/2016 Job Ref: 5385

Produced By	Position	Date
Rohan Shiram	Senior Energy Project Consultant, CIBSE Low Carbon Consultant and BREEAM Assessor	26/04/2016
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Planning Masterplanning Architecture Renewable Energy Sustainable Development



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1.0 INTRODUCTION

- 1.1 This report provides results of the overheating analysis undertaken by Metropolis Green in order to assess performance of the proposed 44 Gloucester Avenue development in the London Borough of Camden, against CIBSE TM52 standards.
- 1.2 The proposed mixed-use development at 44 Gloucester Avenue comprises the refurbishment, extension and conversion of the existing non-domestic buildings on the site, which include 40 nos. 1 to 3 bedroom residential units, of which 22 units will be located in the newly constructed buildings. The commercial space is comprised of approximately 698m² of floor area at the basement and ground floor levels.
- 1.3 Dynamic Simulation Modelling (DSM) of the building has been carried out to determine the likelihood of overheating within the proposed 44 Gloucester Avenue development. A sample of the expected worst performing residential units were selected (i.e. all mid and top floor residential units) and all commercial areas were simulated considering all aspects of occupancy, solar gain, and predicted heat gains.
- 1.4 The calculation results show that none of the residential units overheat in the summer months, however the commercial areas demonstrated non-compliance against at least two of the three CIBSE TM52 overheating criteria. Even though additional measures were specified, the results demonstrated that overheating within the commercial areas cannot be resolved using only passive design measures and as such there is a need for comfort cooling to be provided within these areas.



2.0 CIBSE TM52 REQUIREMENTS

- 2.1 Overheating is assessed using CIBSE TM52. The following three criteria, taken together, provide a robust yet balanced assessment of the risk of overheating of buildings in the UK and Europe. A room or building that fails any two of the three criteria is classed as overheating.
- 2.2 CIBSE recommends that new buildings, major refurbishments and adaptation strategies should conform to Category II in BS EN 15251 (BSI, 2007), which sets a maximum acceptable temperature of 3 °C above the comfort temperature for buildings in free-running mode. For such buildings the maximum acceptable temperature (Tmax) can be calculated from the running mean of the outdoor temperature (Trm) using the formula:

$$Tmax = 0.33 Trm + 21.8$$

2.3 The criteria are all defined in terms of ΔT, the difference between the actual operative temperature in the room at any time (Top), and Tmax the limiting maximum acceptable temperature. ΔT is calculated as:

$$\Delta T = Top - Tmax$$

• Criterion 1: Hours of Exceedence (He):

The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).

The number of hours (He) during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.

• Criterion 2: Daily Weighted Exceedence (We):

The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.

The weighted exceedence (We) shall be less than or equal to 6 in any one day where:

We =
$$(\sum he) \times WF = (he0 \times 0) + (he1 \times 1) + (he2 \times 2) + (he3 \times 3)$$

where the weighting factor wf = 0 if $\Delta T \leq 0$, otherwise

 $WF = \Delta T$, and hey is the time (h) when WF = y



• Criterion 3: Upper Limit Temperature (Tupp)

The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4 K. The absolute maximum value of the indoor operative temperature is expressed as Tupp

$$Tupp = Tmax + 4$$

- 2.4 In order to demonstrate that the proposed development is not at risk of overheating, all of the assessed areas, must comply with at least two of the three assessed criteria.
- 2.5 The weather data used for the thermal comfort analysis is the projected increase future summer temperature CIBSE Design Summer Year, London 2050MH. The simulation period is from 1st May to the 30th September.



3.0 DYNAMIC SIMULATION MODEL

- The analysis was carried out using IES Virtual Environment software, version 2015. The following modules of the software were used in the study;
 - ModelIT to create the building model data such as geometry, site and location.
 - Apache to assign construction materials, internal gains, occupancy patterns etc.
 - SunCast to calculate the solar shading patterns to provide data for the thermal calculations.
 - Apache-Sim to calculate indoor summer temperature.
- 3.2 The 3D model is based on the architectural drawings and other specifications, provided by 21st Architecture.



4.0 MODEL INPUTS AND METHODOLOGY

- 4.1 The dynamic simulation model was created for all blocks within the proposed 44 Gloucester Avenue. The selected sample areas include:
 - Typical mid floor (Figure 1) and typical top floor residential units (Figure 2), and
 - All commercial areas in basement and ground floor (Figures 3 and 4)

Figure 1 - Typical Mid Floor Residential Units

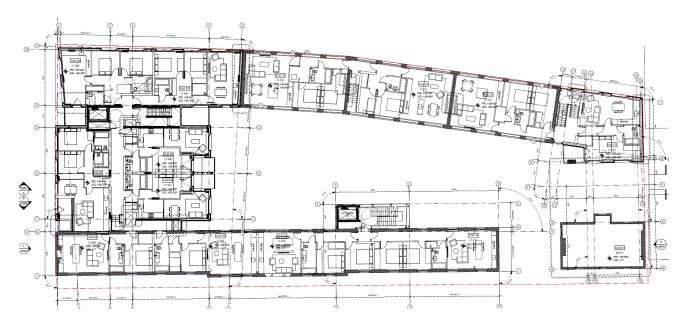


Figure 2 - Typical Top Floor Residential Units

