



Energy Statement

Designated Contractors Ltd

17-27 & 25 Ferdinand Street

Final

S Gowing

BSc (hons), MSc, MEI, MInstP

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Executive Summary

This Energy Statement provides an energy strategy for the development at 17, 25 and 27 Ferdinand Street which comprises of the erection of additional 4th and 5th floors, 5 storey extension to courtyard (west) elevation, single storey extension to east elevation at 17 and 27 Ferdinand Street and redevelopment of 25 Ferdinand Street to create a 5 storey building to provide 10 additional residential units (19 units in total including 9 in situ) and 103m² Class B1a office floorspace.

The energy strategy has been formulated following The London Plan Energy Hierarchy: **Be Lean**, **Be Clean** and **Be Green**. The overriding objective in the formulation of the strategy is to maximise the reductions in Regulated CO_2 emissions through the application of this Hierarchy with a cost-effective, viable and technically appropriate approach.

The development will be registered to Approved Document (AD) Part L1B (dwellings) and AD Part L2B (office). Conversions (and change of use) require special attention to ensure a holistic approach to energy reductions includes other considerations such as moisture management, ventilation, and traditional look. However, significant CO₂ reduction can be achieved with through-through performance uplifts benefiting the development.

A range of advanced *Be Lean* energy efficiency measures are proposed including upgrading all thermal elements in the conversion and for the new builds; low U-values psi-values (and thermal bridge).

The *Be Lean* measures enable the development to meet the energy efficiency requirements of AD Part L1B and L2B (2013). Improving existing thermal elements in the conversion, reducing air leakiness, and selective high performing materials for new thermal elements all assist in the conversions to exceed the original buildings CO₂ baseline by **49.5%**.

Target Emissions Rate (TER) and Target Fabric Energy Efficiency (TFEE) have been taken from energy assessments based on the pre-developed building specification. In this manner we can state the improvement upon the existing building in terms of Regulated CO₂ emissions end fabric energy efficiency.

This represents a good level of sustainable design and construction and indicates the Applicant's commitment to reducing energy demands across the site.

In line with the London Plan, the feasibility of decentralised energy production as a *Be Clean* measure has been carefully examined. There are no existing district heat networks in proximity to the site. Due to the small number of dwellings and space restrictions of the Development site a sitewide communal heating scheme has not been deemed viable, this is inline with the Greater London Authority (GLA) guidance on energy statements.

Significant CO₂ emissions savings have been maximised and made at the *Be Lean* stage. Although not selected, the full spectrum of *Be Green* renewable energy generating technologies has been considered.

The 35% reduction in on-site Regulated CO_2 emissions has been exceeded and the development is considered compliant with London Plan Policy 5.2 and Camden's CC01 policy. Policy 5.7 (B) of the London Plan states provision of renewables is 'within the framework of the energy hierarchy', which firmly requires energy efficiency measures to be prioritised.

Table 1 below summarises the anticipated Domestic CO_2 emissions savings across the scheme. As shown, the combination of **Be Lean** measures results in an exceedance of the 35% CO_2 reduction requirement. **Be Clean** and **Be Green** measures are shown in the table for completion, although the on-site policy target if wholly met within the **Be Lean** Measures.

In line with the GLA Housing Supplementary Planning Guidance, the development will commit to offset the remaining domestic CO_2 emissions. The remaining CO_2 emissions to be offset should be based upon **32.62 Tonnes CO_2 per annum**.

Table 1: Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy				
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)			
	Regulated	Unregulated		
Baseline	64.51	23.58		
After Be Lean Measures	32.62	23.58		
After Be Clean Measures	32.62	23.58		
After Be Green Measures	32.62	23.58		
After Carbon off-setting	0	23.58		
Stage	Regulated Carbo	n Dioxide Savings		
	Tonnes CO ₂ per Annum	Percentage		
Savings from Be Lean Measures	31.89	49.4%		
Savings from Be Clean Measures	0	0%		
Savings from Be Green Measures	0	0%		
After Carbon off-setting	32.62	50.6%		
Cumulative Savings	64.51	100%		



The Non-domestic area is expected to realise a 50% reduction in Regulated CO_2 emissions, see Table 2 below.

Table 2: Non-Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy			
Stage	Carbon Dioxide Emissions (Tonnes CO₂ per Annum)		
	Regulated	Unregulated	
Baseline	6.82	2.25	
After Be Lean Measures	3.39	2.25	
After Be Clean Measures	3.39	2.25	
After Be Green Measures	3.39	2.25	
Stage	Regulated Carbon	n Dioxide Savings	
	Tonnes CO₂ per Annum	Percentage	
Savings from Be Lean Measures	3.43	50.3%	
Savings from Be Clean Measures	0	0%	
Savings from Be Green Measures	0	0%	
Cumulative Savings	3.43	50.3%	

Following the energy hierarchy and accounting for Carbon Offsetting the Proposed Development is expected to reduce 95.3% of the developments Regulated CO_2 emissions, see Table 3 below.

Table 3: Total Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy				
Stage	Carbon Dioxide Emission	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)		
	Regulated	Unregulated		
Baseline	71.33	25.83		
After Be Lean Measures	36.01	25.83		
After Be Clean Measures	36.01	25.83		
After Be Green Measures	36.01	25.83		
After Carbon off-setting	3.39	25.83		
Stage	Regulated Carbo	n Dioxide Savings		
	Tonnes CO ₂ per Annum	Percentage		
Savings from Be Lean Measures	35.32	49.5%		
Savings from Be Clean Measures	0	0%		
Savings from Be Green Measures	0	0%		
After Carbon off-setting	32.62	45.8%		
Cumulative Savings	67.94	95.3%		

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1. INTRODUCTION

- 1.1 This document has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development.
- 1.2 The Energy Statement sets out the energy strategy on behalf of Designated Contractors Ltd (The 'Applicant') in respect to the planning application for the development of 17, 25 and 27 Ferdinand Street, which includes additional floors creating 10 additional dwellings (to the 9 already in situ) and 103m^2 of office space.
- 1.3 The energy strategy for the Site has been formulated to achieve the maximum viable reduction in Regulated CO₂ emissions in line with the Energy Hierarchy outlined in the London Plan. The following understanding of the hierarchy will be used to construct the energy strategy:
 - > Initially implementing **Be Lean** measures to reduce energy consumption through improvements to building fabric performance and auxiliary systems; then
 - > Consideration, and implementation of, **Be Clean** options, including the use of decentralised energy generation; and finally
 - > Reviewing the feasibility of **Be Green** measures, in order to generate renewable energy, and implementing them where appropriate.
- 1.4 A baseline CO₂ emission rate will be initially established for the development using the latest relevant methodology in Part L (2013) of the Building Regulations 2010.
- 1.5 The dwellings within the conversion and top floor extension to the upper floors will be assessed under Part L1B. The proposed office space will be assessed under Part L2B.
- **1.6** The baseline emissions will be based on a combination of the current building's specification and of the new build.

2. DEVELOPMENT OVERVIEW

Site Location

2.1 The development site at 17, 25 & 27 Ferdinand Street in the London Borough of Camden is located between Chalk Farm Road, Ferdinand Street, and Mead Close, as shown in Figure 1 below. The current building is used for a range of commercial units and 9 existing dwellings. The proposed scheme comprises the erection of additional 4th and 5th floors, 5 storey extension to courtyard (west) elevation, single storey extension to east elevation at 17 and 27 Ferdinand Street and redevelopment of 25 Ferdinand Street to create a 5 storey building to provide 10 additional residential units (19 units in total including 9 in situ) and 103m² Class B1a office floorspace.

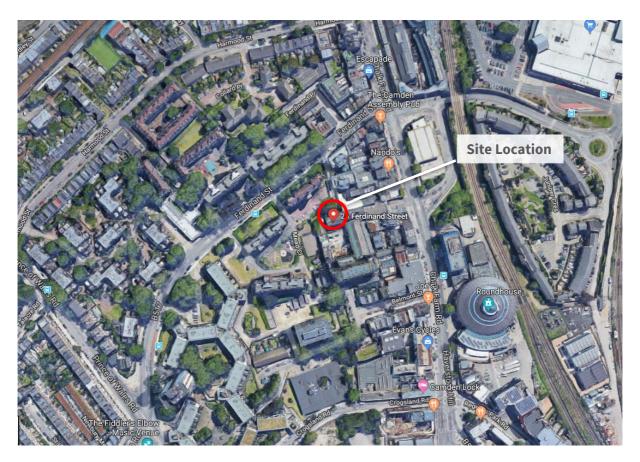


Figure 1: Site Location - Map data © 2018 Google



Proposed Development

2.2 The Proposed Development is described as follows:

"Variation of condition 2 (approved plans) of planning permission 2015/0925/P dated 27/11/2015 for the 'Erection of additional 4th and 5th floors, 5 storey extension to courtyard (west) elevation, single storey extension to east elevation all at 17 and 27 Ferdinand Street and redevelopment of 25 Ferdinand Street to create 5 storey building to provide 10 additional residential units (9 units already in situ) and Class B1a office floorspace', namely to extend the approved single storey east elevation extension to 5 storeys."

2.3 The Proposed Second Floor Plan in Figure 2 below illustrates the site location in more detail.

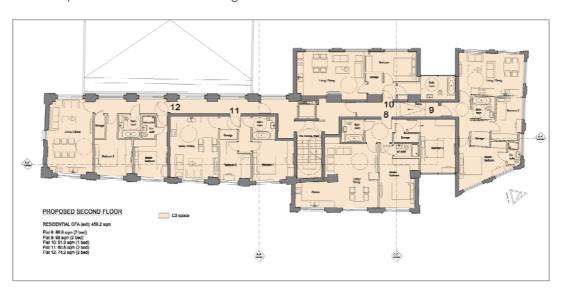


Figure 2: Proposed Second Floor - 2019 (Contemporary Design Solutions)

3. RELEVANT PLANNING POLICY

3.1 The following planning policies and requirements have informed the sustainable design of the proposed development.

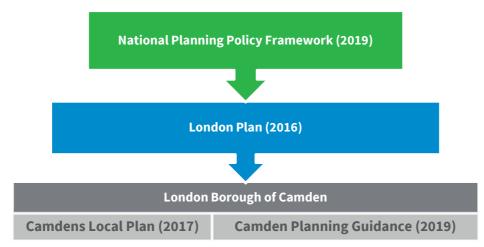


Figure 3: Relevant Planning Policy Documents

National Policy: NPPF

- 3.2 The revised National Planning Policy Framework (NPPF) was published on the 19th February 2019 and sets out the Government's planning policies for England.
- 3.3 The NPPF provides a framework for achieving sustainable development, which has been summarised as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Resolution 42/187 of the United National General Assembly). At the heart of the framework is a **presumption in favour of sustainable development**.
- 3.4 The document states that the planning system has three overarching objectives which are interdependent and need to be pursued in mutually supportive ways:
 - a) An economic objective to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;
 - **b)** A social objective to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with



- accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and
- c) An environmental objective to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

Regional Policy: The London Plan

- The draft London Plan showing Minor Suggested Changes (published on 13th August 2018) has recently been considered by a formal Examination in Public. It is now with the Panel of Inspectors to report the findings and provide any recommendations, with the final published New London Plan expected in early 2020. Once adopted, it will inform decisions on London's development between 2019 and 2041.
- The existing London Plan sets out an integrated economic, environmental, transport and social framework for the development of London. The following policies are considered relevant to the proposed development and this Statement:
- 3.7 Policy 5.3 Sustainable Design and Construction states that the highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.
- 3.8 Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.
- 3.9 Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in the London Plan and the following sustainable design principles:
 - > Minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems).
 - > Avoiding internal overheating and contributing to the urban heat island effect.
 - > Efficient use of natural resources (including water), including making the most of natural systems both within and around buildings.



- > Minimising pollution (including noise, air and urban runoff).
- > Ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions.
- > Securing sustainable procurement of materials, using local supplies where feasible, and
- > Promoting and protecting biodiversity and green infrastructure.
- 3.10 Policy 5.2 Minimising Carbon Dioxide Emissions requires development proposals to make the fullest contribution to minimising carbon dioxide emissions in accordance with the Energy Hierarchy: Be Lean, Be Clean and Be Green. This includes a requirement for all residential buildings to achieve Zero Carbon status from 2016.
- **3.11** GLA Definition: 'Zero carbon' homes are homes forming part of major development applications where the residential element of the application achieves at least a 35% reduction in regulated carbon dioxide emissions (beyond Part L 2013) on-site. The remaining regulated carbon dioxide emissions, to 100%, are to be off-set through a cash-in-lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.
- **3.12 Policy 5.5 Decentralised Energy Networks** states that the Mayor expects 25 per cent of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. The Mayor will prioritise the development of decentralised heating and cooling networks at the development and area wide levels, including larger scale heat transmission networks.
- **3.13 Policy 5.6 Decentralised Energy** requires that all developments should evaluate the feasibility of Combined Heat and Power (CHP) systems and examine the opportunities to extend the system beyond the site boundary to adjacent sites.
- **3.14 Policy 5.7 Renewable Energy** states that within the framework of the energy hierarchy, major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.
- **3.15 Policy 5.8 Innovative Energy Technologies** encourages the more widespread use of innovative energy technologies to reduce use of fossil fuels and carbon dioxide emissions.
- **3.16 Policy 5.9 Overheating and Cooling** seeks to reduce the impact of the urban heat island effect, reduce potential overheating and reduce reliance on air conditioning systems in line with the cooling hierarchy.



Local Policy: London Borough of Camden

Camden Local Plan 2016-2031

- 3.17 The London Borough of Camden's Local Plan 2013-2031 document was adopted in July 2017 and sets out the Councils Strategy for the next 12 years. The following policies are considered relevant to this Statement:
- 3.18 Policy CC1: Climate Change Mitigation Promotes Zero Carbon though use of the Energy Hierarchy and encourages the highest financially feasible environmental standards (during construction and occupation). The energy strategy should first optimise resource efficiency, then assess decentralised energy networks, and monitor any low carbon generation.
- **3.19 Policy CC2: Adapting to Climate Change** Requires measures to reduce the impact of urban and dwelling overheating including application of the cooling hierarchy which aims to reduce the need for active cooling.

Camden Planning Guidance (CPG)

The guidance was adopted 15th March 2019 and provides key messages (not policy) that should be considered. These include:

- > Energy Strategies should reduce regulated CO₂ emissions in accordance with the energy hierarchy (*Be Lean, Be Clean, Be Green*)
- > Natural 'passive' measures should be priorities over active-measures to reduce energy
- > Major development to assess feasibility of decentralised energy network;
- > Targeting a 20% CO₂ reduction through onsite renewable energy technologies.

Summary

3.20 The Development should follow the London Plan Policies and the Energy Assessment Guidance (2018). A minimum 35% CO₂ reduction over the existing development baseline will be targeted, remaining CO₂ emission will be offset through a cash-in-lieu payment to the Council.

4. BUILDING REGULATIONS BASELINE

Methodology

- 4.1 In line with London Plan policy and GLA Energy Assessment Guidance (2018), this report first establishes a baseline assessment of the energy demands and associated CO₂ emissions for the development site based on AD Part L (2013) of the Building Regulations.
- 4.2 The estimated annual energy demand for the residential portion of the Proposed Development has been calculated using Standard Assessment Procedure (SAP 2012) methodology. SAP calculates the Regulated energy demands associated with hot water, space heating and fixed electrical items.
- 4.3 The Unregulated domestic energy demands for appliances and cooking are taken from Chapter 16 of the SAP methodology and converted into CO₂ emissions. This methodology is similar to the BREEDEM methodology and consider then same sources of unregulated CO₂.
- 4.4 Unregulated Non-domestic energy demands, and associated CO₂ emissions have been taken from the BRUKL report. The equipment consumption (kWh/m2) is multiplied by the unit's area and the carbon factor of electricity (0.519) to provide the unregulated non-domestic CO₂ emissions.
- 4.5 SAP calculations have been carried out for representative home types. Three units have been selected and assessed; a mid-floor, mid-floor with exposed roof, and a top-floor unit. This represents a fair aggregation of units at the site.
- 4.6 In order to provide energy demands across the Proposed Development, a selection of dwelling types have been modelled and extrapolated up to provide a reasonable estimation of the Proposed Developments energy demands and use.
- **4.7** The Commercial Unit has been assessed following the methodology within the Simplified Building Energy Model (SBEM). Area weighted energy demands, and CO₂ emission have been applied to a similar shell and core office assessment.

Baseline Calculation

- As the development is a conversion of an existing building the dwellings will be registered under AD Part L1B of the Building Regulations. Therefore, the Proposed Development SAP calculations will be compared to the Dwelling Emission Rate (DER) calculated from the pre-developed building specification using values detailed in the SAP (2012) methodology. This process is in line with the GLA guidance on Energy Statements (October 2018).
- **4.9** The existing building and the baseline emission rate calculation includes the following existing and default performance standards:



- > Single glazing with a U-value of 4.8 W/m²K;
- > External wall U-value 1.21 W/m²K (330mm solid brick with drylining)
- > Sheltered wall to corridor 2.1 W/m²K (290mm brick wall with ISO 6946 shelter factor);
- > Party wall Solid brick to have an effective 0.00W/m²K;
- > Ground floor U-value 1.2 W/m²K;
- > Flat and Mansard roof U-values 1.5 W/m²K; and
- > Natural ventilation with intermittent extract fans with an air leakage rate of 15m³/m²/hr (default untested).
- 4.10 The proposed heating strategy is applied to the existing and proposed dwellings. This ensures CO₂ emissions are not over estimated. Heating systems are the most likely to be in line with recent energy efficiency minimum standards. A boiler efficiency of 89.1% based on a commercially available boiler has also been incorporated within the commercial unit as the baseline case.
- 4.11 Each of the SAP calculations carried out has been multiplied up by the unit's floor area, and then by the number of homes proposed for that unit type, across the development. A table showing the homes selected, the total floor area (TFA) of that unit, and proposed number of homes is shown in **Appendix A.**
- **4.12** Using the Baseline discussed above a Target Emission Rate and Target Fabric Energy Efficiency can be applied.
- **4.13** Table 4 shows the Regulated and Unregulated baseline CO₂ emissions rates for both the residential and non-domestic elements. Pre-conversion DER worksheets for the dwellings and Pre-conversion BRUKL reports are provided in **Appendices B and C** to support these.

Table 4: Regulated and Unregulated Carbon Dioxide Emissions Baseline					
	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)				
	Domestic Non-Domestic Cumulative				
Regulated	64.51	6.82	71.33		
Unregulated	23.58	2.25	25.83		

5. BE LEAN: DEMAND REDUCTION

- 5.1 In line with the London Plan Energy Hierarchy, several measures are proposed in order to reduce energy demands across the development.
- **5.2** The indicative specifications outlined achieve the following standards that the Developer is committing to achieve:
 - > The AD Part L1B and L2B (2013) CO₂ baseline through energy efficiency measures alone;
- **5.3** Similar specifications may be utilised during detailed design to achieve the above performance standards.
- Throughout the design process to date, the Applicant has given consideration to building form and massing, and what impacts these have on energy use, daylighting and overheating. The objective of this consideration is to carefully balance these sometimes-opposing objectives.

Domestic units (Part L1B)

Fabric Performance

- **5.5** The converted units will promote energy efficiency by improving the fabric.
- 5.6 Upgraded and new thermal elements of the fabric should target or improve on the performance U-values detailed in Building Regulations Part L1B. These are detailed below in Table 5 and Table 6.

Table 5: Upgrading retained thermal elements (Part L1B)				
Element	Threshold U-value	Minimum improvement value U-value		
External Wall – Cavity insulation	0.70 W/m ² K	0.55 W/m ² K		
External Wall – external or internal insulation	0.70 W/m ² K	0.30 W/m ² K		
Floor	0.70 W/m ² K	0.25 W/m ² K		
Pitched Roof – insulation at ceiling level	0.70 W/m ² K	0.16 W/m ² K		
Pitched Roof – insulation between rafters	0.35 W/m ² K	0.18 W/m ² K		
Flat Roof	0.35 W/m ² K	0.18 W/m ² K		

5.7 New elements within the extension will meet or improve upon the maximum U-values shown in Table 6.



Table 6: Standards for new thermal elements (Part L1B)			
Element	Limiting U-value		
Wall	0.28 W/m ² K		
Pitched Roof – insulation at ceiling level	0.16 W/m ² K		
Pitched Roof – insulation between rafters	0.18 W/m ² K		
Flat Roof	0.18 W/m ² K		
Floors	0.22 W/m ² K		
Windows	1.6 W/m ² K (WER* Band C)		
Doors	1.8 W/m ² K (DSER** Band E)		

*Window Energy rating, ** Door set energy rating

- **5.8** It is expected that the converted dwellings will incorporate improved U-values and on average achieve the following:
 - > External wall U-values of 0.28 W/m²K (e.g. 125mm mineral wool, 70mm of internal phenolic insulation, or 50mm aerogel such as 'Spacetherm');
 - > New External Walls should target 0.18W/m²K;
 - > Top floor curtain walling U-value of 1.80W/m²K
 - > Party walls will be either solid or fully filled and sealed or solid (achieving an effective U-value of 0.00 W/m²K);
 - > Walls to corridor of 0.28 W/m²K including sheltering factors (e.g. 90mm insulation between steel frame either side of 50mm cavity);
 - > Double glazing with whole unit U-value of 1.30 W/m²K, (with a default g-factor of 0.63);
 - > Roofs to achieve a U-value of 0.18 W/m²K;
 - > Floors with a U-value of 0.22 W/m²K.

Air Tightness & Ventilation

- 5.9 Natural ventilation with intermittent extract fans (system 1) is proposed allowing simple solution to ventilate the dwelling and remove stale or humid air from the kitchen and wet rooms.
- 5.10 All homes will have openable windows and therefore the ability to increase ventilation should the occupant desire. This will facilitate convective ventilation and night purging of heat, as illustrated in Figure 4

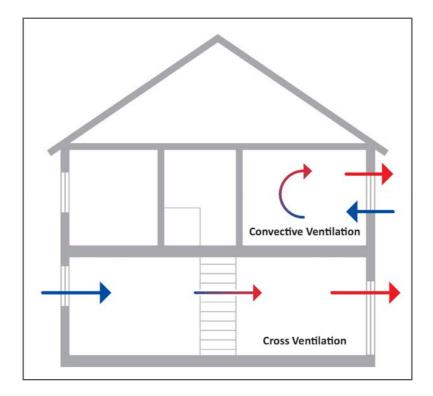


Figure 4: Natural Ventilation

- 5.11 In order to minimise ventilate heat losses, uncontrolled ventilation will be reduced through targeting a low air permeability (building leakage) figure of 6m³/hr/m². This has been used in the Energy Statement calculations.
- **5.12** Consideration to air tightness membranes, detailing, and suitable construction skills will be required to ensure the target air permeability will be achieved when air tested upon completion.

Thermal Bridging

- **5.13** Low thermal bridge heat loss values cannot be designed into conversions as the existing building limits the ability for specific detailing.
- **5.14** However, best practice will be followed where possible such as ACDs for window surrounds.

Space Heating & Hot Water

- **5.15** The development will include individual high efficiency condensing gas boilers.
- **5.16** Sophisticated heated controls will allow heating time and temperature to be allocated to different zones of the dwelling.



Lighting

5.17 Energy efficient lighting will be installed in 100% of internal fittings in the homes.

Unregulated Energy Demands

5.18 Unregulated energy demands are typically defined as the energy needed for cooking and powering appliances within the home. There is difficulty in reducing the energy associated with these uses as they are entirely dependent on the occupant of a home and can vary substantially. However, the Applicant is committed to ensuring that all efforts are made to enable the residents to minimise their unregulated electricity consumption.

Mitigation against Summer Overheating

- **5.19** In line with the Cooling Hierarchy within London Plan Policy 5.9, it is proposed to reduce the need for active cooling as far as possible.
- 5.20 Reducing the summertime overheating risk will be done through the specification of non-mechanical measures such as good thermal insulation and air tightness. When combined with cross ventilation and openable windows to non-noise sensitive dwellings, the risk of overheating has been reduced to appropriate levels. This is demonstrated in section 9 of the DER worksheet in Appendix E.

Non- Domestic unit (Part L2B)

Fabric Performance

- **5.21** The office space will promote energy efficiency by improving the fabric.
- **5.22** Upgraded and new thermal elements of the fabric should target or improve on the performance U-values detailed in Building Regulations AD Part L2B. These are detailed below in Table 5 and Table 6.

Table 7: Upgrading retained thermal elements (Part L2B)				
Element	Threshold U-value	Minimum improvement value U-value		
External Wall – Cavity insulation	0.70 W/m ² K	0.55 W/m ² K		
External Wall – external or internal insulation	0.70 W/m ² K	0.30 W/m ² K		
Floor	0.70 W/m ² K	0.25 W/m ² K		
Pitched Roof – insulation at ceiling level	0.70 W/m ² K	0.16 W/m ² K		
Pitched Roof – insulation between rafters	0.35 W/m ² K	0.18 W/m ² K		
Flat Roof	0.35 W/m ² K	0.18 W/m ² K		

Table 8: Standards for new thermal elements (Part L2B)			
Element	Limiting U-value		
Wall	0.28 W/m ² K		
Pitched Roof – insulation at ceiling level	0.16 W/m ² K		
Pitched Roof – insulation between rafters	$0.18\mathrm{W/m^2K}$		
Flat Roof	0.18 W/m ² K		
Floors	0.22 W/m ² K		
Domestic in character windows	1.6 W/m ² K (WER* Band C)		
All other windows (roof lights etc.)	1.8 W/m ² K		
Doors - Pedestrian/ High usage pedestrian / Vehicles	1.8 W/m ² K /3.5 W/m ² K /1.5 W/m ² K		

*Window Energy rating, ** Door set energy rating

- **5.23** It is expected that the office will incorporate improved U-values and on average achieve the following:
 - > External wall U-values of 0.28 W/m²K (e.g. 125mm mineral wool, 60mm of internal phenolic insulation, or 40mm aerogel such as 'Spacetherm');
 - > Curtain walling U-value of 1.80W/m²K
 - > Party walls will be either solid or fully filled and sealed or solid (achieving an effective U-value of 0.00 W/m²K);
 - > Walls to corridor of 0.28 W/m²K including sheltering factors (e.g. 90mm insulation between steel frame either side of 50mm cavity);
 - > Double glazing with whole unit U-value of 1.30 W/m²K, (with a default g-factor of 0.5 and light transmittance of 0.74);
 - > Roofs to achieve a U-value of 0.18 W/m²K;
 - > Floors with a U-value of 0.22 W/m²K.

Air Tightness & Ventilation

5.24 It is expected that ventilation is provided by a mechanical ventilation and heat recovery system. This system allows heat to be recovered reducing the heating demands for they system. Low specific fan powers and high heat recovery efficiencies should be considered when selecting the unit at the detailed design stage.



5.25 Due to the small size of the office unit it is not required to be pressure tested. Therefore, the default air permeability has been used in the Energy Statement calculations.

Thermal Bridging

- **5.26** Low thermal bridge heat loss values cannot be designed into conversions as the existing building limits the ability for specific detailing.
- **5.27** However, best practice will be followed where possible such as ACDs for window surrounds and openings.

Space Heating & Hot Water

- **5.28** The commercial ambient space heating demands, and low hot water demands) are more suited an efficient heating ventilation and air conditioning (HVAC) system.
- The office will include individual high efficiency Air Source Heat Pumps (ASHP) with compensators (e.g. weather compensators) to further increase the efficiency. An SCOP from a similar completed project of 3.04 has been used in the calculations.
- **5.30** Sophisticated heated controls will allow heating time and temperature to be allocated to different zones of the dwelling.
- **5.31** Hot water is expected to be provide by a point of use electric water heater.

Lighting

5.32 Energy efficient lighting will be installed in 100% of internal fittings and be sub-metered. Photoelectric switching reduces light usage when not required and provides energy savings.

Mitigation against Summer Overheating

- 5.33 In line with the Cooling Hierarchy within London Plan Policy 5.9, it is proposed to reduce the need for active cooling as far as possible.
- 5.34 Reducing the summertime overheating risk will be done through the specification of non-mechanical measures such as good thermal insulation. However, it is expected that cooling is supplied from the ASHP. Existing product Energy Efficiency Rating (EER) 2.64 has been used in the calculations, taken from a similar completed project.
- **5.35** The heating, ventilation, and cooling systems described meet the minimum requirements of the Building Services Guide.

CO₂ Emissions at Be Lean Stage

Table 4, below, details the site wide Regulated CO₂ emissions of the development after the application of the performance standards specified above. It can be seen that these measures enable the targets in Part L (2013) of the Building Regulations, to be met through energy efficiency measures alone. A summary table of these results is presented in **Appendix A**. DER worksheets supporting these calculations are presented in **Appendices C and D**.

Table 9: Regulated Carbon Dioxide Emissions at <i>Be Lean</i> Stage					
	Carbon Dioxide Emissions (Tonnes CO₂ per Annum)				
	Domestic Non-Domestic Cumulative				
Baseline	64.51	6.82	71.33		
After <i>Be Lean</i> Measures	32.62	3.39	36.01		
Total Emissions Reduction 31.89 3.43 35.32					
Percentage Reduction	49.4%	50.3%	49.5%		

5.37 Other than the U-values stated in AD Part L1B there is not a Fabric Energy Efficiency (FEE) criteria. To show how the development is expected to improve on the existing buildings fabric a baseline Target FEE (TFEE) has been calculation from the baseline specification. This allows the developments average Dwelling Fabric Energy Efficiency (DFEE) to be compared to the pre-developed building. The DFEE weighted by the net internal floor areas of the dwellings, has been calculated as 74.8 kWh/m². This represents a 59% improvement over the pre-conversion FEE calculated at the baseline stage. A summary of the FEE scores for each dwelling are presented in **Appendix A**.



6. BE CLEAN: HEATING INFRASTRUCTURE

- 6.1 In line with Policy 5.6 of the London Plan and the CPG, the energy systems required on site have been evaluated and optimised based on the Proposed Development's scale and density. The London Plan outlines the following order of preference for energy generation:
 - > Connection to existing heating or cooling networks;
 - > Site wide CHP network;
 - > Communal heating and cooling.
- The inclusion of a decentralised heating and cooling network has been investigated in terms of appropriateness to the Proposed Development and, to be in line with the priorities for this energy strategy, whether it is the best technology to provide the greatest reductions in CO₂ emissions.

Local Networks

- 6.3 The London Borough of Camden have ascertained that the area has potential for a future district heating network and are seeking to deliver area-wide heat networks. Figure 5 shows the existing Gospel Oak heat network (red line) is 720m away for the development site (red circle) and the proposed initial network corridor (230m away) which runs across Prince of Wales Road (black line).
- 6.4 It would be technically difficult to connect due to the Proposed Developments location as the development's location is bounded by the adjacent buildings and surrounded by private land. The access road is small and would increase a heat network connection length and cost.
- **6.5** For this reason, connection to an offsite energy network is not proposed.

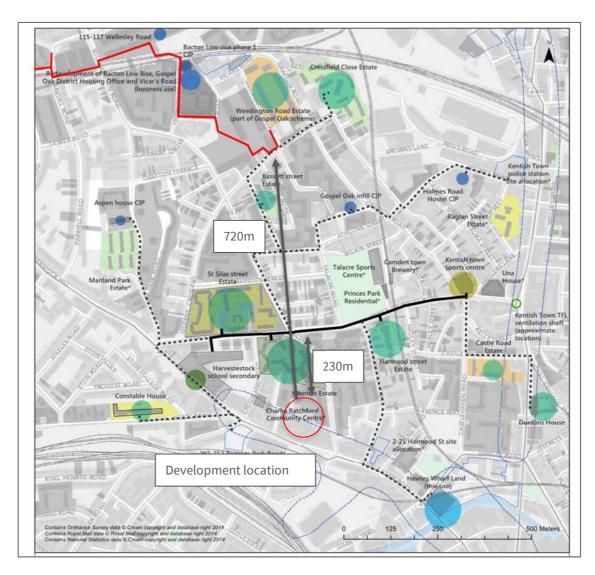


Figure 5: Borough Wide Heat Demand and Heat Source mapping (Copyright © 1976 - 2015 BuroHappold Engineering)

Site-Wide Heat Network

Incorporating a sitewide energy network would require plant rooms or energy centres and increased riser space. With only the possibility of a future connection a site wide network becomes unfeasible. Recuperating high capital costs and high fixed operation and maintenance costs associated with operating an energy centre divided between so few final customers becomes significantly expensive for the occupants.



- This has been considered in line with Camden's Policy CC1 which encourages the **highest financially feasible** environmental standards (during construction **and occupation**).
- 6.8 A site-wide heat network would be uneconomical for 19 small units with minimised heat demands. The following details specific disadvantages associated with applying an on-site community heating scheme:
 - > **Diversity of demand:** Communal boilers can run more efficiently in developments where there is a diversity of energy demand resulting in a more constant load. A large mixed-use scheme, or a large residential scheme (>1000 homes) will have extended periods of the day in which there is a continuous demand for heat. On a small residential scheme such as this, there will be long periods of low or very low heat demand with two sharp peaks in demand for hot water in the morning and evening. Sharp peaks in demand must be dealt with the specification of an oversized communal boiler, which would run efficiently at lower loads.
 - > **Space:** The is not space on site to house a communal plant room to house a communal boiler and associated equipment.
 - > **Distribution Heat Losses:** Even the best insulated heating distribution networks have large standing heat losses. When communal systems satisfy a small and intermittent demand, these standing losses will represent a large part (often over 30%) of total demand. CO₂ savings gained within the dwelling through association with a heat network (and potential low carbon heat) may be considerably reduced by the additional losses associated with the network. Furthermore, the build-up of this heat in residential circulation spaces proves hard to dissipate and can increase to an uncomfortable level. Strategies for the rapid ventilation of this heat reduce the efficiency of the system as a whole by throwing heat away.
 - > **Installed Costs:** The installed cost of a heat distribution network benefits from economies of scale when compared with individual heating systems. On a smaller scheme the upfront cost of commercial heating plant must be divided into relatively few numbers of units.
 - > **Running Costs:** Fixed costs associated with the management and operation of a communal plant room must be shared by occupants as part of an energy standing charge; hence the fewer the number of units, the greater the cost for the individual occupant.
- 6.9 It has been concluded that both a connection to a heat network or an onsite heat network (community heating) would be uneconomical and incur high resident heating cost in terms of service charges.
- **6.10** As such the individual gas boiler strategy (and ASHP for the office) from the **Be Lean** stage will be kept.

CO₂ Emissions at *Be Clean* Stage

6.11 Table 10 details the site wide Regulated CO₂ emission reduction of the development after the implementation any *Be Clean* measures.

Table 10: Regulated Carbon Dioxide Emissions at <i>Be Clean</i> Stage					
	Carbon Dioxide Emissions (Tonnes CO₂ per Annum)				
	Domestic	Non-Domestic	Cumulative		
After <i>Be Lean</i> Measures	32.62	3.39	36.01		
After Be Clean Measures	32.62	3.39	36.01		
Total Emissions Reduction	0	0	0		
Percentage Reduction	0%	0%	0%		



7. BE GREEN: RENEWABLE ENERGY

- 7.1 The final part of the London Plan Energy Hierarchy is *Be Green* which seeks for renewable energy technologies to be specified to provide, where feasible, a reduction in expected CO₂ emissions (Policy 5.7). Camden's key messages in the CGP also looks toward low and zero carbon technologies to reduce CO₂ a further 20%.
- **7.2** Due to the prioritisation and optimisation of energy efficiency measures, the requirement for low carbon and renewable energy technologies is reduced.
- **7.3** This section will summarise low carbon and renewable technologies along with their feasibility. A feasibility table is presented in **Appendix F**.

Biomass Boiler

- **7.4** Biomass boilers generate heat on a renewable basis as they are run on biomass fuel which can be considered as carbon neutral. A biomass boiler would require a central plant room and heat distribution network and would therefore be liable to high capital and running costs.
- 7.5 Additional plant equipment would be required to limit wood burning on the local air quality.
- **7.6** Biomass boilers have therefore been considered not appropriate for this scheme.

Ground and Air Source Heat Pumps (GSHPs and ASHPs)

- 7.7 Heat Pumps upgrade energy from the ground or air and utilise it for space heating and hot water. Heat Pumps are able to provide substantial reductions in energy. This space heating demand has been reduced by the energy efficiency measure detailed in the *Be Lean* chapter.
- **7.8** Ground Source Heat Pumps (GSHPs) require costly ground excavation works to bury the coils boreholes would be required for the proposed development due to the high space requirements of ground coils and this is not possible on this site.
- 7.9 Air Source Heat Pumps (ASHPs) are a more economical alternative to GSHPs as they do not require ground works, but they require external space (e.g. roof or balcony) for the external unit. Suitable space for the individual external units is limited on the development.
- **7.10** ASHPs can provide efficient space heating, for low temperature systems. Hot water is still generally provided by electrical resistance immersion heating (to meet the required higher temperatures) and therefore requires space for a hot water cylinder within the unit.

- **7.11** Electricity is still significantly more expensive than gas, so energy bills are not necessarily reduced by heat pumps as much as by other simpler technologies. Gas boilers have lower maintenance costs than ASHP further reducing the resident's costs.
- **7.12** Considering the above heat pump technology has not been applied to domestic aspect of this development.
- 7.13 Non-domestic areas are more suited to the use of ASHPs as they are able to provide cooling negating the need for an additional air conditioning system. An ASHP has been applied to the non-domestic unit within the *Be Lean* part of the energy hierarchy as it also provides cooling and cannot be considered within the *Be Green* part of the hierarchy.

Wind Turbines

- 7.14 Wind turbines generate electricity via the rotation of the turbine's blades caused by wind. They generally need a minimum constant wind speed of ~5-7m/s. However, the Proposed Development is situated in an urban location. It has been shown that such locations often experience highly turbulent and low speed wind conditions. Because of this, and due to space requirements, the installation of wind turbines would not be a cost effective or appropriate method for the generation of renewable energy on this development.
- **7.15** Wind turbines will therefore not be installed on the site.

Solar Thermal Panels

- 7.16 Solar thermal panels use the sun's energy to generate hot water for each dwelling. Due to the seasonality of solar radiation, solar thermal panels can provide up to ~60% of a dwellings hot water demand, with the remainder being provided as top-up by the conventional gas boiler. They are a robust technology that provides substantial benefits to residents in terms of 'free' energy.
- 7.17 The developments building has some limited flat roof area suitable for solar thermal panel. However, the technical requirements for running the systems heat transfer liquid (usually glycol based) to each of the units on multiple floors would be difficult to practically install.
- **7.18** Solar thermal panels providing CO₂ reductions are linked to providing hot water which limits the CO₂ savings they would provide.
- **7.19** Considering the limited potential CO₂ savings and the technical difficulties (space and dwelling connection) solar thermal panels have not been included within this energy strategy.



Solar Photovoltaics (PV)

- **7.20** PV panels generate electricity from solar radiation. The generating potential of PV panels is not dependent on development demand, but only on available roof space for installation and ensuring that they are not over shaded.
- 7.21 The development is required to include green roofs to meet Camden's Policy CC2c; "Incorporating bio-diverse roofs...". Green roofs increase the biodiversity in an urban area and reduce the urban heat island effect by cooling the local area through evapotranspiration. The prioritisation of green roofs reduces the available roof space for PV due to the additional weight loads and wind (ballast) required.
- 7.22 Therefore, it is not proposed to install any PV due to already achieving target CO₂ reductions by following the energy hierarchy in the most appropriate manner. This reflects Policy 5.7 (B) of the London Plan which states provision of renewables is 'within the framework of the energy hierarchy', which firmly requires energy efficiency measures to be prioritised. In line with the hierarchy, the CO₂ reductions required by policy are achieved through **Be Lean** measures alone.
- **7.23** A roof plan is shown in **Appendix G**.

Be Green Summary

- **7.24** Significant CO₂ emissions savings have been made at the *Be Lean* stage. It is not proposed to install renewable energy technologies since the energy hierarchy has been appropriately followed to maximise CO₂ reductions in the most appropriate manner.
- **7.25** Roof mounted low and zero carbon technologies have been considered, but on balance a green roof would be a more suitable allocation of space providing biodiversity, pleasing view, and localised cooling.

8. ZERO CARBON HOMES

- 8.1 London Plan Policy 5.6 required all domestic major developments to be Zero Carbon by 2016. The GLA has stipulated that 'Zero Carbon' requires all Regulated CO₂ emission to removed; where this cannot be achieved onsite this will be through a carbon offset payment to the Local Authority
- 8.2 Camden's Policy CC1 promotes Zero Carbon development. 'Zero Carbon' has been defined by the Government as reducing Regulated CO₂ to zero. The CPG state the Council may accept the provision of carbon reduction measures elsewhere in the borough or secure a S106 financial contribution to Camden's Carbon Offset Fund if the CO₂ standards have not been met. Camden has aligned their carbon offsetting price to the GLAs; £60 per tonnes per annum for 30 years.
- **8.3** The 'Zero Carbon' Policy will only apply to dwellings. Domestic Regulated CO₂ emission after the application of **Be Lean** measures totals 32.62 Tonnes CO₂ per Annum (see).
- 8.4 The Applicant will offset this remaining CO₂ following further discussion and agreement with the London Borough of Camden.

Table 11: Zero Carbon Homes Offset Payment			
Residential Residual CO ₂ emissions (Tonnes CO ₂ per Annum)	32.62 t.CO ₂ /a		
Carbon Offset Price per Tonne CO ₂	£60		
Carbon Offset Price per Tonne CO ₂ for lifetime of building (30 years)	£1,800		
Total Carbon Offset Payment	£58,716.00		



9. SUMMARY

- 9.1 This Energy Statement provides an energy strategy for the development at 17, 25 and 27 Ferdinand Street which comprises of the erection of additional 4th and 5th floors, 5 storey extension to courtyard (west) elevation, single storey extension to east elevation at 17 and 27 Ferdinand Street and redevelopment of 25 Ferdinand Street to create a 5 storey building to provide 10 additional residential units (19 units in total including 9 in situ) and 103m² Class B1a office floorspace.
- 9.2 The energy strategy has been formulated following The London Plan Energy Hierarchy: *Be Lean*, *Be Clean* and *Be Green*. The overriding objective in the formulation of the strategy is to maximise the reductions in Regulated CO₂ emissions through the application of this Hierarchy with a cost-effective, viable and technically appropriate approach.
- 9.3 The development will be registered to Approved Document (AD) Part L1B (dwellings) and AD Part L2B (office). Conversions (and change of use) require special attention to ensure a holistic approach to energy reductions includes other considerations such as moisture management, ventilation, and traditional look. However, significant CO₂ reduction can be achieved with through-through performance uplifts benefiting the development.
- **9.4** A range of advanced *Be Lean* energy efficiency measures are proposed including upgrading all thermal elements in the conversion and for the new builds; low U-values psi-values (and thermal bridge).
- Part L1B and L2B (2013). Improving existing thermal elements in the conversion, reducing air leakiness, and selective high performing materials for new thermal elements all assist in the conversions to exceed the original buildings CO₂ baseline by **49.5**%.
- 9.6 Target Emissions Rate (TER) and Target Fabric Energy Efficiency (TFEE) have been taken from energy assessments based on the pre-developed building specification. In this manner we can state the improvement upon the existing building in terms of Regulated CO₂ emissions end fabric energy efficiency.
- **9.7** This represents a good level of sustainable design and construction and indicates the Applicant's commitment to reducing energy demands across the site.
- 9.8 In line with the London Plan, the feasibility of decentralised energy production as a *Be Clean* measure has been carefully examined. There are no existing district heat networks in proximity to the site. Due to the small number of dwellings and space restrictions of the Development site a sitewide communal heating scheme has not been deemed viable, this is inline with the Greater London Authority (GLA) guidance on energy statements.

- 9.9 Significant CO₂ emissions savings have been maximised and made at the *Be Lean* stage. Although not selected, the full spectrum of *Be Green* renewable energy generating technologies has been considered.
- The 35% reduction in on-site Regulated CO₂ emissions has been exceeded and the development is considered compliant with London Plan Policy 5.2 and Camden's CC01 policy. Policy 5.7 (B) of the London Plan states provision of renewables is 'within the framework of the energy hierarchy', which firmly requires energy efficiency measures to be prioritised.
- **9.11** Table 12 below summarises the anticipated Domestic CO₂ emissions savings across the scheme. As shown, the combination of *Be Lean* measures results in an exceedance of the 35% CO₂ reduction requirement. *Be Clean* and *Be Green* measures are shown in the table for completion, although the on-site policy target if wholly met within the *Be Lean* Measures.
- **9.12** In line with the GLA Housing Supplementary Planning Guidance, the development will commit to offset the remaining domestic CO₂ emissions. The remaining CO₂ emissions to be offset should be based upon **32.62 Tonnes CO₂ per annum**.

Table 12: Domestic Carbon Dioxide Emission	ns and Savings after each stage	of the Energy Hierarchy	
Stage	Carbon Dioxide Emissions (Tonnes CO₂ per Annum)		
	Regulated	Unregulated	
Baseline	64.51	23.58	
After Be Lean Measures	32.62	23.58	
After Be Clean Measures	32.62	23.58	
After Be Green Measures	32.62	23.58	
After Carbon off-setting	0	23.58	
Stage	Regulated Carbon Dioxide Savings		
	Tonnes CO ₂ per Annum	Percentage	
Savings from Be Lean Measures	31.89	49.4%	
Savings from Be Clean Measures	0	0%	
Savings from Be Green Measures	0	0%	
After Carbon off-setting	32.62	50.6%	
Cumulative Savings	64.51	100%	



9.13 The Non-domestic area is expected to realise a 50% reduction in Regulated CO₂ emissions, see Table 13 below.

Table 13: Non-Domestic Carbon Dioxide Hierarchy	Emissions and Savings after each s	stage of the Energy		
Stage	Carbon Dioxide Emission	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)		
	Regulated	Unregulated		
Baseline	6.82	2.25		
After Be Lean Measures	3.39	2.25		
After Be Clean Measures	3.39	2.25		
After Be Green Measures	3.39	2.25		
Stage	Regulated Carbo	Regulated Carbon Dioxide Savings		
	Tonnes CO ₂ per Annum	Percentage		
Savings from Be Lean Measures	3.43	50.3%		
Savings from Be Clean Measures	0	0%		
Savings from Be Green Measures	0	0%		
Cumulative Savings	3.43	50.3%		

9.14 Following the energy hierarchy and accounting for Carbon Offsetting the Proposed Development is expected to reduce 95.3% of the developments Regulated CO₂ emissions, see Table 14 below.

Table 14: Total Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy			
Stage	Carbon Dioxide Emissions (Tonnes CO₂ per Annum)		
	Regulated	Unregulated	
Baseline	71.33	25.83	
After Be Lean Measures	36.01	25.83	
After Be Clean Measures	36.01	25.83	
After Be Green Measures	36.01	25.83	
After Carbon off-setting	3.39	25.83	
Stage	Regulated Carbon Dioxide Savings		
	Tonnes CO ₂ per Annum	Percentage	
Savings from Be Lean Measures	35.32	49.5%	
Savings from Be Clean Measures	0	0%	
Savings from Be Green Measures	0	0%	
After Carbon off-setting	32.62	45.8%	
Cumulative Savings	67.94	95.3%	

APPENDICES

Appendix A

Summary Baseline and *Be Lean* CO₂ emissions and Fabric Energy Efficiency

Appendix B

Domestic Pre-Conversion DER Worksheets (TER baseline)

Appendix C

Non-Domestic Pre-Conversion BRUKL report (TER Baseline)

Appendix D

Domestic *Be Lean* Dwelling Emission Rate (DER) worksheets

Appendix E

Non- Domestic *Be Lean* BRUKL report

Appendix F

Low and Zero Carbon Technology Feasibility Table

Appendix G

Roof Plans

Appendix A

Summary Baseline and *Be Lean* CO₂ emissions and Fabric Energy Efficiency

Appendix A

CO ₂ Emissions at Be Lean Stage

		<u>Individual</u>			<u>To</u>	<u>tal</u>		
		Dwelling	Target Emissions			Dwelling	Target Emissions	Emissions Rate
Unit Type Description	Unit Floor Area	Emissions Rate	Rate	Number of Units	Total Floor Area	Emissions Rate	Rate	Improvement
Domestic	m ²	kg CO ² /m ² /year	kg CO ² /m ² /year		m ²	kg CO²/year	kg CO²/year	-
Mid Floor dwelling	53	26.2	51.7	10	530	13,907	27,411	49.3%
Mid floor dwellings with heat loss roof and Ground Floors	68	23.2	51.9	7	475	11,035	24,669	55.3%
Top Floor dwellings	110	34.9	56.6	2	220	7,679	12,432	38.2%
			Domestic Subtotal	19	1,225	32,621	64,512	49.4%
Non-domestic								
Office	103	32.9	66.2	1	103	3,389	6,819	50.3%
		Non-	Domestic Subtotal		103	3,389	6,819	50.3%
			Total for All Units		1,328	36,010	71,331	49.5%

Fabric Energy Efficiency

	11 3 El A	Individual Dwelling Fabric	Target Fabric	N 1 (1) 2		tal Dwelling Fabric	1	Fabric Energy Efficiency
Unit Type Description	Unit Floor Area	Energy Efficiency	Energy Efficiency	Number of Units	Total Floor Area	Energy Efficiency	Energy Efficiency	Improvement
Domestic								
Mid Floor dwelling	53	67.6	178.7	10	530	35,866	94,756	62.1%
Mid floor dwellings with heat loss roof and Ground Floors	68	61.5	175.6	7	475	29,203	83,469	65.0%
Top Floor dwellings	110	121.3	206.1	2	220	26,658	45,307	41.2%
		Floor	Weighted Average	19	1,225	74.8	182.4	59.0%



Appendix B

Domestic Pre-Conversion DER Worksheets (TER baseline)



Property Reference	Plot 04				Issued on Date	24/06/2019
Assessment	Baseline		Pro	p Type Ref	VIId	
Reference						
Property	Plot 014, Ferdinand Stree	t, Camden, LC	NDON, LONDON, 1	NW1 8EU		
SAP Rating		66 D	DER	51.68	TER	21.02
Environmental		64 D	% DER <ter< th=""><th></th><th>-145.87</th><th></th></ter<>		-145.87	
CO ₂ Emissions (t/ye	ear)	2.25	DFEE	178.65	TFEE	56.54
General Requireme	ents Compliance	Fail	% DFEE <tfee< th=""><th></th><th>-215.95</th><th></th></tfee<>		-215.95	
Assessor Details	Mr. Simon Gowing, Simon Go Simon@hodkinsonconsultan	0,	36031616,		Assessor ID	T271-0001
Client						

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS CO				
	MPLIANCE REPORT - APPT	oved Document L1A, 2013 Edition	, England	
DWELLING AS DE	SIGNED			
Mid-floor flat	, total floor area 53	2		
It is not a co	mplete report of regul			
la TER and DER				
	heating:Mains gas			
Fuel factor:1. Target Carbon	00 (mains gas) Dioxide Emission Rate	(TER) 21 02 kaCOT/m²		
Dwelling Carbo	n Dioxide Emission Rat	e (DER) 51.68 kgCOU/m²Fail		
Excess emissio	ns =30.66 kgCO□/m² (1	46.0%)		
1b TFEE and DF				
Target Fabric	Energy Efficiency (TFE	E)56.5 kWh/m²/yr		
Dwelling Fabri	c Energy Efficiency (D =122.2 kWh/m²/yr (216	FEE)178.7 kWh/m²/yrFail		
	-122.2 KWII/III-/ YI (210			
2 Fabric U-val		Highest		
	Average 0.96 (max. 0.30)	1.21 (max. 0.70) F	ail	
Party wall	0.00 (max. 0.20)	- 0		
Floor	(no floor)			
Roof Onenings	(no roof) 4.43 (max. 2.00)	4.80 (max. 3.30) F	ail	
2a Thermal bri		5		
	ng calculated using de			
3 Air permeabi	lity			
Air permeabili	ty at 50 pascals:	15.00 (assumed)	OK	
4 Heating effi				
Main heating s		Boiler system with radiator	s or underfloor - Mains gas	
Data from data	base nstar 29CDi Classic Er	D.		
Combi boiler	HSCAL 29CDI CIASSIC EL	F		
Efficiency: 89 Minimum: 88.0%				
		OK		
Secondary heat	ing system:	OK None		
Secondary heat 	ing system: 	None No cylinder		
Secondary heat 5 Cylinder ins Hot water stor	ing system: ulation age	None		
Secondary heat 5 Cylinder ins Hot water stor 6 Controls	ing system: ulation age	None No cylinder		
Secondary heat 5 Cylinder ins Hot water stor 6 Controls Space heating	ing system:	None No cylinder		
Secondary heat	ing system:	No cylinder Programmer and at least two		
Secondary heat 5 Cylinder ins Hot water stor 6 Controls Space heating Hot water cont	ing system: ulation age controls: rols:	No cylinder Programmer and at least two	room thermostats OK	
Secondary heat 5 Cylinder ins Hot water stor 6 Controls Space heating Hot water cont Boiler interlo 7 Low energy 1	ing system: ulation age controls: rols: ck	No cylinder Programmer and at least two No cylinder Yes	room thermostats OK	
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Secondary heat 5 Cylinder ins Hot water stor 6 Controls Space heating Hot water cont Boiler interlo 7 Low energy 1 Percentage of Minimum Not applicable 9 Summertime t 9 Summertime t	ing system: plation controls: rols: ck ights fixed lights with low- entilation	None No cylinder Programmer and at least two No cylinder Yes energy fittings:100% 75%	room thermostats OK OK OK	
Secondary heat 5 Cylinder ins 16 to water stor 6 Controls Space heating Hot water cont Boiler interlo 7 Low energy 1 Percentage of Minimum 8 Mechanical v Not applicable 10 Summertiele 10 Verheating ri Based on:	ing system: ulation ugge controls: rols: ck ights fixed lights with low- mentilation emperature	None No cylinder Programmer and at least two No cylinder Yes energy fittings:100% 75% Slight	room thermostats OK OK OK	
Secondary heat 5 Cylinder ins Hot water stor 6 Controls Space heating Hot water cont Boiler interlo 7 Low energy 1 Fercentage of Minimum Not applicable 9 Summertime t Overheating if	ing system: ulation upge controls: rols: ck lights fixed lights with low- entilation emperature sk (Thames Valley):	None No cylinder Programmer and at least two No cylinder Yes energy fittings:100% 75%	room thermostats OK OK OK	
Secondary heat 5 Cylinder ins 16 to water stor 6 Controls Space heating Hot water cont Boiler interlo 7 Low energy 1 Percentage of Minimum 8 Mechanical v Not applicable 9 Summertime t Overheating ri Based on: Windows facing Windows facing Air change rat	ing system: ulation under a controls: rols: ck lights fixed lights with low- entilation emperature sk (Thames Valley): West: entiletion	None No cylinder Programmer and at least two No cylinder Yes energy fittings:100% 75% 75% 75% No cylinder Yes 10,56 m², No overhang 3,00 ach	room thermostats OK OK OK OK	
Secondary heat S Cylinder ins Cylinder ins Controls Cylinder ins Controls Space heating Hot water cont Boiler interlo T Low energy 1 Percentage of Minimum S Mechanical v Mot applicable 9 Summertime t Govershading in Based on: Overshading in Air change rat Linds/curtain	ing system: ulation gg controls: rols: ck dghts fixed lights with low- entilation emperature sk (Thames Valley): Rest: s: s:	None No cylinder Programmer and at least two No cylinder Yes energy fittings:100% 75% Slight Average 19.55 sg No overhang 1,00 ach Dark-coloured curtain or ro	room thermostats OK OK OK OK Iter blind, closed 100% of daylight h	houri
Secondary heat 5 Cylinder ins. 16 Cylinder ins. 16 Controls Space heating Hot water cont. Boiler instello 7 Low energy 1 Percentage of Minimum Not applicable 9 Sementians 0 Sementians 0 Overheading: Windows facing Coverheading: Windows facing Bainds/curtain Blinds/curtain	ing system: ulation age controls: rols: ck dights fixed lights with low- entilation emperature ak (themes Valley): West:	None No cylinder Programmer and at least two No cylinder Yes energy fittings:100% 75% Slight Average 19.55 sg No overhang 1,00 ach Dark-coloured curtain or ro	room thermostats OK OK OK OK	hour
Secondary heat 5 Cylinder ins 5 Cylinder ins 6 Controls 6 Controls Space heating Hot water cont Boiler interlo 7 Low energy 1 Percentage of Minimum 3 Mechanical v Mot applicable 9 Summertime t Governheating in Based on: Oversheating in Based on: Oversheating in Based on: Oversheating in Based individual in	ing system: plation gge controls: ck lights fixed lights with low- entilation emperature sk (Thames Valley): West: 8: 5: 5: 5: 5: 6: 6: 6: 6: 6: 6	None No cylinder Programmer and at least two No cylinder Yes energy fittings:100% 75% Slight Average 19.55 sg No overhang 1,00 ach Dark-coloured curtain or ro	room thermostats OK OK OK OK Iter blind, closed 100% of daylight h	hourr





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

CALCULATIO	ON OF I	OWELLING	G EMISSI	ONS FOR	REGULA	HONS C	JMPLIAN	ICE 05	Jan 2014				
SAP 2012 WORKSHI	EET FOR N	ew Build (As	Besigned)	(Version	9.92, Janua								
CALCULATION OF						Jan 2014							
1. Overall dwel	ling dime	nsions											
								Area	Sto	rey height		Volume	
Ground floor Total floor are	a TFA = (la)+(lb)+(lc	c)+(1d)+(1e) (In)		53.0400		(m2) 53.0400	(1b) x	(m) 2.8000	(2b) =	(m3) 148.5120	(1b) - (3
Dwelling volume								(3a) + (3b) + (3c))+(3d)+(3e)	(3n) =	148.5120	(5)
2. Ventilation	rate												
					main heating	s	econdary heating		other	tot		3 per hour	
Number of chimne Number of open : Number of inter	flues				0	+	0	+	0 .		0 * 40 = 0 * 20 = 2 * 10 =	0.0000 0.0000 20.0000	(6b)
Number of inters Number of passi Number of fluels	ve vents										0 * 10 = 0 * 40 =	0.0000	(7b)
Infiltration due	o ko obim	51	and form	- (60)+(60	11/7011/7611	(70) -				20 0000	Air change / (5) =	s per hour 0.1347	(0)
Pressure test Measured/design	AP50	neys, riues	and rans	= (04)+(05	7+(74)+(75)+	(70) -				20.0000	/ (3) =	No 15.0000	
Infiltration ra Number of sides	te sheltere	d										0.8847	(18)
Shelter factor Infiltration ra	te adjust	ed to includ	de shelter	factor					(20) = 1	- [0.075 x 21) = (18)	(19)] = x (20) =	0.9250 0.8183	
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	1.0434	1.0229	1.0024	0.9002	0.8797	0.7774	0.7774	0.7569	0.8183	0.8797	0.9206	0.9615	
Effective ac	1.0434	1.0229	1.0024	0.9051	0.8869	0.8022	0.8022	0.7865	0.8348	0.8869	0.9238	0.9623	(25)
3. Heat losses													
Element Orginal (Uw = 4	80)			Gross m2	Openings m2		m2 .5600	U-value W/m2K 4.0268	A x W, 78.76	/K	-value kJ/m2K	A x K kJ/K	(27)
Corridor Door Corridor	,			42.0300	2.1000	2 39	.1000 .9300	1.0000 0.7266	2.10	00 19			(26) (29a)
Bick Wall Total net area (Fabric heat los:	of extern s, W/K =	al elements Sum (A x U)	Aum(A, m2)	57.3200	19.5600		.7600 .3500 (26)(1.2100	45.68				(29a) (31) (33)
Party Wall 1 Party Floor 1 Party Ceilings						53	.8000 .0400	0.0000	0.00	00			(32) (32d) (32h)
Thermal mass pa	rameter (TMP = Cm / T	FFA) in kJ/	m2K		23	.0400					250.0000	(35)
Thermal bridges Total fabric hea	(Default at loss	value 0.150) * total e	xposed area)					(33)	+ (36) =	14.9025 170.4721	(36)
Ventilation hear	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer c	51.1338 oeff 221 6059	50.1312	49.1286	44.3598	43.4675	39.3139	39.3139	38.5447	40.9138	43.4675	45.2725	47.1596	
Average = Sum(3		= Feb		_		_	Jul		_			214.8227	(39)
HLP HLP (average)	Jan 4.1781	4.1592	Mar 4.1403	Apr 4.0504	May 4.0336	Jun 3.9552	3.9552	Aug 3.9407	Sep 3.9854	0ct 4.0336	Nov 4.0676	Dec 4.1032 4.0502	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heating	a energy	remi rements	k (kWh/vear										
Assumed occupan	cy											1.7797	
Average daily h	ot water : Jan	use (litres) Feb	/day) Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	76.4688 Dec	(43)
		81.0570 109.0994	77.9982 112.5808	74.9394	71.8807	68.8219	68.8219	71.8807	74.9394	77.9982	81.0570	84.1157 120.8052	
Energy conte Energy content Distribution los	(annual)	= 0.15 x (4	15)m	98.1507	94.1779	81.2684	75.3071	86.4160	87.4481	101.9123 Total = S	111.2453 um(45)m =	120.8052 1203.1524	
Water storage 1	18.7112 oss:	16.3649	16.8871	14.7226	14.1267	12.1903	11.2961	12.9624	13.1172	15.2868	16.6868	18.1208	(46)
Total storage 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULAT	ION OF I	OWELLIN	IG EMISSI	ONS FO	R REGULA	TIONS CO	OMPLIAN	ICE 09	Jan 2014	ı			
If cylinder co	ntains ded	icated sola	ar storage										
Combi loss	0.0000 39.0655	0.0000 35.2470	0.0000 38.9628	0.0000 37.6374	0.0000 38.8421	0.0000 37.5317	0.0000 38.7469	0.0000 38.8087	0.0000 37.5893	0.0000 38.9129	0.0000 37.7371	0.0000 39.0457	(57) (61)
Total heat red	163.8067	144.3464	151.5437	135.7881	133.0201	118.8001	114.0540	125.2247	125.0374	140.8252	148.9824	159.8508	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 Solar inp	0.0000 ut (sum of	0.0000 months) = S	0.0000 um(63)m =	0.0000	(63) (63)
Output from w	h 163.8067	144.3464	151.5437	135.7881	133.0201	118.8001	114.0540	125.2247	125.0374	140.8252 h/year) = S	148.9824	159.8508 1661.2796	
Heat gains fro	m water he 51.2428	ating, kWh/ 45.0873	month 47.1738	42.0445	41.0247	36.4047	34.7263	38.4355	38.4738		46.4233	49.9291	
5. Internal ga		able 5 and	5a)										
Metabolic gair	s (Table 5), Watts		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66) m	88.9870	88.9870	88.9870	88.9870	88.9870	88.9870	88.9870	88.9870	88.9870	88.9870	88.9870	88.9870	(66)
Lighting gains Appliances gas	13.8292	12.2830	9.9892	7.5624	5.6530	4.7725	5.1569	6.7031	8.9969	11.4236	13.3330	14.2135	(67)
	155.1214	156.7311	152.6747	144.0393	133.1386	122.8935	116.0491	114.4394	118.4958	127.1312	138.0319	148.2770	(68)
Cooking gains	31.8987 3.0000	31.8987 3.0000	31.8987	31.8987 3.0000	31.8987	31.8987 3.0000	31.8987 3.0000	31.8987 3.0000	31.8987 3.0000	31.8987	31.8987 3.0000	31.8987	
Losses e.g. e	aporation	(negative v	3.0000 values) (Tab	le 5)	-71 1896	-71 1896							
Water heating	-71.1896 gains (Tab	le 5)	-71.1896				-71.1896	-71.1896	-71.1896	-71.1896	-71.1896	-71.1896	
Total interna	68.8748 gains	67.0942	63.4057	58.3951	55.1407	50.5620	46.6752	51.6606	53.4359	58.6211	64.4769	67.1090	
	290.5214	288.8043	278.7657	262.6929	246.6284	230.9241	220.5773	225.4992	233.6246	249.8720	268.5379	282.2957	(73)
6 Solar gains													
6. Solar gains													
[Jan]			λ	rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	or	Gains W	
West			19.5	600	19.6403		0.6300	0	.8000	0.77	00	134.1776	(80)
Solar gains Total gains	134.1776 424.6990	262.4798 551.2841	432.2668	630.4354	772.6223 1019.2507	790.9164	752.9846 973.5619	646.8027 872.3019	502.7442 736.3688	311.4544 561.3264	167.3037 435.8416	110.3411	
7. Mean inter													
Temperature de Utilisation fo	ring heati ctor for g	ng periods ains for li	in the livi iving area,	ng area fro nil,m (see	om Table 9, Table 9a)							21.0000	(85)
tau	16.6211	16.6966	16.7729	17.1452	17.2167	Jun 17.5576	Jul 17.5576	Aug 17.6222	Sep 17.4247	Oct 17.2167	Nov 17.0727	Dec 16.9246	
alpha util living as	2.1081 ea	2.1131	2.1182	2.1430		2.1705	2.1705	2.1748	2.1616	2.1478	2.1382	2.1283	
	0.9908	0.9835	0.9673	0.9311	0.8680	0.7719	0.6662	0.7177	0.8723	0.9607	0.9861	0.9923	
MIT Th 2 util rest of h	17.2567 18.2766	17.5578 18.2824	18.1383 18.2882	18.9517 18.3168	19.7172 18.3222	20.3510 18.3484	20.6783 18.3484	20.6062 18.3534	20.0469 18.3382	19.0430 18.3222	18.0296 18.3112	17.2390 18.2998	
MIT 2	0.9869 15.2202	0.9764 15.5214	0.9522 16.0968	0.8951 16.8991	0.7857 17.6071	0.5915 18.1352	0.3472 18.3147	0.4156 18.2996	0.7478 17.9351	0.9328 17.0121	0.9789 16.0078	0.9890 15.2139	(90)
Living area for MIT	action 16.1970	16.4981	17.0760	17.8836	18.6192	19.1980	19.4484	19.4060	fLA =	Living are 17.9862	a / (4) = 16.9775	0.4796 16.1852	(91)
Temperature adjusted MIT	ljustment 16.0470	16.3481	16.9260	17.7336	18.4692	19.0480	19.2984	19.2560	18.7980	17.8362	16.8275	-0.1500 16.0352	(93)
8. Space heat:													
		Feb					Jul						
Utilisation	Jan 0.9816 416 8947	0.9684	Mar 0.9405 668 7539	Apr 0.8839 789 4017	May 0.7918 807 0311	Jun 0.6530 667 2633	Jul 0.4901 477 1056	Aug 0.5491 478 9782	Sep 0.7786 573 3092	Oct 0.9248 519 1034	Nov 0.9723 423 7683	Dec 0.9845 386 5450	(94)
Useful gains Ext temp.	4.3000	4.9000	668.7539 6.5000	789.4017 8.9000	807.0311 11.7000	667.2633 14.6000	477.1056 16.6000	478.9782 16.4000	573.3092 14.1000	10.6000	423.7683 7.1000	386.5450 4.2000	
Heat loss rate	2603.2015		2289.5512	1897.7465	1448.2035	933.1243	566.0830	596.9418	993.0892	1548.1106	2098.6660	2575.7134	
Month fracti Space heating	1.0000 kWh	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000		1.0000	1.0000	
Space heating Space heating		1330.3094	1205.8732	796.0063	477.0323	0.0000	0.0000	0.0000	0.0000) / (4) =	9046.1643 170.5536	(98)
8c. Space cool		ement											
Not applicable													
9a. Energy red	puirements -	- Individua	al heating s	ystems, in	cluding micr	o-CHP							





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat fro Fraction of space heat fro Efficiency of main space h Efficiency of secondary/su Space heating requirement	m main sy eating sy	stem(s) stem 1 (in 4	i:)	n (Table 11)	,						0.0000 1.0000 90.0000 0.0000 10051.2937	(202) (206) (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement 1626.6122 1	338.3894	1205.8732	798.0083	477.0323	0.0000	0.0000	0.0000	0.0000	765.5814	1205.9263	1628.7412	(98)
Space heating efficiency (90.0000	main heat	ing system 1	L)	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	
Space heating fuel (main h 1807.3469 1			996 6750	E20 02E8	0.0000	0.0000	0.0000	0.0000	850.6460	1220 0101	1900 7125	(211)
Water heating requirement		0.0000	0.0000	0.0000		0.0000		0.0000	0.0000	0.0000		
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating Water heating requirement												
163.8067 Efficiency of water heater		151.5437	135.7881	133.0201	118.8001	114.0540	125.2247	125.0374	140.8252	148.9824	159.8508 86.7000	
(217)m 89.6877 Fuel for water heating, kW	89.6677	89.6192	89.5046	89.2592	86.7000	86.7000	86.7000	86.7000	89.4709	89.6249		
182.6413 Water heating fuel used		169.0974	151.7108	149.0267	137.0243	131.5502	144.4345	144.2184	157.3978	166.2288	178.2162 1872.5255	
Annual totals kWh/year												
Space heating fuel - main Space heating fuel - secon											10051.2937 0.0000	
Electricity for pumps and central heating pump main heating flue fan Total electricity for the Electricity for lighting (Total delivered energy for	above, kW	d in Appendi	ix L)								30.0000 45.0000 75.0000 244.2277 12243.0469	(230e) (231) (232)
12a. Carbon dioxide emissi	ons - Ind	ividual heat	ing systems	s including	micro-CHP							
Space heating - main syste Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans Energy for lighting Total CO2, Kg/year Dwelling Carbon Dioxide Em	m 1						Energy kWh/year 10051.2937 0.0000 1872.5255 75.0000 244.2277		ion factor kg CO2/kWh 0.2160 0.0000 0.2160 0.5190 0.5190	3	Emissions cg CO2/year 2171.0794 0.0000 404.4655 2575.5449 38.9250 126.7542 2741.2241 51.6800	(261) (263) (264) (265) (267) (268) (272)
18 COC EMISSIONS ASSOCIATE DER TOTAL PROOF Area Assumed number of occupant CO2 emissions from applian CO2 emissions from applian CO2 emissions from cooking Total CO2 emissions aff Residual CO2 emissions of Residual CO2 emissions of Residual CO2 emissions of Net CO2 emissions of Net CO2 emissions of Net CO2 emissions of Net CO2 emissions	s le 12 for ces, equa , equatio set from ricity ge	electricity tion (L14) n (L16) biofuel CHP neration, kV	y displaced Wh/m²/year	from grid		TY GENERATI	ON TECHNOLO	SIES		TFA N EF	51.6800 53.0400 1.7797 0.5190 17.3306 3.0489 72.0595 0.0000 0.0000 72.0595	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHI CALCULATION OF I	EET FOR Ne	ew Build (As ERGY EFFICIE	Designed)	(Version 9 Jan 2014	9.92, Janua	ry 2014)							
1. Overall dwell	ling dimer	nsions											
Ground floor Total floor area Dwelling volume	a TFA = ()	ia)+(lb)+(lo	c) + (1d) + (1e)(ln)		53.0400		Area (m2) 53.0400		rey height (m) 2.8000)+(3d)+(3e)		Volume (m3) 148.5120 148.5120	(1b) - (
2. Ventilation	rate												
Number of chimne Number of open ! Number of inters Number of passi Number of fluele	flues mittent fa ve vents				main heating 0 0	+ +	econdary heating 0 0	+ +	other 0 0	tot -	0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 20.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration due Pressure test Measured/design Infiltration rat Number of sides	AP50 te		and fans	= (6a)+(6b)+(7a)+(7b)+	(7c) =				20.0000	Air change / (5) =	es per hour 0.1347 No 15.0000 0.8847	
Shelter factor Infiltration rat	te adjuste	ed to includ	de shelter	factor					(20) = 1 (- [0.075 x 21) = (18)	(19)] = x (20) =	0.9250 0.8183	(20) (21)
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	1.0434	1.0229	1.0024	0.9002 0.9051	0.8797 0.8869	0.7774 0.8022	0.7774 0.8022	0.7569 0.7865	0.8183 0.8348	0.8797 0.8869	0.9206 0.9238	0.9615 0.9623	(22b) (25)
3. Heat losses	and heat	Loss paramet	er										
Element Orginal (Uw = 4. Corridor Door Corridor Bick Wall Total net area of Fabric heat loss Party Wall 1 Party Floor 1	of externa s, W/K = S		Aum(A, m2)	Gross m2 42.0300 57.3200	Openings m2 2.1000 19.5600	19 2 39 37 99	.8000	U-value W/m2K 4.0268 1.0000 0.7266 1.2100 30) + (32) 0.0000	A x W, 78.76; 2.100 29.01: 45.68: = 155.56: 0.000	/K 51 00 49 96	-value kJ/m2K	A x K kJ/K	(27) (26) (29a) (29a) (31) (33) (32) (32d)
Party Ceilings : Thermal mass par Thermal bridges	rameter (PMP = Cm / 5	FFA) in kJ/) * total e	m2K xposed area)	53	.0400					250.0000 14.9025	(36)
Total fabric heat Ventilation heat	t loss cal	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	+ (36) =	170.4721 Dec	
(38) m Heat transfer co Average = Sum (39	221.6059	50.1312	49.1286 219.6007	44.3598 214.8318	43.4675 213.9396	39.3139 209.7860	39.3139 209.7860	38.5447 209.0168	40.9138	43.4675 213.9396	45.2725 215.7446	47.1596 217.6317 214.8227	(39)
HLP HLP (average)	Jan 4.1781	Feb 4.1592	Mar 4.1403	Apr 4.0504	May 4.0336	Jun 3.9552	Jul 3.9552	Aug 3.9407	Sep 3.9854	Oct 4.0336	Nov 4.0676	Dec 4.1032 4.0502	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30		(41)
4. Water heating	 ≎y)								1.7797 76.4688	
B-21 b-1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte :	84.1157 124.7412 (annual)	81.0570 109.0994	77.9982 112.5808	74.9394 98.1507	71.8807 94.1779	68.8219 81.2684	68.8219 75.3071	71.8807 86.4160	74.9394 87.4481	77.9982 101.9123 Total = S	81.0570 111.2453 um(45)m =	84.1157 120.8052 1203.1524	(45)
Distribution los Water storage lo Total storage lo	0.0000 oss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)





CALCULAT	ION OF	FABRIC E	NERGY E	FFICIENC	Y 09 Ja	ın 2014							
If cylinder co	ontains ded	licated sola	ır storaqe										
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57) (59)
Heat gains fr	om water he 26.5075	ating, kWh/ 23.1836	month 23.9234	20.8570	20.0128	17.2695	16.0028	18.3634	18.5827	21.6564	23.6396	25.6711	(65)
5. Internal ga			5a)										
Metabolic gair													
(66) m	Jan 88.9870	Feb 88.9870	Mar 88.9870	Apr 88.9870	May 88.9870	Jun 88.9870	Jul 88.9870	Aug 88.9870	Sep 88.9870	Oct 88.9870	Nov 88.9870	Dec 88.9870	(66)
Lighting gain:	13.8292	12.2830	9.9892	7.5624	5.6530	4.7725	5.1569	6.7031	8.9969	11.4236	13.3330	14.2135	(67)
Appliances ga	155.1214	156.7311	152.6747	144.0393	133.1386	122.8935	116.0491	114.4394	118.4958	127.1312	138.0319	148.2770	(68)
Cooking gains	31.8987	31.8987	31.8987	31.8987	31.8987 0 0000	31.8987 0 0000	31.8987 0.0000	31.8987	31.8987	31.8987	31.8987	31.8987	(69)
Pumps, fans Losses e.g. e	0.0000 vaporation	0.0000 (negative v	0.0000 ralues) (Tab	0.0000 ile 5) -71.1896	-71.1896							0.0000	
Water heating	-71.1896 gains (Tab	-71.1896 le 5) 34.4994	-71.1896 32.1551	28.9681	-/1.1896 26.8989	-71.1896 23.9855	-71.1896 21.5091	-71.1896 24.6820	-71.1896 25.8093	-71.1896 29.1080	-71.1896 32.8328	-71.1896	
Total interna	35.6284 L gains 254.2750	253.2096	244.5151	28.9681	25.8989	23.9855	192.4112	195.5206	25.8093	29.1080	233.8938	34.5042 246.6908	
	234.2730	233.2030	244.3131	230.2039	213.3000	201.3470	192.4112	193.3200	202.5501	217.3309	233.0330	240.0300	(13)
6. Solar gain:	3 												
[Jan]			A	m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab	FF data	Acce fact Table	or	Gains W	
West			19.5	600	19.6403		0.6300		.8000	0.77		134.1776	(80)
Solar gains Total gains	134.1776 388.4526	262.4798 515.6894	432.2668 676.7820	630.4354 860.7013	772.6223 988.0089	790.9164 992.2639	752.9846 945.3958	646.8027 842.3233	502.7442 705.7423	311.4544 528.8133	167.3037 401.1975	110.3411 357.0319	
7. Mean inter	nal tempera	ture (heati	ing season)										
Temperature d						Thl (C)						21.0000	(85)
Utilisation for	Jan 16.6211	ains for li Feb 16.6966	War Mar 16.7729	nil,m (see Apr 17.1452	Table 9a) May 17.2167	Jun 17.5576	Jul 17.5576	Aug 17.6222	Sep 17.4247	Oct 17.2167	Nov 17.0727	Dec 16.9246	
tau alpha util living a:	2.1081	2.1131	2.1182	2.1430	2.1478	2.1705	2.1705	2.1748	2.1616	2.1478	2.1382	2.1283	
ucii living a	0.9923	0.9855	0.9701	0.9354	0.8742	0.7805	0.6764	0.7290	0.8805	0.9648	0.9882	0.9936	(86)
MIT Th 2	17.2164 18.2766	17.5189 18.2824	18.1025 18.2882	18.9210 18.3168	19.6928 18.3222	20.3341 18.3484	20.6676 18.3484	20.5922 18.3534	20.0225 18.3382	19.0093 18.3222	17.9911 18.3112	17.1988 18.2998	
util rest of I		0.9792	0.9563	0.9012	0.7943	0.6022	0.3560	0.4272	0.7607	0.9395	0.9820	0.9909	
MIT 2 Living area f:	15.1803 raction	15.4833	16.0626	16.8716	17.5886	18.1271	18.3130	18.2965	17.9190 fLA =		15.9701 a / (4) =	15.1741 0.4796	(91)
MIT Temperature as	16.1569 ijustment	16.4597	17.0410	17.8546	18.5979	19.1857	19.4423	19.3976	18.9279	17.9538	16.9394	16.1453 0.0000	
adjusted MIT	16.1569	16.4597	17.0410	17.8546	18.5979	19.1857	19.4423	19.3976	18.9279	17.9538	16.9394	16.1453	(93)
8. Space heat	ing require	ment											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation Useful gains	0.9848 382.5526	0.9726 501.5503	0.9465 640.6005	0.8928 768.4762	0.8053 795.6743	0.6739 668.7198	0.5192 490.8547	0.5795 488.1285	0.7981 563.2740	0.9340 493.9250	0.9769 391.9156	0.9874 352.5199	(95)
Ext temp. Heat loss rate	4.3000 W 2627 5572	4.9000	6.5000	8.9000	11.7000	14.6000 962 0147	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Month fracti Space heating	1.0000 kWh	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1670.2834	1376.6271	1245.6164	831.7826	505.9586	0.0000	0.0000	0.0000	0.0000		1246.2383	1671.8773 9351.4226	(98)
Space heating	per m2									(98) / (4) =	176.3089	(99)
Bc. Space coo	ling requir	aman+											
Calculated for			st. See Tabl	e 10b									
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000	
Heat loss rate	0.0000	0.0000	0.0000	0.0000	0.0000	1971.9882	1552.4162	1588.5276	0.0000	0.0000	0.0000	0.0000	
Utilisation Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.5143 1014.1176	0.5842 906.8872	0.5369 852.9170	0.0000	0.0000	0.0000	0.0000	(102)
Total gains Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1226.8405	1170.7738	1051.3010	0.0000	0.0000	0.0000	0.0000	(103) (103a)
Space cooling	kWh 0.0000	0.0000	0.0000	0.0000	0.0000	153.1606	196.3316	147.5977	0.0000	0.0000	0.0000	0.0000	
Space cooling Cooled fraction	on								fC =	cooled are	a / (4) =	497.0899 1.0000	

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION OF F.	ABRIC EN	IERGY EF	FICIENCY	09 Ja	n 2014							
Intermittency factor (Tab	le 10b) 0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												()
0.0000	0.0000	0.0000	0.0000	0.0000	38.2901	49.0829	36.8994	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											124.2725	(107)
Space cooling per m2											2.3430	(108)
Energy for space heating											176.3089	(99)
Energy for space cooling											2.3430	(108)
Total											178.6519	(109)
Dwelling Fabric Energy Ef	ficiency (D	FEE)									178.7	(109)





Property Referenc	Plot 14				Issued on Date	24/06/2019
Assessment	Baseline		Pro	op Type Ref	MId With Heat loss	
Reference						
Property	Plot 014, Ferdinand St	treet, Camden, LO	ONDON, LONDON,	NW1 8EU		
SAP Rating		64 D	DER	51.91	TER	18.97
Environmental		60 D	% DER <ter< td=""><td></td><td>-173.63</td><td></td></ter<>		-173.63	
CO ₂ Emissions (t/y	ear)	2.89	DFEE	175.64	TFEE	51.86
General Requirem	ents Compliance	Fail	% DFEE <tfee< td=""><td></td><td>-238.69</td><td></td></tfee<>		-238.69	
Assessor Details	Mr. Simon Gowing, Simor Simon@hodkinsonconsul	0,	036031616,		Assessor ID	T271-0001
Client						

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DES	SIGNED			
Mid-floor flat	, total floor area 68	m. 2		
It is not a com	mplete report of regu			
la TER and DER				
	neating:Mains gas			
ruel factor:1.0	00 (mains gas) Dioxide Emission Rate	(MDD) 10 07 1-00-(-1		
		(TER) 18.97 kgCOU/m² te (DER) 51.91 kgCOU/m²Fai	.1	
Excess emission	ns =32.94 kgCO□/m² (174.0%)		
lb TFEE and DFE				
	Energy Efficiency (TF			
Owelling Fabric Excess energy =	Energy Efficiency () =123.7 kWh/m²/yr (23)	DFEE)175.6 kWh/m²/yrFail 8 0%)		
2 Fabric U-valu Element		Wichest		
External wall	1.19 (max. 0.30)	Highest 1.21 (max. 0.70)	Fail	
Party wall	0.00 (max. 0.20)	-	OK	
Floor Roof	(no floor) 1.50 (max. 0.20)	1.50 (max. 0.35)	Fail	
Openings		1.50 (max. 0.35) 4.80 (max. 3.30)	Fail	
Za Thermal brid				
Thermal bridgin	ng calculated using de	efault y-value of 0.15		
3 Air permeabil	Lity			
Air permeabilit	y at 50 pascals:	15.00 (assumed)		OK
4 Heating effic	ciency			
4 Heating effic Main heating sy	ystem:	Boiler system with ra	diators or underflo	or - Mains gas
Main heating sy Data from datab	ystem: base	-	diators or underfloo	or - Mains gas
Main heating sy Data from datab Worcester Green Combi boiler	ystem: pase nstar 29CDi Classic E:	-	diators or underfloo	or - Mains gas
Main heating sy Data from datab Worcester Green Combi boiler Efficiency: 89.	ystem: pase nstar 29CDi Classic E:	rP	diators or underflo	or - Mains gas
Main heating sy Data from datab Worcester Green Combi boiler	ystem: pase nstar 29CDi Classic E:	-	diators or underfloo	or - Mains gas
Main heating sy Data from datab Worcester Green Combi boiler Efficiency: 89. Minimum: 88.0%	ystem: pase pstar 29CDi Classic E: 1% SEDBUK2009 ing system:	rP		-
Main heating sy Data from datab Worcester Green Combi boiler Efficiency: 89. Minimum: 88.0% Secondary heati	ystem: Dase Dase Dastar 29CDi Classic E: 1% SEDBUK2009 ing system:	rP OK None		-
Main heating sy Data from datab Worcester Green Combi boiler Efficiency: 89. Minimum: 88.0%	ystem: base base base base base base base base	rP OK None		
Main heating sy Data from datak Worcester Green Combi boiler Efficiency: 89. Minimum: 88.0% Secondary heati 5 Cylinder insu Hot water stora 6 Controls	ystem: Jase Jase Jase Jase Jase Jase Jase Jase	OK None No cylinder		
Main heating sy Data from datab Worcester Green Combi boiler Efficiency: 89. Minimum: 88.0% Secondary heati	ystem: Jase Jase Jase Jase Jase Jase Jase Jase	OK None No cylinder		
Main heating sy Data from datak Worcester Green Combi boiler Efficiency: 89. Minimum: 88.0% Secondary heati 5 Cylinder insu Hot water stora 6 Controls Space heating c	ystem: nstar 29CDi Classic E. 1% SEDBUKZ009 ing system: nlation age	OK None No cylinder Programmer and at lea		
Main heating sy Data from datak Worcester Green Combi boiler Efficiency: 89. Minimum: 88.0% Secondary heati 5 Cylinder insu Hot water stora 6 Controls Space heating c	ystem: nstar 29CDi Classic E. 1% SEDBUKZ009 ing system: nlation age	OK None No cylinder		
Main heating sy Data from datak Morcester Green Combi boiler Efficiency: 89. Wininum: 88.0% Secondary heati 5 Cylinder insu Mot water stora 6 Controls Space heating c Hot water control Hot water control Hot water control	ystem: ame	OK None No cylinder Programmer and at less No cylinder		tats OK
Main heating sy Date from datab Morcester Green Combi boiler Efficiency: 89. Minimum: 88.0% Secondary heati- 5 Cylinder insuffer insuffer for Cylinder insuffer for Mortel Space heating c Hot water controls Hot water controls Boiler interloc	ystem: ame	OK None No cylinder Programmer and at lea No cylinder Yes		tats OK
Main heating sy Date from datak Worcester Green Combi boiler Efficiency: 89. Minimum: 88.0% Secondary heati- 5 Cylinder insu- Hot water stora- 6 Controls Space heating c Hot water controls Boiler interloc	ystem: Date 29CD Classic E. 1% SEDBUKZ009 Ling system: Linklini Li	OK None No cylinder Programmer and at les No cylinder Yes	st two room thermos	tats OK
Main heating sy bate from datak Worcester Green Combi boiler Efficiency: 89. Whinimum: 88. Secondary heating to the store of the store	ystem: amage amage amage lik SEDBUKZ009 ling system: llation age conntrols: rols:	OK None No cylinder Programmer and at les No cylinder Yes	st two room thermos	tata OK
Main heating sy bata from datak Morcester Green combi boiler Efficiency: 89. Secondary heating the state of t	ystem: Date 2001 Classic E. Lis SEBGUKZ009 Ling system: Datation Understanding State Controls: Cols: Ck Lights Lights with low	OK None No cylinder Programmer and at lee No cylinder Yes energy fittings:0%	st two room thermos	tats OK OK Fail
Main heating sy Date from datak Worcester Green Combi boiler Efficiency: 89, Winimum: 88.0% Secondary heati 5 Cylinder insu- Hot water store 6 Controls Space heating of Hot water contr Boiler interloc 7 Low energy li Percentage of f Minimum	ystem: amage amage star 29CDi Classic E. 1% SEDBUKZ009 ing system: lation age controls: cols: ck dphts inged lights with low entilation	OK None No cylinder Programmer and at lee No cylinder Yes energy fittings:0%	at two room thermosi	tats OK OK Fail
Main heating sy Data from datak Worcester Green Combi boiler Combi boiler Secondary heati Secondary heati Hot water stora 6 Controls Space heating of Hot water controls Combined the secondary Hot water controls World water controls Hot water controls World water controls Hot water controls World water controls Hot w	ystem: Date of the property of	OK None No cylinder Programmer and at lee No cylinder Yes energy fittings:0%	ast two room thermost	OK Pail
Meain heating sy bata from datak Worcester Green Efficiency: 89. Minimum: 88.0% Secondary heating to Controls Space heating of 6 Controls Space heating of 6 Controls Space heating of 7 Low energy il Percentage of f Minimum: 8 Mechanical ve Wot applicable Wot applicable Wot applicable 9 Summertime te	ystem: Dassic E. Lis SEDBUKK2009 Ling system: Listion Unition	OK None No cylinder Programmer and at lea No cylinder Yes -energy fittings:0%	ast two room thermost	OK Feil
wain heating sy bata from datak Worcester Green Cartello Section 18 9, Minimum: 88.0% Secondary heating the Controls Space heating of Controls Space heating of Controls Space heating or Downers of Controls Space heating or Downers of Controls Space heating of Minimum: 88 Mechanical ve Not applicable worth of the Controls Space Particle Space heating of Minimum Section 18 Mechanical ve Not applicable of Summertime to Overheating ris Based on: 9 Summertime to Exercise Space heating ris Based on:	ystem: Date of the property of	OK None No cylinder Programmer and at les No cylinder Yes -energy fittings:0% 73%	ast two room thermost	OK Pail
Meain heating sy bata from datak Worcester Green Efficiency: 89. Minimum: 88.0% Secondary heating to Cylinder insulation of Communication of Controls Space heating of Board water store. The work of Controls Space heating to the water store of Controls Space heating to Board water store. The work of Controls Space heating of Minimum Sa Mechanical we work of Space S	ystem: Date of the controls: Control	OK None No cylinder Programmer and at lea No cylinder Yes -enexgy fittings:0% 73%	ist two room thermost	OK Feil
Meain heating ay Data from datak Worcester Green Efficiency: 89. Minimum: 88.08 Secondary heati Secondary heati Officiency: 89. Minimum: 88.08 Between the store Hot water store 16 Controls Space heating of Hot water contr Beiler interior 7 Low energy if Percentage of f Minimum 18 Percentage of f Minimum 19 Summertime te Overheating ris Based on: 9 Summertime te Overheating ris Based on: Windows facing Windows facing	ystem: Date of the property of	OK None No cylinder Programmer and at les No cylinder Yes -energy fittings:0% 75% Slight Average 11.46 m², No overhang 7.64 m², No overhang	ist two room thermost	OK Feil
Meain heating sy Date from datak Worcester Green Efficiency: 89. Minimum: 88.08 Secondary heat Socondary heat Socondary heat Hot water store General Society Hot water store Hot water store Town the society	ystem: amaze amaze amaze star Z9CDi Classic E. lis SEBGURZO09 ling system: olation age controls: rols: ck lights diphts with low emperature sk (Thames Valley): North East: East: East: Control Classic E. East: Control Clas	OK None No cylinder Programmer and at les No cylinder Yes -energy fittings:0% 73% Slight Average 11.46 gr, No overhang 7.66 mr, No overhang 7.67 m, No overhang	ist two room thermost	OK Feil
Main heating sy bata from datak Worcester Green Efficiency: 89, Minimum: 88.0% Secondary heating the Minimum: 85.0% Secondary heating to the Minimum: 85.0% Space heating of Boiler interlock of Controls Space heating to the Minimum: 85.0% Mechanical we work specially secondary heating to the Minimum: 85.0% Mechanical we work specially secondary in the Minimum: 85.0% Mechanical we work specially secondary in the Minimum: 95.0% Mechanical we work specially secondary in the Minimum: 95.0% Mechanical we work specially secondary in the Minimum: 95.0% Mechanical we work specially secondary in the Minimum: 95.0% Mechanical we work specially secondary in the Minimum: 95.0% Mechanical we work specially secondary in the Minimum: 95.0% Minimum	ystem: amaze proprieta	OK None No cylinder Programmer and at les No cylinder Yes -energy fittings:0% 73% Slight Average 11.46 m², No overshang 7.66 m², No overshang 7.66 m², No overshang 7.60 m², No overshang 7.00 m², No overshang	ast two room thermos	OK OK CK
Main heating sy bata from datak Worcester Green combi boiler combi boiler combi boiler sy bata from the combine of the combine	ystem: assac	OK None No cylinder Programmer and at les No cylinder Yes -energy fittings:0% 73% Slight Average 11.46 gr, No overhang 7.66 mr, No overhang 7.67 m, No overhang	ast two room thermos	OK OK CK
Meain heating sy bata from datak Worcester Green Efficiency: 89. Minimum: 88.0% Secondary heating of the Mean of t	ystem: amaze good classic E. 18 SEDBUKZ009 ing system: llation ge controls: rols: ch lights fixed lights with low mutilation comperature sk (Thames Valley): North East: East: North West: :: :: :: :: :: :: :: :: :: :: :: :: :	OK None No cylinder Programmer and at lea No cylinder Yes -energy fittings:0% 73% Slight Average 11.46 m², No overhang 7.64 m², No overhang 7.00 ach no overhang 3.00 ach no overhang Dark-coloured cuttain	ast two room thermos	OK OK CK





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

CALCULATIO	DIN OF L	JWELLING	3 EIVIISSI	UNS FUR	REGULAT	IONS C	JIVIPLIAN	ICE US	Jan 2014	,			
SAP 2012 WORKSHI	EET FOR N	ew Build (As	Designed)	(Version	9.92, Janua:	ry 2014) Jan 2014							
1. Overall dwell	ling dime	nsions											
								Area (m2)	Sto	rey height		Volume (m3)	
Ground floor Total floor area		la)+(lb)+(lc	:)+(ld)+(le)(ln)		57.8900		67.8900		2.8000		190.0920	(1b) - (3 (4)
Dwelling volume								(:	8a) + (3b) + (3c) + (3d) + (3e)	(3n) =	190.0920	(5)
2. Ventilation	rate												
					main heating	8	econdary heating		other	tot		3 per hour	
Number of chimne Number of open : Number of intern	flues	ane			0	+	0	+	0	-	0 * 40 = 0 * 20 = 2 * 10 =	0.0000 0.0000 20.0000	(6b)
Number of fassiv Number of fluels	ve vents										0 * 10 = 0 * 40 =	0.0000	(7b)
Infiltration due	a to ob!	nave £1	and force	= (60)+(0-	± (7a) / (7b) ·	(7c) =				20 0000	Air change / (5) =	s per hour 0.1052	(8)
Pressure test Measured/design	AP50	eys, riues	and rans	- (oa)+(bb	+(/0)+(/0)+	(70) =				20.0000	/ (3) =	No 15.0000	
Infiltration rat Number of sides	te sheltere	s										0.8552	(18) (19)
Shelter factor Infiltration rat	te adiust	ed to includ	e shelter	factor					(20) = 1	- [0.075 x 21) = (18)	(19)] = x (20) =	0.9250 0.7911	
					W	Ŧ	71						
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	0ct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate	1.0086	0.9888	0.9691	0.8702	0.8504	0.7515	0.7515	0.7317	0.7911	0.8504	0.8900	0.9295	(22b)
Effective ac	1.0086	0.9889	0.9695	0.8786	0.8616	0.7824	0.7824	0.7677	0.8129	0.8616	0.8960	0.9320	(25)
3. Heat losses a			er										
Element				Gross m2	Openings m2		tArea m2	U-value W/m2K	A ×	/K	-value kJ/m2K	A x K kJ/K	
Normal Window (U Corridor Door Corridor	Uw = 4.80)		3.7000	2.1000	2	.7400 .1000	4.0268 1.0000 0.7266	107.67 2.10 1.16	00			(27) (26) (29a)
Bick Wall External Roof 1				73.2200 23.7500	26.7400	46 23	.4800	1.2100 1.5000	56.24 35.62				(29a) (30)
Total net area of Fabric heat loss Party Wall 1	of extern s, W/K = :	al elements Sum (A x U)	Aum(A, m2)				.6700 (26)(30) + (32)	= 202.80				(31) (33) (32)
Party Floor 1							.8900	0.0000	0.00	00			(32d)
Thermal mass par Thermal bridges Total fabric hea	(Default	IMP = Cm / T value 0.150	FA) in kJ/ * total e	m2K xposed area							+ (36) =	250.0000 15.1005 217.9068	(36)
Ventilation heat		lculated mor	thly (38)m	= 0.33 x (25)m x (5)					(33)			(37)
	Jan 63.2708	Feb 62.0341	Mar 60.8197	Apr 55.1152	May 54.0479	Jun 49.0796	Jul 49.0796	Aug 48.1595	Sep 50.9933	Oct 54.0479	Nov 56.2070	Dec 58.4643	(38)
Heat transfer co Average = Sum(3)	281.1776	279.9409	278.7264	273.0220	271.9547	266.9864	266.9864	266.0663	268.9001	271.9547	274.1138	276.3711 273.0167	
HT.P	Jan 4 1417	Feb 4 1234	Mar 4 1056	Apr 4 0215	May 4 0058	Jun 3 9326	Jul 3 9326	Aug 3 9191	Sep 3 9608	Oct 4 0058	Nov 4 0376	Dec 4 0709	
HLP (average) Days in month	4.141/	4.1234	4.1056	4.0215	4.0058	3.9326	3.9326	3.9191	3.9608	4.0058	4.03/6	4.0709	
	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heating)									
Assumed occupano Average daily ho	cy											2.1938 86.3034	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	/
	use 94.9338 140.7840	91.4816 123.1306	88.0295 127.0598	84.5774 110.7738	81.1252 106.2901	77.6731 91.7203	77.6731 84.9923	81.1252 97.5299	84.5774 98.6947	88.0295 115.0192	91.4816 125.5524	94.9338	
Energy content Distribution los	(annual) ss (46)m	= 0.15 x (4	15) m							Total = S	um (45) m =	1357.8890	(45)
Water storage lo	21.1176 oss:	18.4696	19.0590	16.6161	15.9435	13.7580	12.7488	14.6295	14.8042	17.2529	18.8329	20.4513	(46)
Total storage lo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULAT	ION OF	DWELLIN	IG EMISSI	IONS FO	R REGULA	TIONS C	OMPLIAN	ICE 09	Jan 2014	1			
If cylinder co													
Combi loss	0.0000 39.2379	35.3922	39.1071	0.0000 37.7582	0.0000 38.9533	0.0000 37.6236	0.0000 38.8321	0.0000 38.9107	0.0000 37.6969	0.0000 39.0435	0.0000 37.8852	0.0000 39.2126	
Total heat red	180.0219	158.5228	166.1668	148.5320	145.2434	129.3438	123.8244	136.4406	136.3917	154.0627	163.4377	175.5544	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 Solar inp	0.0000 ut (sum of	0.0000 months) = S	0.0000 um(63)m =	0.0000	(63) (63)
Output from w,	/h 180.0219	158.5228	166.1668	148.5320	145.2434	129.3438	123.8244	136.4406 Total p	136.3917 er vear (kV	154.0627 Th/year) = S	163.4377 um(64)m =	175.5544 1817.5423	
Heat gains fro	om water he 56.6202	ating, kWh/ 49.7890	month 52.0241	46.2718	45.0798	39.9029	37.9680	42.1564	42.2402	48.0048	51.2175	55.1368	
5. Internal qu													
Metabolic gair	ns (Table 5), Watts											
(66) m	Jan 109.6914	Feb 109.6914	Mar 109.6914	Apr 109.6914	May 109.6914	Jun 109.6914	Jul 109.6914	Aug 109.6914	Sep 109.6914	Oct 109.6914	Nov 109.6914	Dec 109.6914	(66)
Lighting gains	34.2915	ed in Apper 30.4574	24.7696	18.7522	14.0175	11.8342	12.7872	16.6213	22.3091	28.3265	33.0612	35.2446	(67)
Appliances ga: Cooking gains	192.3232	194.3189	189.2898	178.5834	165.0684	152.3663	143.8805	141.8847	146.9139	157.6203	171.1353	183.8374	(68)
Pumns, fans	33.9691	33.9691	33.9691	33.9691	33.9691 3 0000	33.9691 3 0000	33.9691 3.0000	33.9691 3.0000	33.9691 3.0000	33.9691 3.0000	33.9691 3.0000	33.9691 3.0000	(69) (70)
Losses e.g. e	vaporation -87.7531	(negative v -87.7531	ralues) (Tab -87.7531	le 5) -87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	
Water heating	76.1024	le 5) 74.0908	69.9249	64.2664	60.5911	55.4207	51.0322	56.6618	58.6670	64.5225	71.1354	74.1086	(72)
Total internal	1 gains 361.6245	357.7745	342.8918	320.5094	298.5844	278.5285	266.6073	274.0753	286.7974	309.3768	334.2393	352.0980	(73)
6. Solar gains													
[Jan]				m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	or	Gains W	
Northeast			11.4		11.2829		0.6300	0	.8000	0.77	00	45.1617	
East Northwest			7.6 7.6	400	19.6403 11.2829		0.6300 0.6300	0	.8000 .8000	0.77 0.77	00	52.4088 30.1078	(76) (81)
Solar gains Total gains	127.6784 489.3029	255.7362 613.5107	444.8822 787.7740	699.5836 1020.0931	911.1587 1209.7432	958.5877 1237.1162	901.8554 1168.4627	737.1378 1011.2131	532.7297 819.5271	308.8908 618.2676	160.0563 494.2956	104.5674 456.6654	
7. Mean inter													
Temperature du Utilisation fa	actor for g	ains for li	iving area,	nil,m (see	Table 9a)							21.0000	(85)
tau alpha	Jan 16.7673 2.1178	Feb 16.8414 2.1228	Mar 16.9147 2.1276	Apr 17.2681 2.1512	May 17.3359 2.1557	Jun 17.6585 2.1772	Jul 17.6585 2.1772	Aug 17.7196 2.1813	Sep 17.5328 2.1689	Oct 17.3359 2.1557	Nov 17.1994 2.1466	Dec 17.0589 2.1373	
util living as	rea 0.9925	0.9874	0.9750	0.9434	0.8821	0.7871	0.6871	0.7482	0.8974	0.9703	0.9891	0.9937	
MIT Th 2	17.2302	17.4992	18.0563 18.2991	18.8735	19.6695 18.3314	20.3252	20.6586	20.5703	19.9753	18.9721	17.9891	17.2172 18.3101	
util rest of h	0.9894	0.9820	0.9632	0.9128	0.8057	0.6110	0.3665	0.4488	0.7886	0.9485	0.9834	0.9910	
MIT 2 Living area fo	15.1995 raction	15.4695	16.0240	16.8344	17.5772	18.1294	18.3188	18.2984	17.8931 fLA =	16.9517 Living are	15.9732 a / (4) =	15.1975 0.3450	(90) (91)
MIT Temperature as		16.1697	16.7251	17.5378	18.2990	18.8869	19.1260	19.0822	18.6114	17.6487	16.6686	15.8943 -0.1500	
adjusted MIT	15.7500	16.0197	16.5751	17.3878	18.1490	18.7369	18.9760	18.9322	18.4614	17.4987	16.5186	15.7443	(93)
8. Space heat:	ing require												
Utilisation	Jan 0.9843	Feb 0.9743	Mar 0.9509	Apr 0.8964	May 0.7982	Jun 0.6456	Jul 0.4663	Aug 0.5398	Sep 0.7960	Oct 0.9368	Nov 0.9766	Dec 0.9865	(94)
Useful gains Ext temp.	481.6048 4.3000	597.7360	749.1260 6.5000	914.3865	965.5944 11.7000	798.7275	544.7979	545.8677 16.4000	652.3821 14.1000	579.2214 10.6000	482.7355 7.1000	450.5124 4.2000	(95)
Heat loss rate	e W 3219.4917	3112.8621	2808.1989	2317.3679	1753.8328	1104.4925	634.3500	673.7212	1172.7784	1876.1219	2581.7720	3190.4966	(97)
Month fracti Space heating	1.0000 kWh	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
Space heating Space heating		1090.1648	1031.9503	1010.1466	586.4493	0.0000	0.0000	0.0000	0.0000			2038.5482 11370.4474 167.4834	(98)
.pass measuring										1,50	(4) -		11
Sa Cassa	1400 000-1-												
8c. Space coo:		ement											





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy re	quirements -	Individua	al heating s	ystems, inc	luding micr	o-CHP							
Fraction of s Fraction of s Efficiency of	pace heat from pace heat from main space he secondary/sup	m seconda m main sy eating sy	ery/suppleme ystem(s) ystem 1 (in	entary syste %)								0.0000 1.0000 90.0000 0.0000 12633.8304	(202) (206) (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	2036.9879 1				586.4493	0.0000	0.0000	0.0000	0.0000	964.8940	1511.3063	2038.5482	(98)
	efficiency (r 90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating	fuel (main he 2263.3199 1			1122.3851	651.6104	0.0000	0.0000	0.0000	0.0000	1072.1044	1679.2292	2265.0536	(211)
Water heating	requirement 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating Water heating													
	180.0219 water heater		166.1668	148.5320	145.2434	129.3438	123.8244	136.4406	136.3917	154.0627	163.4377	175.5544 86.7000	
(217) m	89.7227 r heating, kWI	89.7072	89.6660	89.5630	89.3251	86.7000	86.7000	86.7000	86.7000	89.5308	89.6669	89.7292	
Water heating	200.6426 : fuel used	176.7114	185.3175	165.8408	162.6009	149.1855	142.8193	157.3709	157.3145	172.0778	182.2720	195.6491 2047.8023	
	fuel - main : fuel - second											12633.8304 0.0000	
central he main heati Total electri Electricity f	or pumps and : ating pump ng flue fan city for the a or lighting (sed energy for	above, k@	ed in Append	lix L)								30.0000 45.0000 75.0000 605.5987 15362.2315	(230e) (231) (232)
12a. Carbon d	lioxide emission	ons - Ind	iividual hea	ting system	s including								
Space heating Space heating Water heating Space and wat Pumps and fan Energy for li Total COZ, kg	(other fuel) er heating s ghting	n 1						Energy kWh/year 12633.8304 0.0000 2047.8023 75.0000 605.5987		mion factor kg CO2/kWh 0.2160 0.0000 0.2160 0.5190 0.5190	1	Emissions cg CO2/year 2728.9074 0.0000 442.3253 3171.2327 38.9250 314.3057 3524.4634 51.9100	(261) (263) (264) (265) (267) (268) (272)
16 CO2 EMISSI DER Total Floor A Assumed numbe CO2 emissions CO2 emissions CO2 emissions Total CO2 emi Residual CO2 Additional al	ONS ASSOCIATED TO SERVICE OF THE PROPERTY OF T	O WITH AE le 12 for ces, equation set from ricity ge	electricit tion (L14) on (L16) biofuel CHI	y displaced	from grid		TY GENERAT:	ION TECHNOLO	GIES		TFA N EF	51.9100 67.8900 2.1938 0.5190 16.7870 2.5284 71.2253 0.0000 0.0000 71.2253	ZC1 ZC2 ZC3 ZC4 ZC5 ZC6 ZC7

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHI CALCULATION OF I	EET FOR Ne	ew Build (A:	s Designed) ENCY 0	(Version 19 Jan 2014	9.92, Janua	ry 2014)							
1. Overall dwell	ling dimer	nsions											
Ground floor Total floor area Dwelling volume	a TFA = ()	la)+(lb)+(l	c) + (1d) + (1e	:)(ln)		67.8900		Area (m2) 67.8900		rey height (m) 2.8000)+(3d)+(3e)		Volume (m3) 190.0920 190.0920	(4)
2. Ventilation	ate												
Number of chimne Number of open ! Number of inters Number of passi Number of fluele	flues mittent fa ve vents				main heating 0 0	+ +	econdary heating 0 0	+ +	other 0 0	tot = =	0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 20.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration due Pressure test Measured/design Infiltration rat Number of sides	AP50		and fans	= (6a)+(6b)+(7a)+(7b)+	(7c) =				20.0000	Air change / (5) =	0.1052 No 15.0000 0.8552	
Shelter factor Infiltration rat	e adjuste	ed to inclu	de shelter	factor					(20) = 1	- [0.075 x 21) = (18)	(19)] = x (20) =	0.9250 0.7911	(20) (21)
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	1.0086	0.9888 0.9889	0.9691 0.9695	0.8702 0.8786	0.8504 0.8616	0.7515 0.7824	0.7515 0.7824	0.7317 0.7677	0.7911 0.8129	0.8504 0.8616	0.8900 0.8960	0.9295 0.9320	(22b) (25)
3. Heat losses a	and heat 1	loss parame	ter										
Element Normal Window (U Corridor Door Corridor Bick Wall External Roof 1 Total net area of Fabric heat loss Party Wall 1 Party Floor 1	of externa	al elements	Aum(A, m2)	Gross m2 3.7000 73.2200 23.7500	Openings m2 2.1000 26.7400	26 2 1 46 23 100	m2 .7400 .1000 .6000 .4800 .7500 (26)(U-value W/m2K 4.0268 1.0000 0.7266 1.2100 1.5000 30) + (32) 0.0000	107.67 2.10 1.16 56.24 35.62	/K 79 00 26 08 50	-value kJ/m2K	A × K kJ/K	
Thermal mass par Thermal bridges Total fabric hea	(Default	TMP = Cm / 1 value 0.15	TFA) in kJ/ D * total e	m2K exposed area)					(33)	+ (36) =	250.0000 15.1005 217.9068	(36)
Ventilation heat	Jan 63.2708	lculated mor Feb 62.0341	Mar 60.8197	a = 0.33 x (Apr 55.1152	25)m x (5) May 54.0479	Jun 49.0796	Jul 49.0796	Aug 48.1595	Sep 50.9933	Oct 54.0479	Nov 56.2070	Dec 58.4643	(38)
Heat transfer co Average = Sum(3)	281.1776	279.9409	278.7264	273.0220	271.9547	266.9864	266.9864	266.0663	268.9001	271.9547	274.1138	276.3711 273.0167	(39) (39)
HLP HLP (average) Days in month	Jan 4.1417	Feb 4.1234	Mar 4.1056	Apr 4.0215	May 4.0058	Jun 3.9326	Jul 3.9326	Aug 3.9191	Sep 3.9608	Oct 4.0058	Nov 4.0376	Dec 4.0709 4.0215	(40) (40)
Days In month	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heating		requirement:	s (kWh/year	:)								2.1938	(40)
Assumed occupant Average daily ho		use (litres.	/day) Mar) no e	Mari	Jun	Jul	200	Con	Oct	Nov	2.1938 86.3034 Dec	
Energy conte :	use 94.9338 140.7840 (annual)	91.4816 123.1306	88.0295 127.0598	Apr 84.5774 110.7738	May 81.1252 106.2901	Jun 77.6731 91.7203	Jul 77.6731 84.9923	Aug 81.1252 97.5299	Sep 84.5774 98.6947	88.0295 115.0192 Total = S	91.4816 125.5524	94.9338 136.3418 1357.8890	(45)
Distribution los Water storage lo Total storage lo	0.0000 0.0000 0ss:	= 0.15 x (0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
.ocar scorage 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)





CALCULAT	ION OF I	FABRIC E	NERGY E	FFICIENC	Y 09 Ja	ın 2014							
If cylinder co	ntains ded 0.0000 0.0000	icated sola 0.0000 0.0000	r storage 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains fro	m water he			23.5394	22.5866	19.4906	18.0609	20.7251	20.9726	24.4416	26.6799	28.9726	
5. Internal ga	ins (see T	able 5 and											
Metabolic gain	Jan 109.6914	Feb	Mar 109.6914	Apr 109.6914	May 109.6914	Jun 109.6914	Jul 109.6914	Aug 109.6914	Sep 109.6914	Oct 109.6914	Nov 109.6914	Dec 109.6914	(66)
Lighting gains	(calculat 17.1458	ed in Appen 15.2287	dix L, equa 12.3848	tion L9 or 9.3761	L9a), also 7.0087	see Table 5 5.9171	6.3936	8.3107	11.1545	14.1633	16.5306	17.6223	
Appliances gai	ns (calcul 192.3232	ated in App 194.3189	endix L, eq 189.2898	178.5834	or L13a), a 165.0684	lso see Tab 152.3663	le 5 143.8805	141.8847	146.9139	157.6203	171.1353	183.8374	(68)
Cooking gains Pumps, fans	33.9691 0.0000	d in Append 33.9691 0.0000	33.9691 0.0000	33.9691 0.0000	33.9691 0.0000	33.9691 0.0000	33.9691 0.0000	33.9691 0.0000	33.9691	33.9691	33.9691	33.9691 0.0000	(69)
Losses e.g. ev	aporation -87.7531	(negative v		le 5)	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	
Water heating	40.2105	le 5) 38.9364	36.2906	32.6937	30.3584	27.0702	24.2754	27.8563	29.1287	32.8516	37.0554	38.9417	(72)
Total internal	gains 305.5869	304.3914	293.8726	276.5605	258.3430	241.2610	230.4569	233.9592	243.1045	260.5426	280.6287	296.3088	(73)
6. Solar gains													
[Jan]			A	m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
Northeast East Northwest			11.4 7.6 7.6	400	11.2829 19.6403 11.2829		0.6300 0.6300 0.6300	o o	.8000 .8000	0.77 0.77 0.77	00	45.1617 52.4088 30.1078	(76)
Solar gains Total gains	127.6784 433.2653	255.7362 560.1276	444.8822 738.7549	699.5836 976.1442	911.1587 1169.5017	958.5877 1199.8487	901.8554 1132.3122	737.1378 971.0970	532.7297 775.8342	308.8908 569.4334	160.0563 440.6850	104.5674 400.8762	
7. Mean intern	.1 *******	turo (booki											
Temperature du				ng area fro	om Table 9,	Th1 (C)						21.0000	(85)
Utilisation fa	ctor for g	ains for li Feb	ving area, Mar	nil,m (see Apr	Table 9a) May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau alpha util living ar	16.7673 2.1178	16.8414 2.1228	16.9147 2.1276	17.2681 2.1512	17.3359 2.1557	17.6585 2.1772	17.6585 2.1772	17.7196 2.1813	17.5328 2.1689	17.3359 2.1557	17.1994 2.1466	17.0589 2.1373	
util living ar	0.9942	0.9895	0.9779	0.9477	0.8883	0.7956	0.6978	0.7607	0.9063	0.9746	0.9914	0.9951	(86)
MIT Th 2 util rest of h	17.1810 18.2878	17.4529 18.2935	18.0153 18.2991	18.8397 18.3262	19.6438 18.3314	20.3077 18.3562	20.6469 18.3562	20.5538 18.3609	19.9457 18.3465	18.9312 18.3314	17.9419 18.3209	17.1677 18.3101	(87) (88)
MIT 2 Living area fr	0.9917 15.1507	0.9849 15.4240	0.9674 15.9843	0.9191 16.8035	0.8145 17.5571	0.6220 18.1207	0.3762 18.3168	0.4628 18.2944	0.8037 17.8722	0.9556 16.9132 Living are	0.9867 15.9267	0.9931 15.1483 0.3450	(90)
MIT Temperature ad	15.8511 justment	16.1239	16.6849	17.5059	18.2770	18.8751	19.1206	19.0738	18.5875	17.6094	16.6219	15.8450	(92)
adjusted MIT	15.8511	16.1239	16.6849	17.5059	18.2770	18.8751	19.1206	19.0738	18.5875	17.6094	16.6219	15.8450	(93)
8. Space heati	ng require	ment											
Utilisation Useful gains Ext temp.	Jan 0.9878 427.9856 4.3000	Feb 0.9788 548.2363 4.9000	Mar 0.9572 707.1184 6.5000	Apr 0.9057 884.1306 8.9000	May 0.8124 950.1113 11.7000	Jun 0.6680 801.4874 14.6000	Jul 0.4983 564.2081 16.6000	Aug 0.5745 557.8509 16.4000	Sep 0.8182 634.7512 14.1000	0ct 0.9470 539.2443 10.6000	Nov 0.9817 432.6107 7.1000	Dec 0.9898 396.7793 4.2000	(95)
Heat loss rate	W 3247.9178 1.0000	3142.0290 1.0000	2838.8097 1.0000	2349.6050	1788.6353 1.0000	1141.4008	672.9648 0.0000	711.4137 0.0000	1206.6986	1906.2339	2610.0888	3218.3305 1.0000	
Space heating	kWh 2098.0296	1743.0287	1585.9783	1055.1416	623.8619	0.0000	0.0000	0.0000	0.0000	1017.0402	1567.7842	2099.2341 11790.0987	
Space heating	per m2									(98) / (4) =	173.6647	(99)
8c. Space cool	ing requir	ement											
Calculated for	June, Jul	y and Augus	t. See Tabl	e 10b									
Ext. temp. Heat loss rate	Jan 4.3000 W	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	0ct 10.6000	Nov 7.1000	Dec 4.2000	
Utilisation Useful loss	0.0000	0.0000	0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	2509.6717 0.4964 1245.9164	1975.6990 0.5629 1112.0498	2022.1038 0.5028 1016.7315	0.0000	0.0000	0.0000 0.0000 0.0000	0.0000	(101)
Total gains Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1483.9358	1403.3564	1216.2243	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling		0.0000	0.0000	0.0000	0.0000	171.3740	216.7321	148.4226	0.0000	0.0000	0.0000	0.0000	



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FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION OF FA	ALCULATION OF FABRIC ENERGY EFFICIENCY										
Space cooling Cooled fraction Intermittency factor (Tabl	e 10h)							fC = c	cooled area	/ (4) =	536.5287 1.0000
0.0000 pace cooling kWh	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000
0.0000 pace cooling pace cooling per m2 nergy for space heating nergy for space cooling otal welling Fabric Energy Eff	0.0000 iciency (D	0.0000 FEE)	0.0000	0.0000	42.8435	54.1830	37.1057	0.0000	0.0000	0.0000	0.0000 134.1322 1.9757 173.6647 1.9757 175.6405



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Property Reference	Plot 19				Issued on Date	24/06/2019
Assessment	Baseline		Pro	p Type Ref	Γop Floor Pent Hous	e
Reference				•		
Property	Plot 019, Ferdinand Stree	et, Camden, LO	NDON, LONDON, N	NW1 8EU		
SAP Rating		57 D	DER	56.55	TER	17.80
Environmental		49 E	% DER <ter< th=""><th></th><th>-217.74</th><th></th></ter<>		-217.74	
CO ₂ Emissions (t/yea	ar)	5.13	DFEE	206.09	TFEE	59.16
General Requiremen	nts Compliance	Fail	% DFEE <tfee< th=""><th></th><th>-248.34</th><th></th></tfee<>		-248.34	
	Mr. Simon Gowing, Simon Go	0,	36031616,		Assessor ID	T271-0001
	Simon@hodkinsonconsultan	cy.com				
Client						

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FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

	SIGNED		
Top-floor flat,	total floor area 110	m²	
It is not a cor	mplete report of regul		
Fuel factor:1.0 Target Carbon I Dwelling Carbon Excess emission	Dioxide Emission Rate	e (DER) 56.55 kgCOU/m²Fail 18.0%)	
lb TFEE and DFF Target Fabric B Dwelling Fabric Excess energy	EE Energy Efficiency (TFE	E)59.2 kWh/m²/yr FEE)206.1 kWh/m²/yrFail .0%)	
2 Fabric U-valu Element		Highest 1.21 (max. 0.70) Fail	
Floor Roof	(no floor)	1.50 (max. 0.35) Fail	
2a Thermal brid	lging		
Thermal bridgin	ng calculated using de	fault y-value of 0.15	
	y at 50 pascals:	15.00 (assumed)	OK
4 Heating effic Main heating sy Data from data Worcester Green	ystem:	Boiler system with radiators or underfloor - Ma	ins gas
Efficiency: 89 Minimum: 88.0%	.2% SEDBUK2009	OK	
	ing system:	None	
5 Cylinder inst Hot water store Permitted by Di	ulation age aSCG 2.30	Measured cylinder loss: 1.72 kWh/day OK	
5 Cylinder insu Hot water store Permitted by DE Primary pipewo	ulation age aSCG 2.30	Measured cylinder loss: 1.72 kWh/day	OK
5 Cylinder inst Hot water store Permitted by Di Primary pipewor	ulation age SSCG 2.30 rk insulated:	Measured cylinder loss: 1.72 kWh/day OK Yes	
5 Cylinder inso Hot water store Permitted by Di Primary pipewood 6 Controls Space heating of	ulation age ascG 2.30 ck insulated:	Measured cylinder loss: 1.72 kWh/day OK Yes	OK .
5 Cylinder insu Hot water stor. Permitted by Di Primary pipewor 6 Controls Space heating of Hot water contributions.	plation upe specific	Measured cylinder loss: 1.72 kWh/day OK Yes Programmer and at least two room thermostats Cylinderstat	OK OK
5 Cylinder insumed to the state of the state	ulation upge SSCG 2.30 ck insulated: controls: cols: ck	Measured cylinder loss: 1.72 kWm/day OK Yes Programmer and at least two room thermostats Cylinderstat Independent timer for DHW Yes energy fittings:0% 75%	OK OK
5 Cylinder inst Hot water stor. Permitted by Di Primary pipewo: 6 Controls Space heating of Hot water cont: Boiler interlo. 7 Low energy 1: Percentage of in Minimum	plation gg gscoc 2.30 k insulated: controls: cols: ck ghts gifts fixed lights with low- entilation	Measured cylinder loss: 1.72 kWm/day OK Yes Programmer and at least two room thermostats Cylinderstat Independent timer for DHW Yes energy fittings:0% 75%	OK OK OK OK OK OK Fail
5 Cylinder inst Hot water stor Permitted by Di Primary pipewor 6 Controls Space heating of Hot water contr Boiler interior 7 Low energy 1: Percentage of : Minimum 8 Mechanical ve. Not spplicable 9 Summertine	elation ggg 2, 30 ck insulated: controls: cols: ck insulated insulated: controls: cont	Measured cylinder loss: 1.72 kWm/day OK Yes Programmer and at least two room thermostats Cylinderstat Independent timer for DHW Yes energy fittings:0% 758 Not significant	OK OK OK OK OK OK Fail
5 Cylinder insi Hot water stor. Fermitted by DP Finary pipesor 6 Controls Space heating of Hot water cont: Boiler interlor 7 Low energy 1: Percentage of : Minimum 8 Mechanical ve Not applicable 9 Summertime to Overheating ri Rased on: Windows facing Windows facing Windows facing Windows facing Windows facing	plation gg sSCG 2.30 k insulated: controls: rols: ck lights lixed lights with low- entilation emperature k (Thames Valley): North: South:	Measured cylinder loss: 1.72 kWh/day OK Yes Programmer and at least two room thermostats Cylinderatat Independent timer for DHW Yes energy fittings:0% 75% Not significant Average 10.13 m/, No overhang 10.13 m/, No overhang 5.15 m/, No overhang 5.15 m/, No overhang	OK OK OK OK OK OK Fail
5 Cylinder insi Hot water stor, Fermitted by Di Frimary by Di Hot water conti Boiler interloo 7 Low energy 1: Percentage of 1 Minimum 8 Mechanical v Mot applicable 9 Summertime to Overshading: Windows facing Windows facing Windows facing Windows facing Windows facing Windows facing Mindows facing Air change rat Binde/curtain	cletion gg 22, 30 ck insulated: controls: rols: ck ghts itsed lights with low- entilation comperature k (Thames Valley): North: North: South: West:	Measured cylinder loss: 1.72 kWh/day OK Yes Programmer and at least two room thermostats Cylinderstat Independent timer for DHW Yes energy fittings:0% 75% Not significant Average 10.13 m; No overhang 10.13 m; No overhang 3.00 m; 10.14 m; No overhang 3.00 m; 11.15 m; No overhang 3.10 m; 11.15 m; 11	OK OK OK OK OK OK OK





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

G/ 1200 E/ 1110	311 01 2	VVLLLIIV	O EIVIIOOI	01131011	ILL GOLF	10113 6	JIVII LIIA	ICL US					
SAP 2012 WORKSHE CALCULATION OF I	EET FOR Ne	ew Build (A EMISSIONS F	s Designed) OR REGULATIO	(Version ONS COMPLIAN	9.92, Janua ICE 09	ry 2014) Jan 2014							
1. Overall dwell	ling dimer	nsions											
Ground floor Total floor area Dwelling volume		la)+(lb)+(l	c)+(ld)+(le)(ln)	1	09.9200		Area (m2) 109.9200		rey height (m) 3.0400 (+(3d)+(3e)		Volume (m3) 334.1568	(1b) - (3b (4) (5)
2. Ventilation													
2. Ventilation i					main	s	econdary		other	tot	al m	3 per hour	
Number of chimne Number of open i Number of inter Number of passiv Number of fluele	flues mittent fa ve vents				heating 0 0	++	heating 0 0	+ +	0 .	:	0 * 40 = 0 * 20 = 3 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 30.0000 0.0000	(6b) (7a) (7b)
Infiltration due Pressure test Measured/design Infiltration rat Number of sides	AP50 te		and fans	= (6a)+(6b)	+ (7a) + (7b) +	(7c) =				30.0000	Air change / (5) =	0.0898 No 15.0000 0.8398	
Shelter factor Infiltration rat	te adjuste	ed to inclu	de shelter	factor					(20) = 1	- [0.075 x 21) = (18)	(19)] = x (20) =	0.9250 0.7768	
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	(22) (22a)
Adj infilt rate Effective ac	0.9904	0.9710 0.9714	0.9516 0.9527	0.8545 0.8651	0.8351 0.8487	0.7380 0.7723	0.7380 0.7723	0.7185 0.7581	0.7768 0.8017	0.8351 0.8487	0.8739 0.8818	0.9127 0.9165	
3. Heat losses a	and heat	loss parame	ter	Gross	Openings	Ne	tArea	U-value	Α×	U K	-value	Α×Κ	
orginal (Uw = 4. Curtain Walling External Wall 2 Solid Core External Roof 1 Total net area c Fabric heat loss Party Floor 1	of externa		Aum(A, m2)	m2 98.4700 18.8500 3.7000 109.9200	m2 25.4100	73 18 3 109 230	m2 .4100 .0600 .8500 .7000 .9200 .9400 (26)(W/m2K 4.0268 1.2100 0.7266 0.3152 1.5000 30) + (32)	W, 102.322 88.402 13.69 1.164	/K 21 26 72 52	kJ/m2K	kJ/K	(27) (29a) (29a) (29a) (30) (31) (33) (32d)
Thermal mass par Thermal bridges Total fabric hea	(Default	TMP = Cm / value 0.15	TFA) in kJ/s 0 * total e	m2K xposed area)						(33)	+ (36) =	250.0000 34.6410 405.1092	(36)
Ventilation heat	Jan 109.2197	lculated mo Feb 107.1195	nthly (38)m Mar 105.0610	= 0.33 x (2 Apr 95.3920	15)m x (5) May 93.5830	Jun 85.1616	Jul 85.1616	Aug 83.6021	Sep 88.4054	Oct 93.5830	Nov 97.2426	Dec 101.0686	(38)
	514.3289	512.2287	510.1702	500.5012	498.6922	490.2708	490.2708	488.7113	493.5146	498.6922	502.3518	506.1778 500.4925	(39) (39)
HLP HLP (average) Days in month	Jan 4.6791	Feb 4.6600	Mar 4.6413	Apr 4.5533	May 4.5369	Jun 4.4603	Jul 4.4603	Aug 4.4461	Sep 4.4898	Oct 4.5369	Nov 4.5702	Dec 4.6050 4.5532	(40) (40)
nayo in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)
		requirement)									
Assumed occupant Average daily ho	cy ot water :	use (litres	/day)									2.8143 101.0407	(42) (43)
Daily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	111.1448 164.8245 (annual) ss (46)m	107.1031 144.1565 = 0.15 x (45)m	99.0199 129.6896	94.9782 124.4403	90.9366 107.3825	90.9366 99.5057	94.9782 114.1842	99.0199 115.5479		107.1031 146.9919 um(45)m =	111.1448 159.6237 1589.7635	(45) (45)
Distribution los Water storage lo Store volume a) If manufacts Temperature fa	oss: urer decla	ared loss f		19.4534 own (kWh/da	18.6660 iy):	16.1074	14.9259	17.1276	17.3322	20.1990	22.0488	23.9436 210.0000 1.7200 0.5400	(47) (48)



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



nter (49) or	ON OF L	JWELLIN	G EMISSI	ONS FOR	REGULA	TIONS CO	DMPLIAN	ICE 09	Jan 2014	ļ.			
	(54) in (55	5)										0.9288	(55
otal storage	28.7928	26.0064	28.7928	27.8640	28.7928	27.8640	28.7928	28.7928	27.8640	28.7928	27.8640	28.7928	(56
cylinder co	ntains dedi 28.7928	icated sola 26.0064	r storage 28.7928	27.8640	28.7928	27.8640	28.7928	28.7928	27.8640	28.7928	27.8640	28.7928	(57
imary loss	23.2624	21.0112 water heati	23.2624 ng calculat	22.5120 ed for each	23.2624 month	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59
olar input	216.8797	191.1741 0.0000	200.8118	180.0656 0.0000	176.4955 0.0000	157.7585 0.0000	151.5609 0.0000	166.2394 0.0000 Solar inn	165.9239 0.0000	186.7152 0.0000 months) = S	197.3679 0.0000	211.6789 0.0000 0.0000	(63)
tput from w/	n 216.8797	191.1741	200.8118	180.0656	176.4955	157.7585	151.5609	166.2394	165.9239	186.7152 h/year) = S	197.3679	211.6789 2202.6715	(64
eat gains from	m water hea 96.4483	ating, kWh/ 85.5461	month 91.1057	83.4226	83.0206	76.0055	74.7298	79.6104	78.7205	86.4186	89.1756	94.7190	
Internal ga													
tabolic gain	s (Table 5)), Watts											
6)m ghting gains	Jan 140.7172	Feb 140.7172	Mar 140.7172	Apr 140.7172	May 140.7172	Jun 140.7172	Jul 140.7172	Aug 140.7172	Sep 140.7172	Oct 140.7172	Nov 140.7172	Dec 140.7172	(66
ghting gains	(calculate 48.3983	ed in Appen 42.9870	dix L, equa 34.9594	26.4665	19.7840	see Table 5 16.7025	18.0476	23.4590	31.4866	39.9795	46.6620	49.7435	(67
priances gar	271.4410	274.2577	267.1597	252.0489	232.9742	215.0466	203.0699	200.2532	207.3513	222.4621	241.5368	259.4643	(68
oking gains	37.0717	37.0717	37.0717	37.0717	37.0717	37.0717	37.0717	37.0717	37.0717	37.0717	37.0717	37.0717	
mps, fans sses e.g. ev	3.0000 aporation	3.0000 (negative v	3.0000 ralues) (Tab	3.0000 le 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	
ter heating	-112.5738 gains (Tabl	-112.5738 le 5)	-112.5738	-112.5738	-112.5738		-112.5738	-112.5738		-112.5738	-112.5738		
otal internal	129.6348	127.3008	122.4540	115.8647	111.5868	105.5632	100.4433	107.0032	109.3340	116.1540	123.8550	127.3105	(72
July Titoching	517.6893	512.7607	492.7882	462.5953	432.5601	405.5275	389.7760	398.9306	416.3870	446.8108	480.2689	504.7335	(73
. Solar gains													
Jan]			A	rea	Solar flux		q		FF	Acce		Gains	
				m2	Table 6a W/m2		fic data Table 6b	Specific or Tab	le 6c	fact Table	6d	W	
orth			10.1		10.6334		0.5000		.8000	0.77	00	29.8589 131.2815	
est			5.1	500	19.6403		0.5000		.8000	0.77		28.0380	(80
olar gains otal gains	189.1785 706.8678	326.9156 839.6763	461.1682 953.9564	597.0256 1059.6209	693.8154 1126.3756	700.2957 1105.8232	670.3412 1060.1173	596.0708 995.0015	507.7331 924.1201	364.9104 811.7211	227.4083 707.6773	161.3883 666.1218	
. Mean intern													
emperature du	ring heatir	ng periods	in the livi	ng area fro	m Table 9, 9	fhl (C)						21.0000	(85
tilisation fa	Jan 14.8413	Feb 14.9022	Mar	Apr 15.2514	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
lpha	1.9894	1.9935	14.9623 1.9975	2.0168	15.3067 2.0204	15.5696 2.0380	15.5696 2.0380	15.6193 2.0413	15.4673 2.0312	15.3067 2.0204	15.1952 2.0130	15.0803 2.0054	
lpha	1.9894		14.9623 1.9975 0.9854	2.0168	15.3067 2.0204 0.9560	15.5696 2.0380 0.9193	15.5696 2.0380 0.8648	15.6193 2.0413 0.8848	15.4673 2.0312 0.9475	15.3067 2.0204 0.9800	15.1952 2.0130 0.9910	15.0803 2.0054 0.9944	(86
lpha til living ar IT n 2	1.9894 ea 0.9936 16.9015 18.1454	1.9935	1.9975	2.0168	2.0204	2.0380	2.0380	2.0413	2.0312	2.0204	2.0130	2.0054	(87
lpha til living are IT h 2 til rest of h	1.9894 ea 0.9936 16.9015 18.1454 ouse 0.9909	1.9935 0.9905 17.1382 18.1496 0.9864	1.9975 0.9854 17.6297 18.1538 0.9782	2.0168 0.9753 18.3518 18.1744 0.9603	2.0204 0.9560 19.1188 18.1784 0.9192	2.0380 0.9193 19.8695 18.1976 0.8099	2.0380 0.8648 20.3389 18.1976 0.5657	2.0413 0.8848 20.2699 18.2012 0.6293	2.0312 0.9475 19.6564 18.1901 0.8776	2.0204 0.9800 18.6804 18.1784	2.0130 0.9910 17.6945 18.1704 0.9862	2.0054 0.9944 16.8902 18.1622 0.9920	(88)
lpha til living are IT 1 2 til rest of he IT 2	1.9894 ea 0.9936 16.9015 18.1454 ouse 0.9909 14.8089	1.9935 0.9905 17.1382 18.1496	1.9975 0.9854 17.6297 18.1538	2.0168 0.9753 18.3518 18.1744	2.0204 0.9560 19.1188 18.1784	2.0380 0.9193 19.8695 18.1976	2.0380 0.8648 20.3389 18.1976	2.0413 0.8848 20.2699 18.2012	2.0312 0.9475 19.6564 18.1901 0.8776 17.5487	2.0204 0.9800 18.6804 18.1784 0.9646 16.5955	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044	(87 (88 (89
lpha til living ard IT h 2 til rest of h IT 2 iving area from	1.9894 ea 0.9936 16.9015 18.1454 ouse 0.9909 14.8089 action 15.4954	1.9935 0.9905 17.1382 18.1496 0.9864	1.9975 0.9854 17.6297 18.1538 0.9782	2.0168 0.9753 18.3518 18.1744 0.9603	2.0204 0.9560 19.1188 18.1784 0.9192	2.0380 0.9193 19.8695 18.1976 0.8099	2.0380 0.8648 20.3389 18.1976 0.5657	2.0413 0.8848 20.2699 18.2012 0.6293	2.0312 0.9475 19.6564 18.1901 0.8776	2.0204 0.9800 18.6804 18.1784 0.9646 16.5955	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044 0.3281 15.4886	(87 (88 (89 (90
lpha til living ard IT h 2 til rest of h IT 2 iving area fr. IT emperature ad	1.9894 ea 0.9936 16.9015 18.1454 ouse 0.9909 14.8089 action 15.4954	1.9935 0.9905 17.1382 18.1496 0.9864 15.0464	1.9975 0.9854 17.6297 18.1538 0.9782 15.5378	2.0168 0.9753 18.3518 18.1744 0.9603 16.2635	2.0204 0.9560 19.1188 18.1784 0.9192 17.0186	2.0380 0.9193 19.8695 18.1976 0.8099 17.7349	2.0380 0.8648 20.3389 18.1976 0.5657 18.0997	2.0413 0.8848 20.2699 18.2012 0.6293 18.0656	2.0312 0.9475 19.6564 18.1901 0.8776 17.5487 fLA =	2.0204 0.9800 18.6804 18.1784 0.9646 16.5955 Living are	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111 a / (4) =	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044 0.3281	(87 (88 (89 (90 (91 (92
au Ipha Itil living ar IT h 2 til rest of h IT 2 ving area fr. IT emperature ad djusted MIT Space heati.	1.9894 ea 0.9936 16.9015 18.1454 ouse 0.9909 14.8089 action 15.4954 justment 15.3454	1.9935 0.9905 17.1382 18.1496 0.9864 15.0464 15.7326 15.5826	1.9975 0.9854 17.6297 18.1538 0.9782 15.5378	2.0168 0.9753 18.3518 18.1744 0.9603 16.2635	2.0204 0.9560 19.1188 18.1784 0.9192 17.0186	2.0380 0.9193 19.8695 18.1976 0.8099 17.7349 18.4352	2.0380 0.8648 20.3389 18.1976 0.5657 18.0997	2.0413 0.8848 20.2699 18.2012 0.6293 18.0656	2.0312 0.9475 19.6564 18.1901 0.8776 17.5487 fLA =	2.0204 0.9800 18.6804 18.1784 0.9646 16.5955 Living are 17.2795	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111 a / (4) = 16.2946	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044 0.3281 15.4886 -0.1500	(87 (88 (89 (90 (91 (92
lpha til living are IT h 2 til rest of he IT 2 tiving area fr. IT emperature ad djusted MIT	1.9894 a 0.9936 16.9015 18.1454 ouse 0.9909 14.8089 action 15.4954 justment 15.3454	1.9935 0.9905 17.1382 18.1496 0.9864 15.0464 15.7326	1.9975 0.9854 17.6297 18.1538 0.9782 15.5378 16.2241 16.0741	2.0168 0.9753 18.3518 18.1744 0.9603 16.2635 16.9486	2.0204 0.9560 19.1188 18.1784 0.9192 17.0186 17.7076	2.0380 0.9193 19.8695 18.1976 0.8099 17.7349 18.4352	2.0380 0.8648 20.3389 18.1976 0.5657 18.0997 18.8343	2.0413 0.8848 20.2699 18.2012 0.6293 18.0656 18.7887	2.0312 0.9475 19.6564 18.1901 0.8776 17.5487 fIA " 18.2401 18.0901	2.0204 0.9800 18.6804 18.1784 0.9646 16.5955 Living are 17.2795 17.1295	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111 a / (4) = 16.2946 16.1446	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044 0.3281 15.4866 -0.1500 15.3386	(87 (88 (89 (90 (91 (92
ipha IT h 2 til living are IT h 2 til rest of h IT IT IT IT IT IT IT IT IT I	1.9894 ea 0.9936 16.9015 18.1454 ouse 0.9909 14.8089 action 15.4954 justment 15.3454	1.9935 0.9905 17.1382 18.1496 0.9864 15.0464 15.7326 15.5826	1.9975 0.9854 17.6297 18.1538 0.9782 15.5378 16.2241 16.0741	2.0168 0.9753 18.3518 18.1744 0.9603 16.2635 16.9486 16.7986	2.0204 0.9560 19.1188 18.1784 0.9192 17.0186 17.7076 17.5576	2.0380 0.9193 19.8695 18.1976 0.8099 17.7349 18.4352 18.2852	2.0380 0.8648 20.3389 18.1976 0.5657 18.0997 18.8343 18.6843	2.0413 0.8848 20.2699 18.2012 0.6293 18.0656 18.7887 18.6387	2.0312 0.9475 19.6564 18.1901 0.8776 17.5487 fLA * 18.2401 18.0901	2.0204 0.9800 18.6804 18.1784 0.9646 16.5955 Living are 17.2795 17.1295	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111 a / (4) = 16.2946 16.1446	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044 0.3281 15.4866 -0.1500 15.3386	(87 (88 (89 (90 (91 (92 (93
ipha til living are til living are til living are til T til rest of h TT 2 til rest of h	1.9894 ea	1.9935 0.9905 17.1382 18.1496 0.9864 15.0464 15.7326 15.5826	1.9975 0.9854 17.6297 18.1538 0.9782 15.5378 16.2241 16.0741	2.0168 0.9753 18.3518 18.1744 0.9603 16.2635 16.9486	2.0204 0.9560 19.1188 18.1784 0.9192 17.0186 17.7076 17.5576	2.0380 0.9193 19.8695 18.1976 0.8099 17.7349 18.4352 18.2852	2.0380 0.8648 20.3389 18.1976 0.5657 18.0997 18.8343 18.6843	2.0413 0.8848 20.2699 18.2012 0.6293 18.0656 18.7887	2.0312 0.9475 19.6564 18.1901 0.8776 17.5487 fLA " 18.2401 18.0901	2.0204 0.9800 18.6804 18.1784 0.9646 16.5955 Living are 17.2795 17.1295	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111 a / (4) = 16.2946 16.1446	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044 0.3281 15.4886 -0.1500 15.3386	(87 (88 (89 (90 (91 (92 (93 (93
ipha itil living are itil living are itil living are itil rest of he itil rest	1.9894 ea 0.9936 16.9015 18.1454 ouse 0.9909 14.8089 action 15.4954 justment 15.3454 Jan 0.9861 697.0528 4.3000 W 55680.9706	1.9935 0.9905 17.1382 18.1496 0.9864 15.0464 15.7326 15.5826 15.5826 Feb 0.9797 822.6702 4.9000 5471.9474	1.9975 0.9854 17.627 18.1538 0.9782 15.5378 16.2241 16.0741 Mar 0.9689 924.3329 6.5000 4884.3969	2.0168 0.9753 18.3518 18.1744 0.9603 16.2635 16.9486 16.7986 16.7986	2.0204 0.9560 19.1188 18.1784 0.9192 17.0186 17.7076 17.5576 May 0.9051 1019.4537 11.7000 2921.1509	2.0380 0.9193 19.8695 18.1976 0.8099 17.7349 18.4352 18.2852 Jun 0.8159 902.2737 14.6000	2.0380 0.8648 20.3389 18.1976 0.5657 18.0997 18.8343 18.6843 Jul 0.6584 698.0189 16.66000 1021.8781	2.0413 0.8848 20.2699 18.2012 0.6293 18.0656 18.7887 18.6387 Aug 0.7025 698.9641 16.4000 1094.0784	2.0312 0.9475 19.6564 18.1901 0.8776 17.5487 fLa.* 18.2401 18.0901 Sep 0.8730 806.7806 14.1000 1969.1956	2.0204 0.9800 18.684 18.1784 18.1784 0.9646 16.5955 Living area 17.2795 17.1295	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111 a / (4) = 16.2946 16.1446 Nov 0.9799 693.4777 7.1000	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044 0.3281 15.4886 0-1500 15.3386	(87 (88 (89 (90 (91 (92 (93 (93 (94 (95) (96
Lipha 17 12 12 12 13 14 15 15 17 17 17 17 17 17 17 17	1.9894 ea 0.9936 16.9015 18.1454 ouse 0.9909 14.8089 action 15.4954 justment 15.3454 Jan 0.9861 697.0528 4.3000 W 5560.9706 1.0000	1.9935 0.9905 17.1382 18.1496 0.9964 15.0464 15.7326 15.5826 15.5826 19.9797 822,6702 4.9000 5471.9474 1.0000	1.9975 0.9854 17.6297 18.1538 0.9782 15.5378 16.2241 16.0741 Mar 0.9689 924.3329 6.5000 4884.3399 1.0000	2.0168 0.9753 18.3518 18.1174 0.9603 16.2635 16.9486 16.7986 Apr 0.9476 1004.0675 8.9000 3953.2340 1.0000	2.0204 0.9560 19.1188 18.1784 0.9192 17.0186 17.7076 17.5576 May 0.9051 1019.4537 11.7000 2921.1509 1.0000	2.0380 0.9193 19.8695 18.1976 0.8099 17.7349 18.4352 18.2852 Jun 0.8159 902.2737 14.6000	2.0380 0.8648 20.3389 18.1976 0.5657 18.0997 18.8343 18.6843 Jul 0.6584 698.0189 16.6000 1021.8781 0.0000	2.0413 0.8848 20.2699 18.2012 0.6293 18.0656 18.7887 18.6387 Aug 0.7025 698.9641 16.4000 1094.0784 0.0000	2.0312 0.9475 19.6564 18.1901 0.8776 17.5487 fla. 18.2401 18.0901 Sep 0.8730 806.7806 14.1000 1969.1956 0.0000	2.0204 0.9800 18.6804 18.1784 0.9646 16.5955 Living area 17.2795 17.1295 Oct 0.9540 774.3511 10.6000 3256.2133 1.0000	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111 a / (4) = 16.2946 16.1446 Nov 0.9799 693.4777 7.1000	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044 0.3281 15.4886 -0.1500 15.3386 Dec 0.9878 658.0023 4.2000 5638.1258 1.0000	(87 (88 (89 (90 (91 (92 (93 (93 (95 (96
ipha til living ar IT h 2 til rest of h IT f 2 til rest of h IT generature ad djusted MIT Space heatin tilisation seful gains tt temp. at loss rate onth fracti space heating	1.8894 ea 0.9936 16.9015 18.1454 ouse 0.9909 14.0898 action 15.3454 justment 15.3454 Jan 0.8611 697.0528 4.3000 84.3000 84.3000 3708.0349	1.9935 0.9905 17.1382 18.1496 0.9964 15.0464 15.7326 15.5826 15.5826 19.9797 822,6702 4.9000 5471.9474 1.0000	1.9975 0.9854 17.627 18.1538 0.9782 15.5378 16.2241 16.0741 Mar 0.9689 924.3329 6.5000 4884.3969	2.0168 0.9753 18.3518 18.1174 0.9603 16.2635 16.9486 16.7986 Apr 0.9476 1004.0675 8.9000 3953.2340 1.0000	2.0204 0.9560 19.1188 18.1784 0.9192 17.0186 17.7076 17.5576 May 0.9051 1019.4537 11.7000 2921.1509 1.0000	2.0380 0.9193 19.8695 18.1976 0.8099 17.7349 18.4352 18.2852 Jun 0.8159 902.2737 14.6000	2.0380 0.8648 20.3389 18.1976 0.5657 18.0997 18.8343 18.6843 Jul 0.6584 698.0189 16.66000 1021.8781	2.0413 0.8848 20.2699 18.2012 0.6293 18.0656 18.7887 18.6387 Aug 0.7025 698.9641 16.4000 1094.0784	2.0312 0.9475 19.6564 18.1901 0.8776 17.5487 fla. 18.2401 18.0901 Sep 0.8730 806.7806 14.1000 1969.1956 0.0000	2.0204 0.9800 18.6804 18.1784 0.9646 16.1785 Living are 17.2795 17.1295 Oct 0.9540 774.3511 10.6000 3256.2133 1.0000	2.0130 0.9910 17.6945 18.1704 0.9862 15.6111 a/ (4) = 16.2946 16.1446 Nov 0.9799 693.4777 7.1000 4543.5705 1.0000 2772.0668	2.0054 0.9944 16.8902 18.1622 0.9920 14.8044 0.3281 15.4886 0-1500 15.3386	(87 (88 (89 (90 (91 (92 (93 (94 (95 (97 (97 (98





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements												
Fraction of space heat f Fraction of space heat f Efficiency of main space Efficiency of secondary/ Space heating requiremen	rom seconds rom main sy heating sy supplements	ery/suppleme ystem(s) ystem 1 (in	ntary syste								0.0000 1.0000 90.2000 0.0000 23991.8887	(202) (206) (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	3124.3142	2946.2876		1414.8628	0.0000	0.0000	0.0000	0.0000	1846.5055	2772.0668	3705.2119	(98)
	90.2000	90.2000		90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
	3463.7630	/stem) 3266.3942	2354.1019	1568.5840	0.0000	0.0000	0.0000	0.0000	2047.1236	3073.2448	4107.7737	(211)
Water heating requiremen 0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating Water heating requiremen	t											
Efficiency of water heat	er			176.4955		151.5609	166.2394		186.7152		79.5000	
(217)m 89.5341 Fuel for water heating,		89.4320	89.2609	88.8734	79.5000	79.5000	79.5000	79.5000	89.0988	89.4002	89.5487	(217)
242.2313 Water heating fuel used Annual totals kWh/year	213.5895	224.5415	201.7296	198.5921	198.4384	190.6426	209.1062	208.7094	209.5598	220.7689	236.3842 2554.2936	
Space heating fuel - mai Space heating fuel - sec											23991.8887 0.0000	
Electricity for pumps an central heating pump main heating flue fan Total electricity for th Electricity for lighting Total delivered energy f	e above, kW	ed in Append	lix L)								30.0000 45.0000 75.0000 854.7297 27475.9119	(230e) (231) (232)
12a. Carbon dioxide emis	sions - Ind	iividual hea	ting system	s including	micro-CHP							
Space heating - main sys Space heating - secondar Water heating (other fue Space and water heating Pumps and fans Energy for lighting Total CO2, kg/year Dwelling Carbon Dioxide	tem 1 Y 1)						Energy kWh/year 23991.8887 0.0000 2554.2936 75.0000 854.7297		kg CO2/kWh 0.2160 0.0000 0.2160 0.5190 0.5190	1	Emissions tg CO2/year 5182.2480 0.0000 551.7274 5733.9754 38.9250 443.6047 6216.5051 56.5500	(261) (263) (264) (265) (267) (268) (272)
16 CO2 EMISSIONS ASSOCIA DER Total Floor Area Assumed number of occupa CO2 emission factor in T CO2 emissions from appli CO2 emissions from cock Total CO2 emissions Residual CO2 emissions Additional allowable ele Net CO2 emissions	nts able 12 for ances, equa ng, equation ffset from ctricity ge	e electricit ation (L14) on (L16) biofuel CHF eneration, k	y displaced	from grid		TY GENERATI	ON TECHNOLOG	GIES		TFA N EF	56.5500 109.9200 2.8143 0.5190 14.6334 1.6371 72.8805 0.0000 0.0000 0.0000 72.8805	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

Design SAP elmhurst energy

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHE CALCULATION OF E	EET FOR Ne FABRIC ENE	ew Build (A: ERGY EFFICI	s Designed) ENCY 0	(Version 19 Jan 2014	9.92, Janua	ry 2014)							
1. Overall dwell	Ling dimer	nsions											
								Area (m2)		orey height		Volume (m3)	
Ground floor Total floor area Dwelling volume	a TFA = (1	la)+(lb)+(l	c) + (1d) + (1e	e)(ln)	1	09.9200		109.9200	(1b) x (3a)+(3b)+(3c	3.0400 c)+(3d)+(3e)		334.1568 334.1568	(1b) - (3 (4) (5)
2. Ventilation r	ate												
					main heating	s	econdary heating		other	tot		3 per hour	
Number of chimne Number of open f Number of interm Number of passiv Number of fluels	flues mittent fa ve vents				0	+	0	+ +	0		0 * 40 = 0 * 20 = 4 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 40.0000 0.0000	(6b) (7a) (7b)
Infiltration due	to chimr	neys, flues	and fans	= (6a)+(6b)+(7a)+(7b)+	(7c) =				40.0000	Air change / (5) =	es per hour 0.1197 No	(8)
Measured/design Infiltration rat Number of sides	:e	1										15.0000 0.8697	(18) (19)
Shelter factor Infiltration rat	e adjuste	ed to inclu	de shelter	factor						- [0.075 x (21) = (18)		0.9250 0.8045	
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	(22) (22a)
Adj infilt rate Effective ac	1.0257	1.0056	0.9855	0.8849	0.8648	0.7643	0.7643	0.7441	0.8045	0.8648	0.9050	0.9453	(22b)
3. Heat losses a			ter										
Element				Gross m2	Openings m2		tArea m2	U-value W/m2K		V/K	-value kJ/m2K	A x K kJ/K	
orginal (Uw = 4. Curtain Walling External Wall 2 Solid Core External Roof 1				98.4700 18.8500 3.7000 109.9200	25.4100	73 18 3 109	.4100 .0600 .8500 .7000	4.0268 1.2100 0.7266 0.3152 1.5000	102.32 88.40 13.69 1.10 164.80	026 972 562			(27) (29a) (29a) (29a) (30)
Total net area of Fabric heat loss Party Floor 1	of externa s, W/K = S	al elements Sum (A x U)	Aum(A, m2)				.9400 (26)(.9200	30) + (32)	= 370.46	582			(31) (33) (32d)
Thermal mass par Thermal bridges Total fabric hea	(Default	PMP = Cm / 1 value 0.15	TFA) in kJ/ D * total e	m2K exposed area)					(33)	+ (36) =	250.0000 34.6410 405.1092	(36)
	Jan 113.1066	Iculated mor Feb 110.8888	Mar 108.6826	a = 0.33 x () Apr 98.3123	25)m x (5) May 96.3720	Jun 87.3397	Jul 87.3397	Aug 85.6671	Sep 90.8188	Oct 96.3720	Nov 100.2971	Dec 104.4007	(38)
Heat transfer co Average = Sum(35	518.2157	515.9979	513.7918	503.4214	501.4812	492.4489	492.4489	490.7763	495.9280	501.4812	505.4063	509.5098 503.4090	
HLP HLP (average)	Jan 4.7145	Feb 4.6943	Mar 4.6742	Apr 4.5799	May 4.5622	Jun 4.4801	Jul 4.4801	Aug 4.4648	Sep 4.5117	Oct 4.5622	Nov 4.5979	Dec 4.6353 4.5798	(40) (40)
Days in month	31	28	31	30	31	30	31	31	. 30	31	30	31	(41)
4. Water heating Assumed occupance Average daily ho	:у			:)								2.8143 101.0407	(42)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	, , , , ,
Energy conte 1 Energy content	111.1448 164.8245 (annual)		148.7566	99.0199 129.6896	94.9782 124.4403	90.9366 107.3825	90.9366 99.5057	94.9782 114.1842	99.0199	103.0615 134.6600 Total = S	107.1031 146.9919 um(45)m =	111.1448 159.6237 1589.7635	(45)
Distribution los Water storage lo	0.0000 0.0000	= 0.15 x (0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total storage lo	0.0000	0.0000 icated sola	0.0000 r storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)





	CALCULA	TION OF I	FABRIC E	NERGY E	FFICIENC	Y 09 Ja	n 2014							
Description Company					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
2.		om water he	ating, kWh/	month										
Receive California Califo		33.0232	30.0333	31.0100	27.3330	20.4430	11.0100	21.1430	24.2042	24.5555	20.0132	31.2330	33.3200	(03)
Receive California Califo	5 Internal o	aine (eaa T	ahla 5 and	50)										
General 16.7172 16.7		ns (Table 5), Watts											
Age lances gains (calculated in Agenetic I.) separation (13) or 1130, Alles mer banks 20,000 (20,000) 20,000 (20,000) 21,000 (20,000	(66)m	140.7172	140.7172	140.7172	140 7172	140 7172	140.7172	140.7172	Aug 140.7172	Sep 140.7172				(66)
21,4410 271,2577 20,1579 22,0489 22,7422 15,0468 20,0499 200,2522 207,3513 22,4611 241,5588 239,4640 (48)	Lighting gair	s (calculat 24.1992	ed in Apper 21.4935	17.4797	13.2332	19a), also 9.8920	see Table 5 8.3512	9.0238	11.7295	15.7433	19.9897	23.3310	24.8717	(67)
Company Comp	Appliances ga	271.4410	274.2577	267.1597	252.0489	232.9742	215.0466	203.0699	200.2532	207.3513	222.4621	241.5368	259.4643	(68)
Company Comp	Pumns, fans	37.0717 0.0000	37.0717 0.0000	37.0717 0.0000	37.0717 0.0000	37.0717	37.0717 0.0000	37.0717						
Total internal gains (Table 5) Total gains (Losses e.g. e	evaporation	(negative v	raiues) (Tar	ile 5)									
## Control of the Con		47.0769	le 5) 45.5852	42.4876	38.2765	35.5424	31.6928	28.4206	32.6131	34.1027				
Language	Total interna		406.5516	392.3422	368.7738	343.6238	320.3058	305.7296	309.8110	322.4124	346.1284	373.4660	395.1427	(73)
Lamin Lami														
Table 6a Specific data Specific data Table 6d														
Table 68 Specific data Specific data Table 60	[Jan]				rea	Solar flux	:	a		FF	Acce	88	Gains	
South 10.1300 46.7321 0.5000 0.8000 0.7700 13.2815 (78)							Speci	fic data						
Section 19.1783 326.9156 661.1682 99.0256 63.8154 700.2957 670.3412 596.0708 907.7331 364.9104 277.4083 161.3883 (83) 701.988 771.0387 773.4672 833.5104 963.7994 1037.4392 1020.6015 976.0708 903.818 830.1459 771.0387 600.8743 536.5310 64) 701.9887 771.0387														
7. Mean internal temperature (heating season) Temperature muting periods in the living seas from Table 9, Th1 (C) Temperature factor for gains for living area from Table 9, Th1 (C) Utilisation factor for gains for living area from Table 9, Th1 (C) Utilisation factor for gains for living area from Table 9, Th1 (C) Utilisation factor for gains for living area from Table 9, Th1 (C) Utilisation factor for gains for living area from Table 9, Th1 (C) 1,700 (1														
7. Mean internal temperature (heating season) Temperature muting periods in the living seas from Table 9, Th1 (C) Temperature factor for gains for living area from Table 9, Th1 (C) Utilisation factor for gains for living area from Table 9, Th1 (C) Utilisation factor for gains for living area from Table 9, Th1 (C) Utilisation factor for gains for living area from Table 9, Th1 (C) Utilisation factor for gains for living area from Table 9, Th1 (C) 1,700 (1	Solar gains				597.0256	693.8154	700.2957							
Temperature during heating periods in the living area from Table 9, Th1 (C) Utilisation factor for gains for living area, inil,** (see Table 9a) International Control of Cont	Total gains	597.1107	733.4672	853.5104	965.7994	1037.4392	1020.6015	976.0708	905.8818	830.1455	711.0387	600.8743	556.5310	(84)
Temperature during heating periods in the living area from Table 9, Thi (C) Utilisation factor for gains for living area, init, (see Table 9a) Italiation factor for gains for living area, init, (see Table 9a) Italiation factor for gains for living area, init, (see Table 9a) Italiation factor for gains for living area, init, (see Table 9a) Italiation factor for gains for living area, init, (see Table 9a) Italiation factor for gains for living area, init, (see Table 9a) Italiation factor for gains for living area from Table 9a) Italiation factor for gains for living area from Table 9a) Italiation factor for gains for living area from Table 9a) Italiation factor for gains for living area from Table 9a) Italiation factor for gains for living area from Table 9a) Italiation factor for gains for living area for gains for gains for gains for living area for gains for living area for gains gains for gains gain														
Utilisation factor for gains for living area, nil,m (see Table 9a) tax					ng area fro	m Table 9	Th1 (C)						21 0000	(85)
## Apr Apr	Utilisation i	actor for g	ains for li	ving area, Mar	nil,m (see Apr	Table 9a)		Jul	Aug	Sep	Oct	Nov	Dec	(03)
Company Comp	alpha	1.9820	14.7933 1.9862	14.8569 1.9905	15.1629	15.2216 2.0148	15.5008 2.0334	15.5008 2.0334	15.5536 2.0369	15.3920 2.0261	15.2216 2.0148	15.1034 2.0069	14.9817 1.9988	
Th 2 18.1377 18.1421 18.1465 18.1681 18.1723 18.1925 18.1964 18.1864 18.1723 18.1952 (88) util rest of house side of house sides of house sides sides of house sides sides of house sides sides sides of house sides	util living a	o.9953	0.9926	0.9881	0.9792	0.9620	0.9294	0.8808	0.9006	0.9564	0.9844	0.9934	0.9960	(86)
### Test of house						19.0692							16.8188	(87)
Living area Fraction MIT 15.4209 15.6610 16.1580 16.8914 17.6590 18.3996 18.8128 18.7631 18.1952 17.2203 16.228 15.4517 (92) Temperature adjustment adjustment		house												
MIT 15.429 15.6610 16.1580 16.8914 17.6590 18.3996 18.8128 18.7631 18.1952 17.2203 16.2268 15.4157 (92) Temperature adjustment		raction								fLA =	Living are	a / (4) =	0.3281	(91)
8. Space heating requirement Utilisation 0.9900 0.8844 0.9750 0.9553 0.9192 0.4144 0.7055 0.7992 0.9866 0.5644 0.9854 0.9114 0.9156 0.9114 0.9156 0.7992 0.9866 0.5644 0.9854 0.9114 0.9156 0.9114 0.9156 0.9994 0.9866 0.9644 0.9854 0.9914 0.9114 0.9165 0.7992 0.9866 0.9644 0.9854 0.9914 0.941 0.9866 0.9866 0.9864 0.9854 0.9914 0.941 0.9866 0.98	MIT	15.4209			16.8914	17.6590	18.3996	18.8128			17.2203	16.2268	15.4157 0.0000	(92)
Second	adjusted MIT	15.4209	15.6610	16.1580	16.8914	17.6590	18.3996	18.8128	18.7631	18.1952	17.2203	16.2268	15.4157	(93)
Utilization 0.9900 0.8844 0.9750 0.9853 0.9192 0.8444 0.7055 0.7992 0.9864 0.9854 0.9914 0.1016 0.9854 0.9958 0.9864 0.9854 0.9914 0.1016 0.9858 0.9864 0.9854 0.9914 0.1016 0.9858 0.9854 0.9914 0.1016 0.9858 0.9854 0.9914 0.1016 0.9858 0.9854 0.9914 0.1016 0.9858 0.1016 0.9858 0.9854 0.9914 0.1016 0.10														
Useful gains	8. Space heat	ing require	ment											
Useful gains	776/7/226/22	Jan		Mar	Apr	May	Jun	Jul	Aug	Sep				(0.4)
Reat loss rate W	Useful gains	591.1185	722.0186	832.1378	923.5763	953.6251	859.7682	689.5595	678.7265	744.3073	685.7430	592.1110	551.7486	(95)
Space heating SMR SR26 3246.1986 3072.7568 2311.6298 1513.8185 0.0000 0.0000 0.0000 0.0000 0.0000 1959.8598 2894.8559 3841.0755 (98)	Heat loss rat	e W 5763.0037	5552.6712	4962.1872	4023.0621	2988.3274	1871.1264	1089.6776	1159.7720	2030.9102	3319.9632	4612.7442	5714.4844	(97)
Space heating per m2		kWh												
Sc. Space cooling requirement Calculated for June, July and August. See Table 10b Mar Apr May Jun Jul Aug Sep Oct Nov Dec Ext. temp. 4.3000 6.5000 0.0000 0.0000 0.0000 11.7000 14.6000 16.6000 16.4000 14.1000 10.6000 7.1000 4.2000 Heat loss rate W 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.2658 0.3161 0.2924 0.0000 0.0000 0.0000 0.0000 0.0000 10.0000 0.2658 0.3161 0.2924 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.2658 0.3161 0.2924 0.0000 0.			3240.1300	3072.7300	2231.0290	1313.0103	0.0000	0.0000	0.0000	0.0000			22608.0773	(98)
Calculated for June, July and August. See Table 10b														
Calculated for June, July and August. See Table 10b	8c. Space cod	oling requir	ement											
Ext. temp. 4,3000 4,3000 6,5000 8,9000 11,7000 14,6000 16,6000 16,4000 14,1000 10,6000 7,1000 4,2000		or June, Jul	y and Augus	t. See Tabl	e 10b									
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 4629.0198 3644.1220 3729.8997 0.0000		4.3000			Apr 8.9000	May 11.7000				Sep 14.1000				
Useful loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1230.3828 1151.8499 1090.7712 0.0000 0.0000 0.0000 0.0000 0.0000 (102) Total gains 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1303.0507 1248.5727 1168.5157 0.0000 0.0		0.0000			0.0000		0.2658	0.3161	0.2924	0.0000				
Month fracti 0.0000 0.0000 0.0000 0.0000 0.0000 1.0000 1.0000 1.0000 0.0	Useful loss Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1230.3828 1303.0507	1151.8499 1248.5727	1090.7712 1168.5157	0.0000	0.0000	0.0000	0.0000	(102) (103)
0.0000 0.0000 0.0000 0.0000 0.0000 52.3209 71.9617 57.8419 0.0000 0.0000 0.0000 0.0000 (104)	Month fracti	0.0000 kWh	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
		0.0000	0.0000	0.0000	0.0000	0.0000	52.3209	71.9617	57.8419	0.0000	0.0000	0.0000		

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION OF FA	ABRIC EN	IERGY EF	FICIENCY	09 Ja	n 2014							
Cooled fraction Intermittency factor (Tabl	e 10h)							fC =	cooled area	/ (4) =	1.0000	(105
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106
Space cooling kWh												
O.0000 Space cooling Space cooling per m2 Energy for space heating Energy for space cooling Total Dwelling Fabric Energy Eff	0.0000	0.0000 FEE)	0.0000	0.0000	13.0802	17.9904	14.4605	0.0000	0.0000	0.0000	0.0000 45.5311 0.4142 205.6776 0.4142 206.0918 206.1	(10) (10) (99) (10) (10)



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

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Appendix C

Non-Domestic Pre-Conversion BRUKL report (TER Baseline)

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name Shell and Core

Office As built

Date: Fri Jun 21 13:23:10 2019

Administrative information

Building Details
Address: London.

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

lame:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

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

The building does not comply with England Building Regulations Part L 2013

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	18.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	18.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	66.2
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	Ua-Limit	Ua-Calc	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	1.21	1.21	01 Ground Floor - Office_W_8
Floor	0.25	1.2	1.2	01 Ground Floor - Office_F_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	4.8	4.8	01 Ground Floor - Office_G_12
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"
Ua-Limit = Limiting area-weighted average U-values [W/			Hilosia = C	alculated maximum individual element Ll-values (W//m²K)1

^{*} There might be more than one surface where the maximum U-value occurs.

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	25

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency	
This system	0.89	-	-	-	-	
Standard value	0.91*	N/A	N/A	N/A	N/A	
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NC						
* Standard shown is for ras single holler systems <=2 MW output. For single holler systems >2 MW or multi-holler systems (overall) limit						

^{*} Standard shown is for gas single boiler systems <= 2 MW output. For single boiler systems > 2 MW or multi-boiler systems, (overall) limitin efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Project DHW

		Water heating efficiency	Storage loss factor [kWh/litre per day]
1	This building	1	0.005
- [5	Standard value	1	N/A

[&]quot;No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

Shell and core configuration

Zone	Excluded from calculation?
01 Ground Floor - Office	NO

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
01 Ground Floor - Office	28	-	-	5510

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?
01 Ground Floor - Office	YES (+11%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Page 1 of 5 Page 2 of 5

^{**} 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.

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

Building Use

	Actual	Notional
Area [m²]	250.1	250.1
External area [m²]	467.6	467.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	807.06	228.15
Average U-value [W/m²K]	1.73	0.49
Alpha value* [%]	3.47	15.11

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

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels

C2 Residential Institutions: Hospitals and Care Homes C2 Residential Institutions: Residential schools

C2 Residential Institutions: Universities and colleges

C2A Secure Residential Institutions

Residential spaces

D1 Non-residential Institutions: Community/Day Centre

D1 Non-residential Institutions: Libraries, Museums, and Galleries

D1 Non-residential Institutions: Education

D1 Non-residential Institutions: Primary Health Care Building

D1 Non-residential Institutions: Crown and County Courts

D2 General Assembly and Leisure, Night Clubs, and Theatres

Others: Passenger terminals

Others: Emergency services

Others: Miscellaneous 24hr activities

Others: Car Parks 24 hrs Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	131.96	30.95
Cooling	0	0
Auxiliary	2.13	1.01
Lighting	66.87	19.79
Hot water	3.68	3.34
Equipment*	42.18	42.18
TOTAL**	204.64	55.09

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

Energy Production by Technology [kWh/m²]

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

Energy & CO, Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	576.11	232.39
Primary energy* [kWh/m²]	384.13	103.7
Total emissions [kg/m²]	66.2	18.3

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

H	IVAC Sys	tems Per	formanc	е						
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central he	ating using	water: rad	iators, [HS]	LTHW boil	ler, [HFT] N	atural Gas,	[CFT] Natu	ral Gas	
	Actual	377.7	198.4	132	0	2.1	0.8	0	0.89	0
	Notional	91.3	141.1	31	0	1	0.82	0		

Key to terms

Heat dem [MJ/m2] = Heating energy demand Cool dem [MJ/m2] = Cooling energy demand Heat con [kWh/m2] = Heating energy consumption Cool con [kWh/m2] = Cooling energy consumption Aux con [kWh/m2] = Auxiliary energy consumption

Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)

= Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

ST = System type HS = Heat source HFT = Heating fuel type CFT = Cooling fuel type

Page 3 of 5 Page 4 of 5

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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	1.21	01 Ground Floor - Office_W_8
Floor	0.2	1.2	01 Ground Floor - Office_F_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	4.8	01 Ground Floor - Office_G_12
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"
Ui-Typ = Typical individual element U-values [W/(m²k	0)]		U _{I-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the	minimum L	J-value oc	curs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	25

Appendix D

Domestic *Be Lean* Dwelling Emission Rate (DER) worksheets



Property Reference	Plot 04				Issued on Date	24/06/2019
Assessment	Be Lean		Pro	p Type Ref	ЛId	
Reference						
Property	Plot 014, Ferdinand Stree	et, Camden, Lo	ONDON, LONDON,	NW1 8EU		
SAP Rating		79 C	DER	26.22	TER	21.02
Environmental		82 B	% DER <ter< th=""><th></th><th>-24.74</th><th></th></ter<>		-24.74	
CO ₂ Emissions (t/ye	ear)	1.17	DFEE	67.62	TFEE	56.54
General Requireme	ents Compliance	Fail	% DFEE <tfee< th=""><th></th><th>-19.59</th><th></th></tfee<>		-19.59	
Assessor Details	Mr. Simon Gowing, Simon Go Simon@hodkinsonconsultan	0,	036031616,		Assessor ID	T271-0001
Client						

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS CO		ed Document L1A, 2013 Edit	tion, England			
DWELLING AS DE	SIGNED					
Mid-floor flat	, total floor area 53 m²					
	vers items included with					
la TER and DER						
Fuel for main	heating:Mains gas					
Fuel factor:1. Target Carbon	00 (mains gas) Dioxide Emission Rate (T	ER) 21.02 kaCO□/m²				
Dwelling Carbo Excess emissio	n Dioxide Emission Rate ns =5.20 kgCOU/m² (24.7	(DER) 26.22 kgCOU/m²Fail %)				
1b TFEE and DF	EE					
Dwelling Fabri	Energy Efficiency (TFEE) c Energy Efficiency (DFE =11.1 kWh/m ² /yr (19.6%)	56.5 kWh/m²/yr E)67.6 kWh/m²/yrFail				
2 Fabric U-val						
Element	Average	Highest				
External wall	0.26 (max. 0.30)	0.30 (max. 0.70)	OK			
Floor	0.00 (max. 0.20) (no floor)		011			
Roof	(no roof)	1.30 (max. 3.30)	OK			
	dging ng calculated using defa					
3 Air permeabi	lity					
Maximum	ty at 50 pascals:	6.00 (design value) 10.0			OK	
4 Heating effi Main heating s	ciency	Boiler system with radio				
Data from data						
Combi boiler Efficiency: 89						
Minimum: 88.0%		OK				
Secondary heat		None				
5 Cylinder ins	ulation					
Hot water stor	age	No cylinder				
6 Controls						
Space heating	controls:	Programmer and at least	two room therm	ostats	OK	
Hot water cont	rols:	No cylinder				
Boiler interlo		Yes			OK	
7 Low energy 1	ights					
Minimum		ergy fittings:100% 75%			OK	
8 Mechanical v Not applicable	entilation					
	emperature sk (Thames Valley):	Medium			OK	
Based on: Overshading:		Average				
	West:	19.56 m², No overhang				
Windows facing				alasad 100	2 of dayligh	t hou
Air change rat	8:	Dark-coloured curtain o:	r roller bilna,	CIOSEG IOO		
	s: 		r roller blind,			
Air change rat Blinds/curtain	s: s					





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

CALCULATIO	ON OF L	WELLING	i EMISSI	ONS FOR	REGULAT	IONS CO	JIVIPLIAN	ICE 05	Jan 2014				
SAP 2012 WORKSH	EET FOR Ne	ew Build (As	Designed)	(Version	9.92, Januar								
CALCULATION OF						an 2014							
1. Overall dwel	ling dimer	sions											
								Area	Sto	ey height		Volume	
Ground floor Total floor are	a TFA = (1	a)+(1b)+(1c)+(1d)+(1e) (1n)		3.0400		(m2) 53.0400	(1b) x	(m) 2.8000	(2b) =	(m3) 148.5120	(1b) - (3
Dwelling volume								(3a) + (3b) + (3c)	+(3d)+(3e)	(3n) =	148.5120	(5)
2. Ventilation	rate												
					main heating		econdary heating		other	tot		3 per hour	
Number of chimn Number of open Number of inter	flues				0	+	0	+	0 .		0 * 40 = 0 * 20 = 2 * 10 =	0.0000 0.0000 20.0000	(6b)
Number of inter Number of passi Number of fluel	ve vents										0 * 10 = 0 * 40 =	0.0000	(7b)
Infiltration du		51	and force	- (50) + (50)	1 (70) 1 (75) 1 1	70) -				20 0000	Air change / (5) =	s per hour 0.1347	(0)
Pressure test Measured/design	AP50	eys, ilues	and rans	- (02)+(01)	+(/4)+(/5)+1	.707 -				20.0000	/ (3) -	Yes 6.0000	
Infiltration ra Number of sides	te sheltered	1										0.4347	(18) (19)
Shelter factor Infiltration ra	te adjuste	ed to includ	e shelter	factor					(20) = 1	[0.075 x 21) = (18)	(19)] = x (20) =	0.9250 0.4021	
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate	0.5126	0.5026	0.4925	0.4423	0.4322	0.3820	0.3820	0.3719	0.4021	0.4322	0.4523	0.4724	
Effective ac	0.6314	0.6263	0.6213	0.5978	0.5934	0.5729	0.5729	0.5692	0.5808	0.5934	0.6023	0.6116	(25)
3. Heat losses													
Element Normal Window (II 1 201			Gross m2	Openings m2		m2 .5600	U-value W/m2K 1.2357	A x W, 24.17	K K	-value kJ/m2K	A x K kJ/K	
Corridor Door Corridor	ON - 1.50)			42.0300	2.1000	2 39	.1000 .9300	1.0000	2.10 9.18	00 80			(26) (29a)
Bick Wall Total net area Fabric heat los	of externa	l elements	Aum(A, m2)	57.3200	19.5600		.7600 .3500	0.3000	= 46.78				(29a) (31) (33)
Party Wall 1 Party Floor 1						53	.8000 .0400	0.0000	0.00	10			(32) (32d)
Party Ceilings Thermal mass pa		MP = Cm / T	FA) in kJ/	m2K		53	.0400					250.0000	(32b) (35)
Thermal bridges Total fabric he	(Default	value 0.150	* total e	xposed area)						(33)	+ (36) =	14.9025 61.6846	(36)
Ventilation hea	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer c	30.9442 oeff 92.6288	30.6941	30.4490	29.2978	29.0824	28.0796	28.0796	27.8939	28.4659	29.0824	29.5181	29.9737	
Average = Sum(3	9)m / 12 =											90.9813	
HLP HLP (average) Days in month	Jan 1.7464	Feb 1.7417	Mar 1.7371	Apr 1.7154	May 1.7113	Jun 1.6924	Jul 1.6924	Aug 1.6889	Sep 1.6997	0ct 1.7113	Nov 1.7195	Dec 1.7281 1.7153	
2012 11 11011111	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heatin)									
Assumed occupan Average daily h	cy											1.7797	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	,
Energy conte	84.1157 124.7412	81.0570 109.0994	77.9982 112.5808	74.9394 98.1507	71.8807 94.1779	68.8219 81.2684	68.8219 75.3071	71.8807 86.4160	74.9394 87.4481	77.9982 101.9123	81.0570 111.2453	84.1157 120.8052	(45)
Energy content Distribution lo	(annual) ss (46)m	= 0.15 x (4	15) m							Total = S	um (45) m =	1203.1524	(45)
Water storage 1 Total storage 1	18.7112 oss: oss	16.3649	16.8871	14.7226	14.1267	12.1903	11.2961	12.9624	13.1172	15.2868	16.6868	18.1208	(46)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



To explain the control additional policy of the control and cont
Comparison Com
Total net required for water beating calculated for each month. Solar input (2000 5.0000 5.0000 5.0000 5.0000 5.0000 5.0000 5.0000 5.0000 6.0
Solar inputs 0.0000 0.0
Heat galas from state heating, Markowsch
51. Taternal gains (see Table 5 and 5s)
Description Section
Mathabilic part March Ma
Column C
Appliances gains (calculated in Appendix), equation 113 or 1134), also see Table 5 Cooking gains (251214 15.0711 13.0711 13.0711 13.07
15.1214 156.731 12.677 14.033 13.336 12.835 15.091 14.039 118.095 127.1312 138.031 14.0770 (60)
Name
Lacese e.g. evaporation (negative values) (Table 5) Thisse -71.1896 -71.189
Total internal gains 290.2014 288.8043 278.7657 262.6029 246.6284 230.9241 220.3773 225.4992 233.6266 249.8720 268.5379 282.2557 (73) Comparison
Companies 134.1776 288.8043 278.7657 262.6929 246.6284 230.9241 220.3773 225.4992 233.6246 249.8720 268.5379 282.2957 (73)
Clan Area Rep Area Rep R
Clan Area Rep Area Rep R
Table 66 West 19.500 19.4003 0.6300 0.8000 0.7701 134.1776 (80)
Solar gains 134.1776 262.4798 432.2668 630.4354 772.6223 790.9164 752.9846 646.8027 502.7442 311.4544 167.3037 110.3411 (83)
Total gains 424.6990 551.2841 711.0325 893.1283 1019.2507 1021.8405 973.5619 872.3019 736.3688 561.3264 435.8416 392.6368 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Thi (C) Utilisation factor for gains for living area, nil, see Table 9, Thi (C) Table 13.6510 30.651 39.8721 39.9722 49.9792 30.6503 30.7351 30.7
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating periods in the living area from Table 9. Thi (C) Temperature during heating heating periods in the living area from Table 9. Thi (C) Temperature during heating h
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Thi (C) Temperature during heating periods in the living area from Table 9, Thi (C) Temperature during heating periods in the living area from Table 9, Thi (C) Temperature during heating periods in the living area from Table 9, Thi (C) Temperature during heating periods in the living area from Table 9, Thi (C) Temperature during heating periods in the living area from Table 9, Thi (C) Temperature during heating periods in the living area from Table 9, Thi (C) Temperature during heating periods in the living area from Table 9, Thi (C) Temperature during heating periods in the living area for Table 9, Thi (C) Temperature during heating periods in the living area for Table 9, Thi (C) Temperature during heating periods in the living area for Table 9, Thi (C) Temperature during heating periods in the living area for Table 9, Thi (C) Temperature during heating periods in the living area for 10, 20, 20, 20, 20, 20, 20, 20, 20, 20, 2
Utilisation factor for gains for living area, nil;s (see Table 9s)
Late
0.9935 0.9832 0.9812 0.8951 0.8609 0.7079 0.5316 0.3973 0.4569 0.7174 0.9353 0.8972 0.9951 (86) MIT 1 3.2033 19.4890 19.9447 20.4670 20.8030 20.9495 20.9868 20.9782 20.8860 20.3270 19.5655 19.1591 (87) Th 2 19.5078 19.5111 19.5124 19.5129 19.5122 19.5463 19.5463 19.5488 19.5411 19.5328 19.5269 19.5208 (88) MIT 2 17.9302 18.2148 18.6500 19.1257 19.7812 20.0840 20.2098 20.2360 20.2320 20.1330 19.0457 18.3911 17.9801 (89) Living area fraction
Th 2 19.5078 19.511 19.5144 19.529 19.5328 19.5463 19.5468 19.548 19.5411 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 (88) 19.511 19.5328 19.5269 19.5208 19.5
No. Company
Living area fraction MT 18.508 18.8260 19.2757 19.7812 20.0840 20.2098 20.2360 20.2320 20.1330 19.6602 19.001 18.5018 (2) Temperature adjustment adjustmen
Temperature adjustment 18.3908 18.6760 19.1257 19.6312 19.9340 20.0598 20.0860 20.0820 19.9830 19.5102 18.8510 18.3518 (93)
Mar Apr May Jun Jul Aug Sep Cet Nov Dec
Mar Apr May Jun Jul Aug Sep Cet Nov Dec
Utilisation 0.9887 0.9729 0.9239 0.5208 0.6526 0.4631 0.3183 0.3719 0.6449 0.9037 0.9783 0.9914 (94) Useful gains 419.9207 5.65.338 660.4437 733.0892.665.1242 473.1642 309.8421 324.3844 474.6899 507.2479 426.3723 389.2511 (95) Ext temp. 4.3000 4.9000 6.5000 8.9000 11.0000 14.6000 16.6000 16.6000 10.0000 7.1000 4.2000 (96) Ext temp. 4.3000 4.9000 6.5000 8.9000 11.0000 14.6000 16.6000 16.6000 10.6000 7.1000 4.2000 (96) Month fracti 1305.2145 1272.6668 1163.2520 747.3785 490.0952 312.9158 329.8311 530.3562 80.7539 1071.6421 1297.1293 (97) Space heating 1.0000 1.0000 1.0000 1.0000 1.0000 0.0000 0.0000 0.0000 0.0000 1.0000 1.0000 1.0000 1.0000 (97.4) Space heating 1.0000 1.0000 1.0000 1.0000 1.0000 0.0000 0.0000 0.0000 224.3204 464.943 675.4613 (98) Space heating 1.0000 1.0000 1.0000 1.0000 1.0000 0.0000 0.0000 0.0000 0.0000 224.3204 464.943 675.4613 (98) 3128.2721 (98)
Useful gaine 419,9207 516,3338 660,4437 733,0508 665,1242 473,1842 399,8421 324,3844 474,8690 507,2479 426,3723 389,2511 (95)
1305.2145 1272.6086 163.2502 976.3520 747.3785 490.0952 312.9158 329.8311 530.3562 808.7539 1071.6421 1297.1293 (97)
Space heating kWh 658.6586 494.7754 374.0880 175.1768 61.1972 0.0000 0.0000 0.0000 224.3204 464.5943 675.4613 (98) Space heating 3128.2721 (98)
Space heating per m2 (98) / (4) = 58.9795 (99)
8c. Space cooling requirement
Calculated for June, July and August. See Table 10b Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Ext. temp. 4.3000 4.9000 6.5000 8.9000 11.7000 14.6000 16.6000 16.4000 14.1000 7.1000 4.2000
Heat loss rate W 0.000 0





CALCULA1	ION OF D	WELLING	G EMISSI	ONS FOR	REGULA	TIONS C	OMPLIAN	NCE 09	Jan 2014	ļ.			
Useful loss Total gains Month fracti Space cooling	0.0000 0.0000 0.0000 kWh	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	769.4992 1253.4171 1.0000	629.2608 1195.9399 1.0000	1078.2796	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	(103)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	348.4209	421.6092	333.4048	0.0000	0.0000	0.0000	1103.4349	(104)
Cooled fracti Intermittency	on factor (Tab: 0.0000	le 10b)	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	fC =	0.0000	0.0000	0.0000	
Space cooling	kWh	0.0000	0.0000	0.0000		164.2255			0.0000	0.0000	0.0000	0.0000	
Space cooling Space cooling												520.0956 9.8057	(107)
9a. Energy re		T. 411 41											
Fraction of s Fraction of s Fraction of s Efficiency of Efficiency of Space heating Cooling Syste	pace heat fro pace heat fro main space I secondary/so requirement	om secondar om main sys heating sys upplementar	ry/supplemer stem(s) stem 1 (in % ry heating s	tary system								0.0000 1.0000 90.0000 0.0000 3475.8579 4.0000	(202) (206) (208) (211)
Space heating	Jan requirement	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	658.6586 efficiency	494.7754 (main heati	ing system 1	.)	61.1972	0.0000	0.0000	0.0000		224.3204			
Space heating	90.0000 fuel (main 1	heating sys	90.0000 stem)		90.0000	0.0000	0.0000		0.0000	90.0000	90.0000	90.0000	
Water heating	requirement	0.0000	0.0000	0.0000	67.9969	0.0000	0.0000		0.0000	0.0000	0.0000	750.5126	
Water heating Water heating			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Efficiency of	163.8067	144.3464	151.5437	135.7881	133.0201	118.8001	114.0540	125.2247	125.0374	140.8252	148.9824	159.8508 86.7000	
(217)m Fuel for wate	89.3229 r heating, ki	89.2329 Wh/month	89.0231	88.5286	87.7134	86.7000	86.7000	86.7000	86.7000	88.6980	89.1758	89.3492	(217)
Water heating	183.3872 fuel used		170.2296	153.3833	151.6531	137.0243	131.5502	144.4345	144.2184	158.7694	167.0659	178.9057 1882.3852	
Space cooling (221)m Cooling Annual totals	0.0000	0.0000	0.0000	0.0000	0.0000	41.0564	49.6806	39.2870	0.0000	0.0000	0.0000	0.0000 130.0239	
Space heating Space heating	fuel - main fuel - secon	system ndary										3475.8579 0.0000	
Electricity f central he main heati Total electri Electricity f Total deliver	ating pump ng flue fan city for the or lighting	above, kWł (calculateo	n/year i in Appendi	x L)								30.0000 45.0000 75.0000 244.2277 5807.4948	(230e) (231) (232)
12a. Carbon d	ioxide emiss	ions - Indi	ividual heat	ing system	s including	micro-CHP							
Space heating Space heating Water heating	- main syste - secondary (other fuel)	em 1						Energy kWh/year 3475.8579 0.0000 1882.3852		ion factor kg CO2/kWh 0.2160 0.0000 0.2160	k	Emissions g CO2/year 750.7853 0.0000 406.5952 1157.3805	(261) (263) (264)
Space and wat Space cooling Pumps and fan Energy for li Total CO2, kg	s ghting /year							130.0239 75.0000 244.2277		0.5190 0.5190 0.5190		67.4824 38.9250 126.7542 1390.5421	(266) (267) (268) (272)
Dwelling Carb	on Dioxide Er	mission Rat	te (DER)									26.2200	(273)
DER Total Floor A Assumed numbe CO2 emission CO2 emission CO2 emissions Total CO2 emi Residual CO2 Additional al Resulting CO2 Net CO2 emiss	rea r of occupant factor in Tal from appliat from cooking ssions emissions of: lowable elect emissions o	ts ble 12 for nces, equat g, equation fset from 1 tricity ger	electricity tion (L14) n (L16) piofuel CHP meration, kV	displaced	from grid			ION TECHNOLO	GIES		TFA N EF	26.2200 53.0400 1.7797 0.5190 17.3306 3.0489 46.5995 0.0000 0.0000 46.5995	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)

Design SAP elmhurst energy

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHI CALCULATION OF	EET FOR Ne	ew Build (As	Designed)	(Version 9 Jan 2014		ry 2014)							
1. Overall dwel	ling dimer	nsions											
Ground floor Total floor are: Dwelling volume	a TFA = (1	ia)+(lb)+(lc	:) + (1d) + (1e))(ln)	5	53.0400		Area (m2) 53.0400		y height (m) 2.8000 (3d)+(3e)		Volume (m3) 148.5120 148.5120	(4)
2. Ventilation	rate												
Number of chimn Number of open: Number of inter Number of passi Number of fluel	flues mittent fa ve vents				main heating 0 0	+ +	econdary heating 0 0	+ +	other 0 = 0 =	tot	0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 20.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration du Pressure test Measured/design Infiltration ra Number of sides	AP50 te		and fans	= (6a)+(6b)	+(7a)+(7b)+	(7c) =				20.0000	Air change / (5) =	0.1347 Yes 6.0000 0.4347	
Shelter factor Infiltration ra	te adjuste	ed to includ	e shelter :	factor					(20) = 1 - (21	[0.075 x) = (18)	(19)] = x (20) =	0.9250 0.4021	(20) (21)
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	0.5126 0.6314	0.5026 0.6263	0.4925 0.6213	0.4423 0.5978	0.4322 0.5934	0.3820 0.5729	0.3820 0.5729	0.3719 0.5692	0.4021 0.5808	0.4322 0.5934	0.4523 0.6023	0.4724 0.6116	(22b) (25)
3. Heat losses	and heat 1	Loss paramet	er										
Element Normal Window (Corridor Door Corridor Bick Wall Total net area (Fabric heat los: Party Wall 1 Party Floor 1 Party Ceilings:	of externs	al elements	Aum(A, m2)	Gross m2 42.0300 57.3200	Openings m2 2.1000 19.5600	19. 2. 39. 37. 99. 5.	m2 .5600 .1000 .9300 .7600 .3500	U-value W/m2K 1.2357 1.0000 0.2300 0.3000 300) + (32) 0.0000	A x U W/K 24.1711 2.1000 9.1830 11.3280 = 46.7821 0.0000		-value kJ/m2K	A × K kJ/K	(27) (26) (29a) (29a) (31) (33) (32) (32d) (32b)
Thermal mass par Thermal bridges Total fabric her	(Default	PMP = Cm / T value 0.150	FA) in kJ/r * total e:	m2K xposed area)						(33)	+ (36) =	250.0000 14.9025 61.6846	(36)
Ventilation hear	Jan 30.9442	Iculated mon Feb 30.6941	thly (38)m Mar 30.4490	= 0.33 x (2 Apr 29.2978	5)m × (5) May 29.0824	Jun 28.0796	Jul 28.0796	Aug 27.8939	Sep 28.4659	Oct 29.0824	Nov 29.5181	Dec 29.9737	(38)
Heat transfer co Average = Sum(3	92.6288	92.3787	92.1336	90.9823	90.7669	89.7642	89.7642	89.5785	90.1504	90.7669	91.2027	91.6582 90.9813	
HLP HLP (average)	Jan 1.7464	Feb 1.7417	Mar 1.7371	Apr 1.7154	May 1.7113	Jun 1.6924	Jul 1.6924	Aug 1.6889	Sep 1.6997	Oct 1.7113	Nov 1.7195	Dec 1.7281 1.7153	(40) (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heating	 cy)								1.7797 76.4688	
	Jan	Feb	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	, , , , ,
Energy conte Energy content	84.1157 124.7412 (annual)		77.9982 112.5808	74.9394 98.1507	71.8807 94.1779	68.8219 81.2684	68.8219 75.3071	71.8807 86.4160	74.9394 87.4481	77.9982 101.9123 Total = S	81.0570 111.2453 um(45)m =	84.1157 120.8052 1203.1524	(45)
Distribution los Water storage los Total storage los	ss (46)m 0.0000 oss:	= 0.15 x (4	5)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
-June Storage II	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)





CALCULAT	TION OF I	FABRIC E	NERGY E	FFICIENC	Y 09 Ja	n 2014							
If cylinder c	ontoino dod	instead only											
	0.0000 0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Primary loss Heat gains fr	om water he	0.0000 ating, kWh/	month	0.0000		0.0000	0.0000		0.0000			0.0000	
	26.5075	23.1836	23.9234	20.8570	20.0128	17.2695	16.0028	18.3634	18.5827	21.6564	23.6396	25.6711	(65)
5. Internal q	ains (see T	able 5 and	5a)										
Metabolic gai													
(66)m	Jan 88.9870	Feb 88.9870	Mar 88.9870	Apr 88.9870	May 88.9870	Jun 88.9870	Jul 88.9870	Aug 88.9870	Sep 88.9870	Oct 88.9870	Nov 88.9870	Dec 88.9870	(66)
Lighting gain	s (calculat	ed in Appen	dix L, equa	tion L9 or	L9a), also:	see Table 5	5.1569	6.7031	8.9969	11.4236	13.3330		
Appliances ga	ins (calcul	ated in App	endix L, eq	uation L13	or L13a), a:	lso see Tab	le 5					14.2135	
Cooking gains	155.1214 (calculate	156.7311 d in Append	152.6747 lix L, equat	144.0393 ion L15 or	133.1386 L15a), also	122.8935 see Table	116.0491 5	114.4394	118.4958	127.1312	138.0319	148.2770	
Pumps, fans	0.0000	0.0000	0.0000	0.0000	31.8987 0.0000	31.8987 0.0000	31.8987 0.0000	31.8987 0.0000	31.8987	31.8987 0.0000	31.8987 0.0000	31.8987 0.0000	
Losses e.g. e	vaporation -71.1896	(negative v -71.1896	ralues) (Tab -71.1896	le 5) -71.1896	-71.1896	-71.1896	-71.1896	-71.1896	-71.1896	-71.1896	-71.1896	-71.1896	(71)
Water heating	gains (Tab		32.1551	28.9681	26.8989	23.9855	21.5091	24.6820	25.8093	29.1080	32.8328	34.5042	
Total interna		253.2096	244.5151	230.2659	215.3866	201.3476	192.4112	195.5206	202.9981	217.3589	233.8938	246.6908	
	234.2730	233.2030	244.3131	230.2039	213.3000	201.3470	192.4112	193.3200	202.9901	217.3309	233.0330	240.0300	(73)
6. Solar gain	s												
[Jan]			A	rea m2	Solar flux Table 6a W/m2	or	fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	or	Gains W	
West			19.5	600	19.6403		0.6300		.8000	0.77	00	134.1776	(80)
Solar gains	134.1776	262.4798	432.2668	630.4354	772.6223	790.9164	752.9846	646.8027	502.7442	311 4544	167.3037	110.3411	(0.2)
Total gains	388.4526	515.6894	432.2668 676.7820	860.7013	988.0089	992.2639	752.9846 945.3958	842.3233	705.7423	528.8133	401.1975	357.0319	
7. Mean inter													
Temperature d Utilisation f	uring heati actor for g	ng periods ains for li	in the livi	ng area fro	m Table 9, 1 Table 9a)	Phl (C)						21.0000	(85)
tau	Jan 39.7645	Feb 39.8721	Mar 39.9782	Apr 40.4841	May 40.5801	Jun 41.0334	Jul 41.0334	Aug 41.1185	Sep 40.8576	Oct 40.5801	Nov 40.3863	Dec 40.1855	
alpha util living a	3.6510	3.6581	3.6652	3.6989	3.7053	3.7356	3.7356	3.7412	3.7238	3.7053	3.6924	3.6790	
ucii iiving a	0.9952	0.9863	0.9574	0.8719	0.7216	0.5447	0.4083	0.4714	0.7360	0.9450	0.9902	0.9964	(86)
MIT	19.1468	19.4357	19.8995	20.4375	20.7893	20.9453	20.9855	20.9758	20.8348	20.2864	19.6036	19.1031	
Th 2 util rest of		19.5111	19.5144	19.5299	19.5328	19.5463	19.5463	19.5488	19.5411	19.5328	19.5269	19.5208	
MIT 2	0.9934 17.8742	0.9815 18.1627	0.9425 18.6167	0.8305 19.1248	0.6439 19.4126	0.4349 19.5262	0.2780 19.5437	0.3311 19.5437	0.6284 19.4654	0.9176 19.0098	0.9859 18.3432	0.9952 17.8403	(90)
Living area f	raction 18.4846	18.7733	19.2320	19.7544	20.0729	20.2069	20.2352	20.2306	fLA = 20.1222	Living are 19.6221	a / (4) = 18.9477	0.4796 18.4460	
Temperature a adjusted MIT	djustment 18.4846	18.7733	19.2320	19 7544	20 0729	20 2069	20.2352	20 2306	20 1222	19 6221	18 9477	0.0000	
aajaseca mii	10.4040	10.7733	13.1310	1317344	20.0723	20.2005	20.2552	20.2500	2011222	17.0221	10.54//	10.4400	(33)
8. Space heat	ing require	ment											
Utilisation	Jan 0.9917	Feb 0.9783	Mar 0.9390	Apr 0.8377	May 0.6745	Jun 0.4866	Jul 0.3409	Aug 0.3989	Sep 0.6752	Oct 0.9197	Nov 0.9836	Dec 0.9938	(94)
Useful gains Ext temp.	385.2430 4.3000	504.4996 4.9000	635.4693 6.5000	720.9883 8.9000	666.4239 11.7000	482.8303 14.6000	322.2702 16.6000	335.9729 16.4000	476.5118 14.1000	486.3323 10.6000	394.6331 7.1000	354.8284 4.2000	(95)
Heat loss rat	1313.8998	1281.5952 1.0000	1173.0407	987.5574 1.0000	759.9847 1.0000	503.2960	326.3146 0.0000	343.1398 0.0000	542.9041 0.0000	818.9051 1.0000	1080.5458	1305.7631	(97) (97a)
Space heating	690.9206	522.2082	399.9531	191.9297	69.6092	0.0000	0.0000	0.0000	0.0000	247.4342	493.8571	707.4954	(98)
Space heating Space heating										(98) / (4) =	3323.4076 62.6585	
	-												
8c. Space coo	ling requir	ement											
Calculated fo													
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000	
Heat loss rat	e W 0.0000	0.0000	0.0000	0.0000	0.0000	843.7833	664.2549	680.7965	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9071 765.3799	0.9441 627.1258	0.9205 626.6865	0.0000	0.0000	0.0000	0.0000	(101)
Total gains Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1226.8405	1170.7738	1051.3010	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti Space cooling	kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	332.2517	404.4741	315.9132	0.0000	0.0000	0.0000	0.0000 1052.6389	(104)
Cooled fracti	on								fC =	cooled are	a / (4) =	1.0000	(105)

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



0.0000 (106)

LCULATION	N OF FAI	BRIC ENE	RGY EFFI	CIENCY	09 Jan	2014			
rmittency fact		10b) 0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000

Space cooling WM 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000

elmhurst energy



Property Reference	Plot 14				Issued on Date	24/06/2019	
Assessment	Be Lean			Prop Type Ref	MId With Heat loss		
Reference							
Property	Plot 014, Ferdinand Stree	et, Camden, LC	NDON, LOND	ON, NW1 8EU			
SAP Rating		80 C	DER	23.22	23.22 TER		
Environmental		83 B	% DER <ter< th=""><th></th><th>-22.40</th><th></th></ter<>		-22.40		
CO ₂ Emissions (t/y	ear)	1.30	DFEE	61.45	TFEE	51.86	
General Requireme	ents Compliance	Fail	% DFEE <tfe< th=""><th>E</th><th>-18.50</th><th></th></tfe<>	E	-18.50		
Assessor Details	Mr. Simon Gowing, Simon Go Simon@hodkinsonconsultan	0,	036031616,	Assessor ID	T271-0001		
Client							

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Regs Region: England SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

	FLIANCE REPORT - APPT	oved Document L1A, 2013 E	dition, England	
DWELLING AS DES	SIGNED			
Mid-floor flat,	total floor area 68	m²		
It is not a con	rers items included wi mplete report of regul			
la TER and DER				
Fuel for main h Fuel factor:1.0	meating:Mains gas			
Target Carbon I	Dioxide Emission Rate			
Excess emission	ns =4.25 kgCO□/m² (22	e (DER) 23.22 kgCO\ m^2Fai .4%)	1	
1b TFEE and DFE Target Fabric E Dwelling Fabric Excess energy =	Energy Efficiency (TFE	E)51.9 kWh/m²/yr FEE)61.5 kWh/m²/yrFail		
2 Fabric U-valu	ies			
Element External wall	Average 0.30 (max. 0.30)	Highest 0.30 (max. 0.70)	OK	
Party wall	0.00 (max. 0.20)	-	OK	
Floor Roof	(no floor)	0.13 (max. 0.35)	OK	
Openings	0.13 (max. 0.20) 1.28 (max. 2.00)	1.30 (max. 3.30)	OK	
2a Thermal brid Thermal bridgin	iging	fault y-value of 0.15		
3 Air permeabil	ity			
Air permeabilit Maximum	y at 50 pascals:	6.00 (design value) 10.0		OK
4 Heating effice Main heating sy Data from datab Worcester Greer Combi boiler Efficiency: 89. Minimum: 88.0%	ystem: pase nstar 29CDi Classic Er	P	diators or underfloor - Ma	ins gas
		O.K.		
Secondary heati	ng system:	OK None		
		None		
5 Cylinder insu Hot water store	lation ige	None No cylinder		
5 Cylinder insu Hot water stors	slation age	None No cylinder		
5 Cylinder insu Hot water stors 6 Controls Space heating o	ulation age controls:	None No cylinder		
5 Cylinder inst Hot water store 6 Controls Space heating of Hot water controls Boiler interloc	ulation ege controls:	None No cylinder Programmer and at lea No cylinder Yes		
5 Cylinder insu Hot water store 6 Controls Space heating of Hot water contr Boiler interloc 7 Low energy 15 Percentage of 1 Minimum	elation gg controls: cols: k ghts fixed lights with low-	No cylinder Programmer and at lea No cylinder Yes energy fittings:100% 75%		OK
5 Cylinder insu Hot water stora 6 Controls Space heating of Hot water controls 7 Low energy 11 7 Low energy 11 8 Mechanical ve 8 Mechanical ve Not applicable	lation gg controls: cols: k ghts ghts ixed lights with low- controlsion.	None No cylinder Programmer and at lea No cylinder Yes energy fittings:100%		OK OK
5 Cylinder inst Hot water store 6 Controls Space heating of Hot water controls Boiler interloo 7 Low energy li Powershage of f Minimum 8 Mechanical ve Not applicable 9 Summertime te Overheating ris Based on:	lation gg controls: cols: k ghts ghts with low- intilation	None No cylinder Programmer and at lea No cylinder Yes energy fittings:100% 75% Medium	st two room thermostats	OK OK
5 Cylinder inst Hot water store 6 Controls Space heating of Hot water contr Boiler interlor 7 Low energy li Minimum Minimum Not applicable 9 Summertime to Overshading: Based on Overshading:	ontrols: cols: ck dghts dghts dists with low- entilation emperature k (Thames Valley):	None No cylinder Programmer and at lea No cylinder Yes energy fittings:100% 753 Medium Average	st two room thermostats	OK OK
5 Cylinder inst Hot water store 6 Controls Space heating of Hot water control Boiler interloo 7 Low energy 11 Percentage of 19 Minimum 18 8 Mechanical ve Not applicable 9 Summertime to Covershading virial Based on: Overshading sindows facing	ontrols: cols: ck display cinced lights with low- mitiation maperature maperature May (Thames Valley): North East:	None No cylinder Programmer and at lea No cylinder Yes energy fittings:100% 75% Medium Average 11.46 m². No overhang 7.68 m². No overhang	st two room thermostats	OK OK
5 Cylinder installed the state of a controls space heating of Booler interloc Hot water controls space heating of Booler interloc T Low energy il T Low energy il Whinimum en state of the state of th	lation gge controls: ck dgts dgts disds lights with low- nntilation comperature dk (Thames Valley): North East: East:	None No cylinder Programmer and at lea No cylinder Yes energy fittings:100% 75% Medium Average 11.46 m², No overhang 7.66 m², No overhang 7.66 m², No overhang	st two room thermostats	OK OK
5 Cylinder inside the state of	nlation gge controls: cols: ck dghts dghts dights with low- entilation emperature k (Thames Valley): North East: East: Horth West:	None No cylinder Programmer and at lea No cylinder Yes energy fittings:100% 75% Medium Average 11.46 m², No overhang 7.46 m², No overhang 3.00 ach No overchang 3.00 ach Dark-coloured cuttain	st two room thermostats	OK OK
5 Cylinder inst Hot water store 6 Controls Space heating o Hot water contr Boiler interloc 7 Low energy 11 Percentage of Minimum Minimum Minimum S Mechanical ve Wenter of Minimum 9 Summertime tr Based only Windows facing Windows facing Windows facing Air change rate windows facing Air change rate and windows facing Air change rate windows facing Air change rate and windows facing Air change rate Air and windows facing Air and windows faci	lation gge controls: ck k dysts itimed lights with low- meritation supportative sup	None No cylinder Programmer and at lea No cylinder Yes energy fittings:100% 75% Medium Average No overhang 1.66 m², No overhang 1.66 m², No overhang 3.00 ach	st two room thermostats	OK OK
S Cylinder into Hot water store 6 Controls Space heating of Hot water contr Boiler interloc 7 Low energy li Percentage of i Minimum 10 S Mechanical ve Not applicable 9 Summertime to Covershading: Windows facing Windows facing Windows facing Windows facing Windows facing Air change rate Binds/curtains	nlation gg controls: cols: ck ghts ghts ized lights with low- entilation comperature k (Thames Valley): North East: East: North West:	None No cylinder Programmer and at lea No cylinder Yes energy fittings:100% 75% Medium Average 11.46 m², No overhang 7.46 m², No overhang 3.00 ach No overchang 3.00 ach Dark-coloured cuttain	st two room thermostats	OK OK

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

			o Liviiooi		MEGGEA	10113 0	JIVII EIAIV	CL 0.	Juli Lui-				
SAP 2012 WORKSHI CALCULATION OF	EET FOR Ne	w Build (As	s Designed) OR REGULATIO	(Version	9.92, Janua: NCE 09	ry 2014) Jan 2014							
1. Overall dwel	ling dimen	sions											
Ground floor Total floor are: Dwelling volume			c) + (1d) + (1e)	(ln)		67.8900		Area (m2) 67.8900		rey height (m) 2.8000)+(3d)+(3e)		Volume (m3) 190.0920 190.0920	(1b) - (3i (4) (5)
2. Ventilation	rate												
					main	s	econdary		other	tot	al m	3 per hour	
Number of chimne Number of open : Number of inter: Number of passi Number of fluel	flues mittent fa ve vents				heating 0 0	+ +	heating 0 0	++	0		0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 20.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration du Pressure test Measured/design Infiltration rat Number of sides	AP50 te		and fans	= (6a)+(6b))+(7a)+(7b)+	(7c) =				20.0000	Air change / (5) =	0.1052 Yes 6.0000 0.4052	
Shelter factor Infiltration ra	te adjuste	d to includ	de shelter :	Factor					(20) = 1	- [0.075 x 21) = (18)	(19)] = x (20) =	0.9250 0.3748	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	(22) (22a)
Effective ac	0.4779 0.6142	0.4685 0.6098	0.4592 0.6054	0.4123 0.5850	0.4029 0.5812	0.3561 0.5634	0.3561 0.5634	0.3467 0.5601	0.3748 0.5702	0.4029 0.5812	0.4217 0.5889	0.4404 0.5970	
3. Heat losses	and heat 1	oss paramet	ter										
Element Normal Window (Corridor Door Corridor Bick Wall External Roof 1 Total net area (Fabric heat los: Party Wall 1 Party Floor 1	of externa	l elements		Gross m2 3.7000 73.2200 23.7500	Openings m2 2.1000 26.7400	26 2 1 46 23 100	tArea m2 .7400 .1000 .6000 .4800 .7500 .6700 (26) (3	U-value W/m2K 1.2357 1.0000 0.2300 0.3000 0.1300 30) + (32) 0.0000	33.04 2.10 0.36 13.94 3.08	/K 37 00 80 40 75	-value kJ/m2K	A x K kJ/K	
Thermal mass par Thermal bridges Total fabric her	(Default	MP = Cm / 1 value 0.150	FFA) in kJ/r) * total e:	n2K kposed area))					(33)	+ (36) =	250.0000 15.1005 67.6437	(36)
Heat transfer co	Jan 38.5285 peff	culated mor Feb 38.2504	Mar 37.9777	= 0.33 x (2 Apr 36.6971	25)m x (5) May 36.4575	Jun 35.3421	Jul 35.3421	Aug 35.1355	Sep 35.7717	Oct 36.4575	Nov 36.9422	Dec 37.4489	(38)
Average = Sum(3	106.1722	105.8941	105.6214	104.3408	104.1012	102.9858	102.9858	102.7792	103.4154	104.1012	104.5859	105.0926 104.3396	(39) (39)
HLP HLP (average) Days in month	Jan 1.5639	Feb 1.5598	Mar 1.5558	Apr 1.5369	May 1.5334	Jun 1.5170	Jul 1.5170	Aug 1.5139	Sep 1.5233	Oct 1.5334	Nov 1.5405	Dec 1.5480 1.5369	(40) (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heating	 cy			 !								2.1938	(42)
Average daily h	ot water u	se (litres)	/day) Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	86.3034 Dec	(43)
Daily hot water Energy conte Energy content	use 94.9338 140.7840 (annual)	91.4816 123.1306	88.0295 127.0598	84.5774 110.7738	81.1252 106.2901	77.6731 91.7203	77.6731 84.9923	81.1252 97.5299	84.5774 98.6947	88.0295 115.0192	91.4816 125.5524 um(45)m =	94.9338 136.3418 1357.8890	(45)
Distribution lo: Water storage lo	ss (46)m 21.1176 oss:	= 0.15 x (4	19.0590	16.6161	15.9435	13.7580	12.7488	14.6295	14.8042	17.2529	18.8329	20.4513	(46)
Total storage 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION	OF DWELLIN	IG EMISSI	IONS FO	R REGULA	ATIONS CO	OMPLIAN	ICE 09	Jan 2014	ļ.			
If cylinder contain	s dedicated sol	ar storage										
0.	0000 0.0000 2379 35.3922	0.0000 39.1071	0.0000 37.7582	0.0000 38.9533	0.0000 37.6236	0.0000 38.8321	0.0000 38.9107	0.0000 37.6969	0.0000 39.0435	0.0000 37.8852	0.0000 39.2126	
180.	0219 158.5228 0000 0.0000	166.1668 0.0000	148.5320 0.0000	145.2434 0.0000	129.3438	123.8244 0.0000	136.4406 0.0000 Solar inn	136.3917 0.0000 ut (sum of:	154.0627 0.0000 months) = S	163.4377 0.0000	175.5544 0.0000 0.0000	(63)
Output from w/h 180.	0219 158.5228	166.1668	148.5320	145.2434	129.3438	123.8244	136.4406	136.3917 er year (kW	154.0627	163.4377	175.5544 1817.5423	(64)
Heat gains from wat 56.	er heating, kWh 6202 49.7890	/month 52.0241	46.2718	45.0798	39.9029	37.9680	42.1564	42.2402	48.0048	51.2175	55.1368	
5. Internal gains (
Metabolic gains (Ta Ja		Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m 109. Lighting gains (cal	6914 109.6914 culated in Appe	109.6914 ndix L, equa	109.6914 tion L9 or	109.6914 L9a), also	109.6914 see Table 5	109.6914	109.6914	109.6914	109.6914	109.6914	109.6914	
17. Appliances gains (c 192.	1458 15.2287 alculated in Ap 3232 194 3189	12.3848 pendix L, eq	9.3761 puation L13	7.0087 or L13a), a	5.9171 slso see Tab	6.3936 le 5 143.8805	8.3107 141.8847	11.1545	14.1633 157.6203	16.5306 171.1353	17.6223 183.8374	
Cooking gains (calc	ulated in Appen 9691 33.9691	dix L, equat	ion L15 or 33.9691	L15a), also 33.9691	see Table 33.9691	5 33.9691	33.9691	33.9691	33.9691	33.9691	33.9691	
Pumps, fans 3. Losses e.g. evapora	0000 3.0000 tion (negative	3.0000 values) (Tab	3.0000 le 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains	7531 -87.7531 (Table 5) 1024 74.0908	-87.7531 69.9249	-87.7531 64.2664	-87.7531 60.5911	-87.7531 55.4207	-87.7531 51.0322	-87.7531 56.6618	-87.7531 58.6670	-87.7531 64.5225	-87.7531 71.1354	-87.7531 74.1086	
Total internal gain 344.	s		311.1333	291.5757	272.6114	260.2137	265.7646	275.6429	295.2135	317.7087	334.4757	
6. Solar gains												
[Jan]		A	ırea	Solar flux		g		FF	Acce		Gains	
			m2	Table 6a W/m2	Speci or	fic data Table 6b	Specific or Tab	data le 6c	fact Table		W	
Northeast East		11.4	400	11.2829 19.6403	3	0.6300	ō	.8000	0.77	00	45.1617 52.4088	(76)
Northwest		7.6	400	11.2829) 	0.6300	0	.8000	0.77	00	30.1078	(81)
Solar gains 127. Total gains 472.		444.8822 775.3892	699.5836 1010.7170	911.1587 1202.7344	958.5877 1231.1992	901.8554 1162.0691	737.1378 1002.9025	532.7297 808.3725	308.8908 604.1044	160.0563 477.7650	104.5674 439.0431	
7. Mean internal te	mperature (heat	ing season)										
Temperature during Utilisation factor	for gains for 1	in the livi	ng area fro	om Table 9, Table 9a)	Th1 (C)						21.0000	(85)
Ja tau 44.	n Feb 4051 44.5217	Mar 44.6366	Apr 45.1845	May 45.2885	Jun 45.7790	Jul 45.7790	Aug 45.8710	Sep 45.5888	Oct 45.2885	Nov 45.0786	Dec 44.8612	
alpha 3. util living area	9603 3.9681	3.9758	4.0123	4.0192	4.0519	4.0519	4.0581	4.0393	4.0192	4.0052	3.9907	
	9961 0.9898 3242 19.5676	0.9659	0.8784	0.7060	0.5147	0.3847	0.4594	0.7487	0.9552	0.9922	0.9971 19.2873	
Th 2 19. util rest of house	6399 19.6430	19.6459	19.6599	19.6626	19.6748	19.6748	19.6771	19.6701	19.6626	19.6572	19.6517	(88)
	9947 0.9862 1490 18.3928	0.9539 18.8101	0.8402 19.3065	0.6324 19.5743	0.4168 19.6625	0.2715 19.6733	0.3332 19.6736	0.6489 19.6034	0.9329 19.1714 Living are	0.9888 18.5713 a / (4) =	0.9960 18.1212 0.3450	(90)
MIT 18. Temperature adjustm	5544 18.7981	19.2178	19.7237	20.0131	20.1125	20.1282	20.1258	20.0368	19.5767	18.9726	18.5235 -0.1500	
adjusted MIT 18.	4044 18.6481	19.0678	19.5737	19.8631	19.9625	19.9782	19.9758	19.8868	19.4267	18.8226	18.3735	(93)
8. Space heating re	quirement											
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation 0. Useful gains 468. Ext temp. 4.	9929 0.9825	0.9473 734.5412 6.5000	0.8373 846.2965 8.9000	0.6443 774.9664 11.7000	0.4388 540.2299 14.6000	0.2978 346.0635 16.6000	0.3625 363.5283 16.4000	0.6672 539.3189 14.1000	0.9277 560.4322 10.6000	0.9859 471.0136 7.1000	0.9946 436.6741 4.2000	(95)
Heat loss rate W 1497. Month fracti 1.	4947 1455.8374 0000 1.0000	1327.4291	1113.6989	849.7831 1.0000	552.2657 0.0000	347.9070 0.0000	367.5141 0.0000	598.4442 0.0000	918.8662 1.0000	1226.0201	1489.5302 1.0000	
Space heating kWh 765. Space heating	3477 583.3109	441.1086	192.5297	55.6637	0.0000	0.0000	0.0000	0.0000	266.6749	543.6047	783.3249 3631.5651	(98) (98)
Space heating per m	2								(98	(4) =	53.4919	
Bc. Space cooling r	equirement											
Calculated for June		st. See Tabl	e 10b									
Ja	n Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	





CALCULATION OF D	WELLING	G EMISSI	ONS FOR	REGULA	TIONS C	OMPLIAN	ICE 09	Jan 2014				
Utilisation 0.0000 Useful loss 0.0000 Total gains 0.0000 Month fracti 0.0000 Space cooling kWh	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	968.0661 0.9340 904.2018 1512.2863 1.0000	762.0946 0.9620 733.1056 1430.1132 1.0000	781.1219 0.9379 732.6449 1245.0298 1.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	(101) (102) (103)
0.0000 Space cooling Cooled fraction	0.0000	0.0000	0.0000	0.0000	437.8208	518.5737	381.2143	0.0000 fC =	0.0000 cooled area	0.0000	0.0000 1337.6088 1.4730	(104)
Intermittency factor (Tabl	.e 10b) 0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh 0.0000 Space cooling Space cooling per m2	0.0000	0.0000	0.0000	0.0000	161.2243	190.9610	140.3794	0.0000	0.0000	0.0000	0.0000 492.5647 7.2553	(107)
9a. Energy requirements -				luding micr	o-CHP							
Fraction of space heat from Fraction of space heat from Efficiency of main space hefficiency of secondary/su Space heating requirement Cooling System Energy Effi	m secondar m main sys eating sys	cy/supplement stem(s) stem 1 (in stem 1)	t) system, %)						0.0000 1.0000 90.0000 0.0000 4035.0723 4.0000	(202) (206) (208) (211)
Jan Space heating requirement	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
765.3477 Space heating efficiency				55.6637	0.0000	0.0000	0.0000	0.0000	266.6749	543.6047	783.3249	(98)
90.0000 Space heating fuel (main h	90.0000 eating sys	90.0000 stem)	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	
850.3863 Water heating requirement	648.1232	490.1207	213.9219	61.8485	0.0000	0.0000	0.0000	0.0000	296.3054	604.0052	870.3610	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating Water heating requirement 180.0219 Efficiency of water heater (217)m 89.3524 Fuel for water heating, kV	89.2739	166.1668 89.0723	148.5320 88.5325	145.2434 87.5898	129.3438 86.7000	123.8244 86.7000	136.4406 86.7000	136.3917 86.7000	154.0627 88.7629	163.4377 89.2151	175.5544 86.7000 89.3772	(216)
201.4741 Water heating fuel used	177.5691	186.5527	167.7712	165.8223	149.1855	142.8193	157.3709	157.3145	173.5666	183.1952	196.4197 2059.0612	
Space cooling fuel require (221)m 0.0000 Cooling Annual totals kWh/year	0.0000	0.0000	0.0000	0.0000	40.3061	47.7403	35.0949	0.0000	0.0000	0.0000	0.0000 123.1412	(221) (221)
Space heating fuel - main Space heating fuel - secon	system dary										4035.0723 0.0000	
Electricity for pumps and central heating pump main heating flue fan Total electricity for the Electricity for lighting Total delivered energy for	above, kWi		ix L)								30.0000 45.0000 75.0000 302.7994 6595.0740	(230e) (231) (232)
12a. Carbon dioxide emissi	ons - Indi	vidual heat	ing system	including	micro-CHP							
Space heating - main systs Space heating - secondary Water heating (other fuel) Space and water heating Space cooling Pumps and fans Energy for lighting Total CO2, kd/year	m 1			, including			Energy kWh/year 4035.0723 0.0000 2059.0612 123.1412 75.0000 302.7994		ion factor kg CO2/kWh 0.2160 0.0000 0.2160 0.5190 0.5190 0.5190	k	Emissions g CO2/year 871.5756 0.0000 444.7572 1316.3328 63.9103 38.9250 157.1529 1576.3210	(263) (264) (265) (266) (267) (268) (272)
Dwelling Carbon Dioxide Em	ission Rat	e (DER)									23.2200	(273)
16 CO2 EMISSIONS ASSOCIATE DER AL Floor Area Technical Floor Area Coupant Coupant Co2 emission factor in Tal CO2 emissions from applian CO2 emissions from applian CO2 emissions from policial CO2 emissions of Total CO2 emissions of Additional allowable electromagnetic Resulting CO2 emissions of Net CO2 emissions of Net CO2 emissions	s le 12 for ces, equat g, equation set from 1 ricity ger	electricity cion (L14) h (L16) ciofuel CHP deration, ki	y displaced Wh/m²/year	from grid		TY GENERATI	ON TECHNOLOG	SIES		TFA N EF	23.2200 67.8900 2.1938 0.5190 16.7870 2.5284 42.5353 0.0000 0.0000 42.5353	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHI CALCULATION OF I	EET FOR Ne FABRIC ENE	w Build (As	Designed)	(Version 9 Jan 2014	9.92, Janua	ry 2014)							
1. Overall dwell	ling dimen	sions											
Ground floor								Area (m2) 67.8900		rey height (m)	(2h) =	Volume (m3) 190.0920	(lb) - (
Total floor area Dwelling volume	a TFA = (1	a)+(lb)+(lc	e) + (1d) + (1e))(ln)		67.8900			(3a) + (3b) + (3c			190.0920	(4)
2. Ventilation	cate												
					main heating	8	econdary heating		other	tot	al m	3 per hour	
Number of chimne Number of open : Number of interr Number of passiv Number of fluele	flues mittent fa ve vents				0	++	0 0	++	0	=	0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 20.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration due Pressure test Measured/design Infiltration rat Number of sides	AP50		and fans	= (6a)+(6b)+(7a)+(7b)+	(7c) =				20.0000	Air change / (5) =	0.1052 Yes 6.0000 0.4052	
Shelter factor Infiltration rat			e shelter :	Eactor						- [0.075 x		0.9250 0.3748	(20)
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	(22) (22a)
Adj infilt rate Effective ac	0.4779 0.6142	0.4685 0.6098	0.4592 0.6054	0.4123 0.5850	0.4029 0.5812	0.3561 0.5634	0.3561 0.5634	0.3467		0.4029 0.5812	0.4217 0.5889	0.4404 0.5970	
3. Heat losses a			er										
Element Normal Window (U				Gross m2	Openings m2		tArea m2 7400	U-value W/m2K 1 2357	A > V 33.04	I/K	-value kJ/m2K	A x K kJ/K	
Corridor Door Corridor Bick Wall External Roof 1				3.7000 73.2200 23.7500	2.1000 26.7400	2 1 46 23	.1000 .6000 .4800	1.2357 1.0000 0.2300 0.3000 0.1300	2.10 0.36 13.94 3.08	000 580 140			(26) (29a) (29a) (30)
Total net area of Fabric heat loss Party Wall 1 Party Floor 1	of externa s, W/K = S	1 elements um (A x U)	Aum(A, m2)			29	.6700 (26)(.7900 .8900	30) + (32) 0.0000	= 52.54 0.00				(31) (33) (32) (32d)
Thermal mass par Thermal bridges Total fabric hea	(Default it loss	value 0.150	* total e:	sposed area						(33)	+ (36) =	250.0000 15.1005 67.6437	(36)
Ventilation heat (38)m Heat transfer co	Jan 38.5285	culated mor Feb 38.2504	thly (38)m Mar 37.9777	= 0.33 x (Apr 36.6971	25)m x (5) May 36.4575	Jun 35.3421	Jul 35.3421	Aug 35.1355	Sep 35.7717	Oct 36.4575	Nov 36.9422	Dec 37.4489	(38)
Average = Sum(3	106.1722	105.8941	105.6214	104.3408	104.1012	102.9858	102.9858	102.7792	103.4154	104.1012	104.5859	105.0926 104.3396	
HLP HLP (average)	Jan 1.5639	Feb 1.5598	Mar 1.5558	Apr 1.5369	May 1.5334	Jun 1.5170	Jul 1.5170	Aug 1.5139	Sep 1.5233	Oct 1.5334	Nov 1.5405	Dec 1.5480 1.5369	(40) (40)
Days in month	31	28	31	30	31	30	31	31	. 30	31	30	31	(41)
4. Water heating	g energy r	equirements	(kWh/year										
Assumed occupant Average daily ho	y ot water u	se (litres)	'day)									2.1938 86.3034	(42) (43)
Daily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	94.9338 140.7840 (annual)	91.4816 123.1306	88.0295 127.0598	84.5774 110.7738	81.1252 106.2901	77.6731 91.7203	77.6731 84.9923	81.1252 97.5299		88.0295 115.0192 Total = S	91.4816 125.5524 um(45)m =	94.9338 136.3418 1357.8890	(45)
Water storage lo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage lo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)





CALCULAT	ION OF I	FABRIC E	NERGY E	FFICIENC	Y 09 Ja	n 2014							
If cylinder co	ontains ded	icated sola	r storage 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss Heat gains fro	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	29.9166	26.1653	27.0002	23.5394	22.5866	19.4906	18.0609	20.7251	20.9726	24.4416	26.6799	28.9726	(65)
5. Internal ga Metabolic gair			5a)										
	Jan	Feb	Mar 109.6914	Apr 109.6914	May 109.6914	Jun 109.6914	Jul 109.6914	Aug 109.6914	Sep 109.6914	Oct 109.6914	Nov 109.6914	Dec 109.6914	(66)
(bb)m Lighting gains	(calculat 17.1458	ed in Appen 15.2287	dix L, equa 12.3848	tion L9 or 9.3761	L9a), also 7.0087	see Table 5 5.9171	6.3936	8.3107	11.1545	14.1633	16.5306	17.6223	(67)
Appliances gai	ns (calcul	ated in App 194 3189	endix L, eq	178 5834	or L13a), a	150 see Tab	143 8805	141.8847	146.9139	157.6203	171.1353	183.8374	(68)
Cooking gains Pumps, fans	33.9691 0.0000	33.9691 0.0000	33.9691 0.0000	33.9691 0.0000	33.9691 0 0000	33.9691 0.0000	33.9691 0.0000	33.9691 0.0000	33.9691	33.9691	33.9691	33.9691 0.0000	(69)
Losses e.g. ev					-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	-87.7531	
Water heating	gains (Tab 40.2105	le 5) 38.9364	36.2906	32.6937	30.3584	27.0702	24.2754	27.8563	29.1287	32.8516	37.0554	38.9417	
Total internal	gains 305.5869	304.3914	293.8726	276.5605	258.3430	241.2610	230.4569	233.9592	243.1045	260.5426	280.6287	296.3088	(73)
6. Solar gains													
[Jan]			А	rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	or	Gains W	
Northeast East Northwest				600 400 400	11.2829 19.6403 11.2829		0.6300 0.6300 0.6300	0	.8000 .8000	0.77 0.77 0.77	00	45.1617 52.4088 30.1078	(76)
NOTENWEST							0.6300		.8000	0.77	00	30.1078	(01)
Solar gains Total gains	127.6784 433.2653	255.7362 560.1276	444.8822 738.7549	699.5836 976.1442	911.1587 1169.5017	958.5877 1199.8487	901.8554 1132.3122	737.1378 971.0970	532.7297 775.8342	308.8908 569.4334	160.0563 440.6850	104.5674 400.8762	
7. Mean interr	al tempera	ture (heati	ng season)										
Temperature du	ring heati	ng periods	in the livi	ng area fro	om Table 9,	Thl (C)						21.0000	(85)
Utilisation fa	Jan 44.4051	Feb 44.5217	Ving area, Mar 44.6366	Apr 45.1845	May 45.2885	Jun 45.7790	Jul 45.7790	Aug 45.8710	Sep 45.5888	Oct 45.2885	Nov 45.0786	Dec 44.8612	
alpha util living ar	3.9603	3.9681	3.9758	4.0123	4.0192	4.0519	4.0519	4.0581	4.0393	4.0192	4.0052	3.9907	
	0.9971	0.9919	0.9707	0.8885	0.7190	0.5264	0.3943	0.4730	0.7667	0.9627	0.9941	0.9979	
MIT Th 2	19.2749 19.6399	19.5205 19.6430	19.9509 19.6459	20.4892 19.6599	20.8354 19.6626	20.9643 19.6748	20.9913 19.6748	20.9826 19.6771	20.8462 19.6701	20.3089 19.6626	19.6883 19.6572	19.2387 19.6517	
util rest of h	0.9961 18.1000	0.9890 18.3463	0.9602 18.7711	0.8522 19.2841	0.6458 19.5674	0.4270 19.6614	0.2785 19.6731	0.3437 19.6732	0.6686 19.5958	0.9434 19.1373	0.9916 18.5255	0.9972 18.0728	(89)
Living area fr	action 18.5053	18.7514	19.1781	19.6999	20.0048	20.1109	20.1278	20 1249		Living are	a / (4) = 18.9266	0.3450	(91)
Temperature ac adjusted MIT		18.7514	19.1781	19.6999	20.0048	20.1109	20.1278	20.1249	20.0272	19.5415	18.9266	0.0000	
8. Space heati													
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation Useful gains	0.9949 431.0510	0.9863 552.4711	0.9556 705.9275	0.8535 833.1173	0.6659 778.7851	0.4607	0.3187 360.8447	0.3887 377.4853	0.6979 541.4824	0.9411	0.9896 436.1126	0.9962 399.3580	(94)
Ext temp. Heat loss rate	4.3000 W	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti Space heating	1.0000	1466.7806	1339.0789	1126.8657	864.5402 1.0000	567.5406 0.0000	363.3180 0.0000	382.8409 0.0000	612.9590 0.0000	930.8167 1.0000	1.0000	1500.1942	
Space heating	801.4061	614.4160	471.0647	211.4988	63.8018	0.0000	0.0000	0.0000	0.0000	293.8065	576.5646	819.0222 3851.5807	(98)
Space heating	per m2									(98) / (4) =	56.7327	(99)
8c. Space cool			b Con E-11	a 10h									
Calculated for Ext. temp.	Jan 4.3000	y and Augus Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000	
Heat loss rate Utilisation	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	968.0661 0.9304	762.0946 0.9597	781.1219 0.9336	0.0000	0.0000	0.0000	0.0000	
Useful loss Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	900.6617 1483.9358	731.3471 1403.3564	729.2589 1216.2243	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti Space cooling	0.0000 kWh	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
	0.0000	0.0000	0.0000	0.0000	0.0000	419.9574	499.9749	362.3023	0.0000	0.0000	0.0000	0.0000	(104)

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FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION OF FA	ABRIC EN	IERGY EF	FICIENCY	09 Ja	n 2014							
Space cooling Cooled fraction Intermittency factor (Tabl								fC =	cooled area	/ (4) =	1282.2345	
0.0000 Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
0.0000 Space cooling Space cooling per m2 Energy for space heating Energy for space cooling	0.0000	0.0000	0.0000	0.0000	104.9893	124.9937	90.5756	0.0000	0.0000	0.0000	0.0000 320.5586 4.7217 56.7327 4.7217	(107) (108) (99)
Total Dwelling Fabric Energy Eff	Ficiency (D	FEE)									61.4544 61.5	(109 (109

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Property Reference	e Plot 19				Issued on Date	24/06/2019				
Assessment	Be Lean		pp Type Ref	Top Floor Pent House						
Reference		,								
Property	Plot 019, Ferdinand Str	Plot 019, Ferdinand Street, Camden, LONDON, LONDON, NW1 8EU								
SAP Rating		72 C	DER	34.93	TER	18.05				
Environmental		69 C	% DER <ter< td=""><td></td><td>-93.50</td><td></td></ter<>		-93.50					
CO ₂ Emissions (t/y	ear)	3.15	DFEE	121.26	60.48					
General Requirem	ents Compliance	Fail	% DFEE <tfee< td=""><td></td><td>-100.48</td><td></td></tfee<>		-100.48					
Assessor Details	Mr. Simon Gowing, Simon G		Assessor ID	T271-0001						
Client										

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FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

		red Document L1A, 2013 Edition, England	
DWELLING AS DESIGNED			
Top-floor flat, total f	loor area 110 m	m ²	
This report covers item It is not a complete re	port of regulat		
la TER and DER Fuel for main heating:M. Fuel factor:1.00 (mains Target Carbon Dioxide E	ains gas gas) mission Rate (1 Emission Rate kgCOU/m² (93.	FER) 18.05 kgCOI/m² (DER) 34.93 kgCOII/m²Pei1 .5%)	
lb TFEE and DFEE Target Fabric Energy Ef Dwelling Fabric Energy E Excess energy =60.8 kWh	ficiency (TFEE) Efficiency (DFF /m²/yr (100.0%	60.5 kWh/m²/yr ZE) 21.3 kWh/m²/yrFail k)	
2 Fabric U-values		Highest	
External wall 0.24 (m.	ax. 0.30)	0.32 (max. 0.70) OK	
Floor (no floor Roof 0.13 (m.	or) ax. 0.20)	0.13 (max. 0.35) OK	
Openings and curtain wall 1.72 (m.	ax. 2.00)	1.80 (max. 3.30) OK	
2a Thermal bridging Thermal bridging calcul-		ault v-value of 0.15	
Air permeability at 50 Maximum		6.00 (design value) 10.0	OK
4 Heating efficiency Main heating system: Data from database Worcester Greenstar 24i		Boiler system with radiators or underfloor - Ma	
Efficiency: 89.2% SEDBU	K2009	OK	
Secondary heating system	m:	None	
5 Cylinder insulation Hot water storage Permitted by DBSCG 2.30 Primary pipework insula		Measured cylinder loss: 1.72 kWh/day OK Yes	OK
6 Controls			
Space heating controls:		Programmer and at least two room thermostats	OK
Hot water controls:		Cylinderstat Independent timer for DHW	OK
Boiler interlock		Yes	OK
7 Low energy lights Percentage of fixed ligh			
Minimum		75%	OK
8 Mechanical ventilatio Not applicable	n		
9 Summertime temperature Overheating risk (Thame: Based on:	e	Not significant	OK
		Average 10.13 m ² , No overhang	
Overshading: Windows facing North: Windows facing South:		10.13 m², No overhang	
Windows facing North: Windows facing South: Windows facing West: Air change rate:		5.15 m ² , No overhang 3.00 ach	100% of davlight
Windows facing North: Windows facing South: Windows facing West:		5.15 m², No overhang 3.00 ach Light-coloured curtain or roller blind, closed	





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE	09 Jan 2014	

SAP 2012 WORKSH CALCULATION OF	DWELLING E	EMISSIONS F	OR REGULATI	ONS COMPLIA	NCE 09	ry 2014) Jan 2014							
1. Overall dwel	ling dimer	nsions											
Ground floor Total floor are Dwelling volume	a TFA = (1	la)+(lb)+(l	c)+(ld)+(le)(ln)	1	09.9200		Area (m2) 109.9200		rey height (m) 3.0400)+(3d)+(3e)		Volume (m3) 334.1568	(1b) - (3k (4) (5)
2. Ventilation	rate												
					main heating	84	econdary heating		other	tot		n3 per hour	
Number of chimn Number of open Number of inter Number of passi Number of fluel	flues mittent fa ve vents				0	++	0	+ +	0		0 * 40 = 0 * 20 = 3 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 30.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration du Pressure test Measured/design Infiltration ra Number of sides	AP50		and fans	= (6a)+(6b))+(7a)+(7b)+	(7c) =				30.0000	Air change / (5) =	0.0898 Ves 6.0000 0.3898	(-,
Shelter factor Infiltration ra			de shelter	factor					(20) = 1	- [0.075 x 21) = (18)	(19)] = x (20) =	0.9250 0.3605	(20)
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	0.4597 0.6057	0.4507 0.6016	0.4417 0.5975	0.3966 0.5786	0.3876 0.5751	0.3425 0.5587	0.3425 0.5587	0.3335 0.5556		0.3876 0.5751	0.4056 0.5823	0.4236 0.5897	
3. Heat losses	and heat 1	loss parame	ter	Gross m2	Openings m2		tArea m2	U-value W/m2K	A ×	U K	-value kJ/m2K	A × K kJ/K	
Opening Type 1 Curtain Walling External Wall 2 Solid Core External Roof 1 Total net area Fabric heat los Party Floor 1	of externa	al elements		98.4700 18.8500 3.7000 109.9200	25.4100	25 73 18 3 109 230	.4100 .0600 .8500 .7000 .9200	1.4151 1.8000 0.2300 0.3152 0.1300 30) + (32)	35.95 131.50 4.33 1.16 14.28	75 80 51 62 96			(27) (29a) (29a) (29a) (30) (31) (33) (32d)
Thermal mass pa Thermal bridges Total fabric he	(Default	TMP = Cm / value 0.15	TFA) in kJ/ 0 * total e	m2K xposed area)					(33)	+ (36) =	250.0000 34.6410 221.8974	(36)
Ventilation hea (38)m Heat transfer c	Jan 66.7871	Feb 66.3347	nthly (38)m Mar 65.8912	= 0.33 x () Apr 63.8083	25)m x (5) May 63.4185	Jun 61.6043	Jul 61.6043	Aug 61.2684	Sep 62.3031	Oct 63.4185	Nov 64.2069	Dec 65.0312	(38)
	288.6845	288.2321	287.7886	285.7056	285.3159	283.5017	283.5017	283.1657	284.2005	285.3159	286.1043	286.9286 285.7038	
HLP HLP (average) Days in month	Jan 2.6263	Feb 2.6222	Mar 2.6182	Apr 2.5992	May 2.5957	Jun 2.5792	Jul 2.5792	Aug 2.5761	Sep 2.5855	Oct 2.5957	Nov 2.6028	Dec 2.6103 2.5992	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heatin	cy)								2.8143 101.0407	(42) (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte Energy content	111.1448 164.8245 (annual)	107.1031 144.1565	103.0615 148.7566	99.0199 129.6896	94.9782 124.4403	90.9366 107.3825	90.9366 99.5057	94.9782 114.1842		103.0615 134.6600 Total = S	107.1031 146.9919 um(45)m =	111.1448 159.6237 1589.7635	(45)
Distribution lo Water storage 1	24.7237	= 0.15 x (21.6235	45)m 22.3135	19.4534	18.6660	16.1074	14.9259	17.1276	17.3322	20.1990	22.0488	23.9436	(46)
Store volume a) If manufact Temperature f	urer decla	ared loss f Table 2b	actor is kn	own (kWh/da	ay):							210.0000 1.7200 0.5400	(48)



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCOLATI	ON OF I	JWELLIN	G EIVIISS	ONS FOR	R REGULA	HONS C	JIVIPLIAN	ICE 09	Jan 2014	,			
nter (49) or		5)										0.9288	(55
otal storage :	loss 28.7928	26.0064	28.7928	27.8640	28.7928	27.8640	28.7928	28.7928	27.8640	28.7928	27.8640	28.7928	(56
cylinder cor	28.7928	26.0064	28.7928	27.8640	28.7928	27.8640	28.7928	28.7928	27.8640	28.7928	27.8640	28.7928	(57
imary loss	23.2624	21.0112	23.2624	22.5120 ed for each	23.2624 month	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59
olar input	216.8797 0.0000	191.1741 0.0000	200.8118	180.0656 0.0000	176.4955 0.0000	157.7585 0.0000	151.5609 0.0000	166.2394	165.9239	186.7152	197.3679	211.6789 0.0000 0.0000	(63)
itput from w/h		191.1741	200.8118	180.0656	176.4955	157.7585	151.5609	166.2394	165.9239	months) = S 186.7152	197.3679	211.6789	(64
eat gains from	n water he	ating, kWh/	month 91 1057	83 4226	83 0206	76 0055	74.7298	Total p	er year (kW	h/year) = S	um(64)m =	2202.6715	
Internal ga:	ins (see T	able 5 and	5a)										
tabolic gains													
6) m	Jan 140.7172	Feb 140.7172	Mar 140.7172	Apr 140.7172	May 140.7172	Jun 140.7172	Jul 140.7172	Aug 140.7172	Sep 140.7172	Oct 140.7172	Nov 140.7172	Dec 140.7172	(66
ghting gains	24.1992	21.4935	17.4797	13.2332	9.8920	8.3512	9.0238	11.7295	15.7433	19.9897	23.3310	24.8717	(67
pliances gai:	271 4410	274 2577	267 1597	252 0489	232 9742	215 0466	203 0699	200.2532	207.3513	222.4621	241.5368	259.4643	(68
oking gains	(calculate 37.0717	d in Append 37.0717	lix L, equat 37.0717	ion L15 or 37.0717	L15a), also 37.0717	see Table 37.0717	5 37.0717	37.0717	37.0717	37.0717	37.0717	37.0717	(69
mps, fans sses e.g. eva	3.0000 aporation	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	
ter heating o	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	(7)
ter heating o	129.6348	127.3008	122.4540	115.8647	111.5868	105.5632	100.4433	107.0032	109.3340	116.1540	123.8550	127.3105	(72
tal internal	gains 493.4902	491.2672	475.3085	449.3620	422.6681	397.1762	380.7522	387.2012	400.6437	426.8210	456.9380	479.8618	(73
. Solar gains													
[an]			,	m2	Solar flux Table 6a W/m2		g fic data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
rth			10.1		10.6334		0.5000		.8000	0.77		29.8589	
outh est			10.1 5.1	300 500	46.7521 19.6403		0.5000		.8000	0.77 0.77		131.2815 28.0380	
olar gains otal gains	189.1785 682.6687	326.9156 818.1828	461.1682 936.4768	597.0256 1046.3877	693.8154 1116.4836	700.2957 1097.4719	670.3412 1051.0935	596.0708 983.2720	507.7331 908.3768	364.9104 791.7314	227.4083 684.3463	161.3883 641.2501	
. Mean interna	al tempera	ture (heati	ng season)										
mperature du ilisation fac	tor for q	ains for li	in the livi	nil.m (see	Table 9a)	Th1 (C)						21.0000	(85
au lpha	Jan 26.4418 2.7628	Feb 26.4833 2.7656	Mar 26.5241 2.7683	Apr 26.7175 2.7812	May 26.7540 2.7836	Jun 26.9252 2.7950	Jul 26.9252 2.7950	Aug 26.9571 2.7971	Sep 26.8590 2.7906	Oct 26.7540 2.7836	Nov 26.6802 2.7787	Dec 26.6036 2.7736	
il living are	0.9961	0.9932	0.9876	0.9746	0.9459	0.8862	0.7959	0.8299	0.9337	0.9813	0.9938	0.9968	(86
T 2	18.2117 18.9485	18.4210 18.9508	18.8103 18.9531	19.3525 18.9638	19.9197 18.9658	20.4293 18.9752	20.7215 18.9752	20.6700 18.9769	20.2463 18.9716	19.5186 18.9658	18.7726 18.9617	18.1781 18.9575	(87
il rest of ho	0.9946	0.9904	0.9819	0.9609	0.9088	0.7798	0.5593	0.6195	0.8670	0.9685	0.9906	0.9955	
T 2 ving area fra	16.5582 action	16.7682	17.1570	17.6998	18.2500	18.7144	18.9172	18.8952	18.5672 fLA =	17.8701 Living are	17.1269 a / (4) =	16.5306 0.3281	(91
IT emperature ad	17.1006 justment	17.3104	17.6994	18.2420	18.7977	19.2770	19.5091	19.4774	19.1181	18.4109	17.6668	17.0711 -0.1500	
djusted MIT	16.9506	17.1604	17.5494	18.0920	18.6477	19.1270	19.3591	19.3274	18.9681	18.2609	17.5168	16.9211	(93
	ng require	nent											
Space heati		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Jan	0.9865	0.9758	0.9520	0.9003 1005 1447	0.7911 868 2458	0.6205	0.6710 659.7762	0.8668 787 3922	0.9614	0.9870	0.9934	(94
ilisation	Jan 0.9921		6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
cilisation	0.9921 677.2621 4.3000	807.1415 4.9000	0.5000		1982.3037	1283.4152	782.2185	828.9418	1383.5055	2185.7827	2980.2922		
cilisation seful gains at temp. eat loss rate	0.9921 677.2621 4.3000 W 3652.0461	4.9000 3533.8361	3179.8811	2626.2078			0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97
ilisation meful gains at temp. mat loss rate muth fracti	0.9921 677.2621 4.3000 W 3652.0461 1.0000	4.9000 3533.8361 1.0000	3179.8811	1.0000	1.0000	0.0000							
onth fracti pace heating 1	0.9921 677.2621 4.3000 W 3652.0461 1.0000 kWh	4.9000 3533.8361	3179.8811	1.0000		0.0000	0.0000	0.0000	0.0000	1059.9037	1659.4704	2241.7043 12593.2390 114.5673	(98
tilisation seful gains kt temp. eat loss rate onth fracti pace heating !	0.9921 677.2621 4.3000 W 3652.0461 1.0000 kWh	4.9000 3533.8361 1.0000	3179.8811	1.0000	1.0000			0.0000	0.0000		1659.4704	12593.2390	(98
cilisation deful gains at temp. eat loss rate enth fracti ace heating l	0.9921 677.2621 4.3000 W 3652.0461 1.0000 kWh 2213.2393 per m2	4.9000 3533.8361 1.0000 1832.3387	3179.8811	1.0000	1.0000			0.0000	0.0000		1659.4704	12593.2390	(98





CALCULAT	ION OF D	WELLIN	G EMISSI	ONS FOR	REGULA	TIONS C	OMPLIA	NCE 09	Jan 2014	ļ			
Ext. temp. Heat loss rate	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000	
Utilisation Useful loss Total gains Month fracti Space cooling	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	2664.9160 0.4737 1262.4833 1376.9212 1.0000	2097.9126 0.5522 1158.4000 1320.5953 1.0000	2152.0596 0.5175 1113.7795 1242.9059 1.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	(101) (102) (103)
Space cooling Cooled fraction	0.0000 on	0.0000	0.0000	0.0000	0.0000	82.3952	120.6733	96.0700	0.0000 £C =	0.0000 cooled are	0.0000 a / (4) =	0.0000 299.1386 0.9098	(104)
Intermittency	0.0000	e 10b) 0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling Space cooling Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	18.7398	27.4457	21.8500	0.0000	0.0000	0.0000	0.0000 68.0355 0.6190	(107)
9a. Energy req												0.0000	
Fraction of sp Fraction of sp Efficiency of Efficiency of Space heating Cooling System	ace heat fro main space h secondary/su requirement	m main sy eating sy pplementa	stem(s) stem 1 (in : ry heating :	t) system, t	(Table II	,						1.0000 90.2000 0.0000 13961.4623 4.0000	(202) (206) (208) (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	requirement 2213.2393 1	832.3387	1685.9277	1173.6487	727.0063	0.0000	0.0000	0.0000	0.0000	1059.9037	1659.4704	2241.7043	(98)
Space heating	efficiency (90.2000	main heat 90.2000	ing system : 90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating	2453.7021 2	031.4177	stem) 1869.0995	1301.1626	805.9936	0.0000	0.0000	0.0000	0.0000	1175.0595	1839.7676	2485.2598	(211)
Water heating	requirement 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating	216.8797	191.1741	200.8118	180.0656	176.4955	157.7585	151.5609	166.2394	165.9239	186.7152	197.3679	211.6789 79.5000	(64)
Efficiency of (217)m Fuel for water	89.1294	89.0674	88.9261	88.6136	87.8892	79.5000	79.5000	79.5000	79.5000	88.4176	88.9278	89.1646	(217)
Water heating Space cooling	243.3312 fuel used	214.6397	225.8187	203.2032	200.8158	198.4384	190.6426	209.1062	208.7094	211.1742	221.9418	237.4025 2565.2237	
(221) m Cooling Annual totals	0.0000	0.0000	0.0000	0.0000	0.0000	4.6850	6.8614	5.4625	0.0000	0.0000	0.0000	0.0000 17.0089	(221) (221)
Space heating Space heating	fuel - main	system dary										13961.4623 0.0000	
Electricity for central hear main heatin Total electric Electricity for Total delivere	ting pump og flue fan tity for the or lighting (above, kW	n/year d in Append	ix L)								30.0000 45.0000 75.0000 427.3648 17046.0598	(230e) (231) (232)
12a. Carbon di	oxide emissi	ons - Ind	ividual hea	ting system	including	micro-CHP							
Space heating Space heating Water heating Space and wate	- main syste - secondary (other fuel)							Energy kWh/year 13961.4623 0.0000 2565.2237		ion factor kg CO2/kWh 0.2160 0.0000 0.2160	1	Emissions cg CO2/year 3015.6759 0.0000 554.0883 3569.7642	(261) (263) (264) (265)
Space cooling Pumps and fans Energy for lig Total CO2, kg/ Dwelling Carbo	hting 'year	ission Ra	te (DER)					17.0089 75.0000 427.3648		0.5190 0.5190 0.5190		8.8276 38.9250 221.8023 3839.3191 34.9300	(267) (268) (272)
16 CO2 EMISSIO DER Total Floor Ar Assumed number CO2 emissions CO2 emissions Total CO2 emis Residual CO2 e Additional all Resulting CO2 Net CO2 emissi	ea of occupant factor in Tab from applian from cooking ssions missions off owable elect emissions of	s le 12 for ces, equa , equation set from : ricity ge	electricity tion (L14) n (L16) piofuel CHP meration, k	y displaced Wh/m²/year	from grid			ION TECHNOLO	GIES		TFA N EF	34.9300 109.9200 2.8143 0.5190 14.6334 1.6971 51.2605 0.0000 0.0000 51.2605	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHE CALCULATION OF F	EET FOR Ne	ew Build (A:	s Designed) ENCY 0		9.92, Janua	ry 2014)							
1. Overall dwell	ling dimer	nsions											
Ground floor Total floor area Dwelling volume	a TFA = (I	ia)+(lb)+(l	c)+(1d)+(1e)(ln)	1	09.9200		Area (m2) 109.9200		rey height (m) 3.0400)+(3d)+(3e)		Volume (m3) 334.1568 334.1568	(1b) -
2. Ventilation r	ate												
Number of chimne Number of open f Number of interm Number of passiv Number of fluele	flues mittent fa ve vents				main heating 0 0	+ +	econdary heating 0 0	+ +	other 0 0	tot = =	0 * 40 = 0 * 20 = 4 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 40.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration due Pressure test Measured/design Infiltration rat Number of sides	e to chimr AP50 :e	neys, flues	and fans	= (6a)+(6b)+(7a)+(7b)+	(7c) =				40.0000		es per hour 0.1197 Yes 6.0000 0.4197	(8)
Shelter factor Infiltration rat	e adjuste	ed to inclu	de shelter	factor					(20) = 1	- [0.075 x 21) = (18)	(19)] = x (20) =	0.9250 0.3882	(20) (21)
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	0.4950 0.6225	0.4853 0.6177	0.4756 0.6131	0.4270 0.5912	0.4173 0.5871	0.3688 0.5680	0.3688 0.5680	0.3591 0.5645	0.3882 0.5754	0.4173 0.5871	0.4368 0.5954	0.4562 0.6040	
3. Heat losses a	and heat 1	loss parame	ter										
Element Opening Type 1 (Curtain Walling External Wall 2 Solid Core External Roof 1 Total net area c Fabric heat loss Party Floor 1	of externa	al elements		Gross m2 98.4700 18.8500 3.7000 109.9200	Openings m2 25.4100	25 73 18 3 109 230	######################################	U-value W/m2K 1.4151 1.8000 0.2300 0.3152 0.1300 30) + (32)	35.95 131.50 4.33 1.16 14.28	/K 75 80 51 62 96	-value kJ/m2K	A × K kJ/K	
Thermal mass par Thermal bridges Total fabric hea	(Default	PMP = Cm / 9 value 0.15	TFA) in kJ/ 0 * total e	m2K xposed area)					(33)	+ (36) =	250.0000 34.6410 221.8974	(36)
Ventilation heat	Jan 68.6449	Iculated mor Feb 68.1204	nthly (38)m Mar 67.6062	= 0.33 x (Apr 65.1911	25)m x (5) May 64.7392	Jun 62.6357	Jul 62.6357	Aug 62.2462	Sep 63.4459	Oct 64.7392	Nov 65.6533	Dec 66.6090	(38)
Heat transfer co 2 Average = Sum(39	290.5423	290.0177	289.5036	287.0884	286.6366	284.5331	284.5331	284.1436	285.3433	286.6366	287.5507	288.5063 287.0863	(39) (39)
HLP HLP (average) Days in month	Jan 2.6432	Feb 2.6384	Mar 2.6338	Apr 2.6118	May 2.6077	Jun 2.5885	Jul 2.5885	Aug 2.5850	Sep 2.5959	Oct 2.6077	Nov 2.6160	Dec 2.6247 2.6118	(40) (40)
	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heating	g energy r	requirement:	s (kWh/year)									
Assumed occupanc Average daily ho	y ot water t	se (litres	/day)									2.8143 101.0407	(42) (43)
Daily hot water	111.1448	Feb 107.1031 144.1565		Apr 99.0199 129.6896	May 94.9782 124.4403	Jun 90.9366 107.3825	Jul 90.9366 99.5057	Aug 94.9782 114.1842	Sep 99.0199 115.5479	Oct 103.0615 134.6600	Nov 107.1031 146.9919	Dec 111.1448 159.6237	
Energy conte 1									440.04/3				
Energy conte 1 Energy content (Distribution los Water storage lo	0.0000		45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Total = S 0.0000	um(45)m =	0.0000	





CALCULAT	ION OF	FABRIC E	NERGY E	FFICIENC	Y 09 Ja	an 2014							
Part	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Primary loss Heat gains fro	0.0000 om water he 35.0252	0.0000 ating, kWh/ 30.6333	0.0000 month 31.6108	0.0000 27.5590	0.0000 26.4436	0.0000	0.0000	0.0000	0.0000	0.0000 28.6152	0.0000	0.0000	
5. Internal qu	ains (see T	able 5 and	5a)										
Metabolic gair	ns (Table 5), Watts											
(66)m	Jan 140.7172	Feb 140.7172	Mar 140.7172	Apr 140.7172	May 140.7172	Jun 140.7172	Jul 140.7172	Aug 140.7172	Sep 140.7172	Oct 140.7172	Nov 140.7172	Dec 140.7172	(66)
Lighting gains Appliances ga:	24.1992	21.4935	17.4797	13.2332	9.8920	8.3512	9.0238	11.7295	15.7433	19.9897	23.3310	24.8717	(67)
Cooking gains								200.2532	207.3513	222.4621	241.5368	259.4643	
Pumps, fans	0.0000	0.0000	0.0000	0.0000	37.0717 0.0000	37.0717 0.0000	37.0717 0.0000	37.0717 0.0000	37.0717 0.0000	37.0717 0.0000	37.0717 0.0000	37.0717 0.0000	
Losses e.g. ev	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	-112.5738	(71)
Total internal	47.0769 l gains	45.5852	42.4876	38.2765	35.5424	31.6928	28.4206	32.6131	34.1027	38.4614	43.3830	45.5914	
	407.9323	406.5516	392.3422	368.7738	343.6238	320.3058	305.7296	309.8110	322.4124	346.1284	373.4660	395.1427	(73)
5. Solar gains	8												
[Jan]			А	m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	or	Gains W	
North South West			10.1 10.1 5.1	300	10.6334 46.7521 19.6403		0.5000 0.5000 0.5000	C	.8000 .8000 .8000	0.77 0.77 0.77	00	29.8589 131.2815 28.0380	(78)
Solar gains Total gains	189.1785 597.1107	326.9156 733.4672	461.1682 853.5104	597.0256 965.7994	693.8154 1037.4392	700.2957 1020.6015	670.3412 976.0708	596.0708 905.8818	507.7331 830.1455	364.9104 711.0387	227.4083 600.8743	161.3883 556.5310	(83) (84)
7. Mean interr Pemperature du Utilisation fa	uring heati actor for g Jan	ng periods ains for li Feb	in the livi ving area, Mar	nil,m (see Apr	Table 9a) May	Jun	Jul	Aug	Sep	Oct	Nov	21.0000 Dec	(85)
tau alpha util living an	26.2727 2.7515 rea	26.3202 2.7547	26.3670 2.7578	26.5888 2.7726	26.6307 2.7754	26.8276 2.7885	26.8276 2.7885	26.8644 2.7910	26.7514 2.7834	26.6307 2.7754	26.5460 2.7697	26.4581 2.7639	
	0.9972	0.9949	0.9901	0.9791	0.9542	0.9016	0.8197	0.8531	0.9457	0.9857	0.9955	0.9978	
NT h 2 stil rest of h	18.1408 18.9390	18.3519 18.9417	18.7449 18.9443	19.2941 18.9567	19.8686 18.9590	20.3901 18.9698	20.6941 18.9698	20.6381 18.9719	20.1994 18.9656	19.4605 18.9590	18.7081 18.9543	18.1096 18.9494	
HT 2	0.9961 16.4816	0.9927 16.6938	0.9856 17.0869	0.9675 17.6391	0.9217 18.1998	0.8038 18.6835	0.5898 18.9031	0.6530 18.8775	0.8879 18.5252	0.9756 17.8097	0.9933 17.0581	0.9969 16.4571	(90)
iving area f: HT 'emperature ac	17.0259	17.2377	17.6308	18.1820	18.7472	19.2433	19.4906	19.4551	19.0744	= Living are 18.3513	a / (4) = 17.5994	0.3281 16.9992 0.0000	
djusted MIT	17.0259	17.2377	17.6308	18.1820	18.7472	19.2433	19.4906	19.4551	19.0744	18.3513	17.5994	16.9992	(93)
. Space heat:													
tilisation Seful gains	Jan 0.9944 593.7898	Feb 0.9899 726.0387	Mar 0.9810 837.3160	Apr 0.9609 928.0526	May 0.9167 951.0614	Jun 0.8225 839.4190	Jul 0.6703 654.2396	Aug 0.7203 652.5379	Sep 0.8926 740.9938	Oct 0.9708 690.2886	Nov 0.9908 595.3593	Dec 0.9955 553.9993	(95)
eat loss rate	4.3000 e W 3697.4080	4.9000	6.5000	8.9000 2664.7587	11.7000	14.6000	16.6000 822.4799	16.4000 868.0880	14.1000	10.6000	7.1000 3019.1081	4.2000	
Nonth fracti pace heating	1.0000 kWh	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
pace heating pace heating		1916.6268	1774.5024	1250.4284	795.2872	0.0000	0.0000	0.0000	0.0000	1139.4401		2335.1580 13265.6340 120.6844	(98)
Sc. Space cool	ling requir	ement											
			. Coo E-2-1	- 10h									
alculated for ext. temp.	Jan 4.3000	y and Augus Feb 4.9000	t. See Tabl Mar 6.5000	e 10b Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000	
Heat loss rate Utilisation Useful loss Total gains	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	2674.6111 0.4512 1206.7719 1303.0507	2105.5449 0.5278 1111.2613 1248.5727	2159.4911 0.4915 1061.4893 1168.5157	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	(101)
Month fracti Space cooling	0.0000 kWh	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	69.3208	102.1597	79.6276	0.0000	0.0000	0.0000	0.0000 251.1081	

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Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.10r08

FULL SAP CALCULATION PRINTOUT Calculation Type: New Build (As Designed)



CALCULATION	OF FA	ABRIC EN	IERGY EF	FICIENCY	09 Ja	n 2014							
Cooled fraction									fC =	cooled area	/ (4) =	1.0000	(105
Intermittency factor		0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	/106
Space cooling kWh	1000	0.0000	0.0000	0.0000	0.0000	0.2300	0.2300	0.2300	0.0000	0.0000	0.0000	0.0000	(100)
0.0	1000	0.0000	0.0000	0.0000	0.0000	17.3302	25.5399	19.9069	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												62.7770	(107)
Space cooling per m2												0.5711	(108)
Energy for space hea	ting											120.6844	(99)
Energy for space coo	ling											0.5711	(108)
Total	-											121.2556	(109)
Dwelling Fabric Ener	av Eff	iciency (D)	FEE)									121.3	(109)



Appendix E

Non-Domestic *Be Lean* BRUKL report

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name Shell and Core

Office As built

Date: Fri Jun 21 13:20:33 2019

Administrative information

Building Details
Address: London.

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

lame:

Telephone number: Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

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

The building does not comply with England Building Regulations Part L 2013

CO ₂ emission rate from the notional building, kgCO ₂ /m².annum	20.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	32.9
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

 $\label{thm:continuous} \mbox{Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.} \\$

Building fabric

Element	Ua-Limit	Ua-Calc	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.28	0.28	01 Ground Floor - Office_W_8
Floor	0.25	0.22	0.22	01 Ground Floor - Office_F_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.3	1.3	01 Ground Floor - Office_G_12
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"
Us-Limit = Limiting area-weighted average U-values [V			Hilom = C	Calculated maximum individual element Ll-values (N//m²K)1

^{*} There might be more than one surface where the maximum U-value occurs.

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

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	25

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency
This system	3.04	2.64	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic moni	toring & targeting w	ith alarms for out-of	-range values for thi	s HVAC syster	n NO
* Standard shown is f	or all types >12 kW output.	except absorption and gas	s engine heat numps. For the	vnes <=12 kW outni	it refer to FN 14825

^{*} Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 1482 for limiting standards.

1- Project DHW

		Water heating efficiency	Storage loss factor [kWh/litre per day]
1	This building	1	0.005
- [5	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)]				IID -	eriala many
ID of system type	Α	В	С	D	E	F	G	Н	I	пке	fficiency
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01 Ground Floor - Office	-	-	-	1.4	-	-	-	-	-	0.69	0.5

Shell and core configuration

Zone	Excluded from calculation?
01 Ground Floor - Office	NO

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
01 Ground Floor - Office	65	-	-	2331

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?
01 Ground Floor - Office	NO (-27%)	NO

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^{**} 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.

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
Area [m²]	250.1	250.1
External area [m²]	467.6	467.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	185.18	228.15
Average U-value [W/m²K]	0.4	0.49
Alpha value* [%]	15.12	15.11

^{*} 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

B1 Offices and Workshop businesses

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Institutions: Hospitals and Care Homes

C2 Residential Institutions: Residential schools

C2 Residential Institutions: Universities and colleges

C2A Secure Residential Institutions

Residential spaces

D1 Non-residential Institutions: Community/Day Centre

D1 Non-residential Institutions: Libraries, Museums, and Galleries

D1 Non-residential Institutions: Education

D1 Non-residential Institutions: Primary Health Care Building

D1 Non-residential Institutions: Crown and County Courts

D2 General Assembly and Leisure, Night Clubs, and Theatres

Others: Passenger terminals Others: Emergency services

Others: Miscellaneous 24hr activities

Others: Car Parks 24 hrs Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	11.71	5.73
Cooling	17.69	11.03
Auxiliary	5.46	2.7
Lighting	24.87	19.79
Hot water	3.68	3.34
Equipment*	42.18	42.18
TOTAL**	63.42	42.58

^{*} Energy used by equipment does not count towards the total for consumption or calculating emissions. ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO, Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	238.81	192.99
Primary energy* [kWh/m²]	194.71	121.14
Total emissions [kg/m²]	32.9	20.9

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

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H	HVAC Systems Performance										
System Type I		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST	[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	119.5	119.4	11.7	17.7	5.5	2.83	1.87	3.04	2.64	
	Notional	50.1	142.9	5.7	11	2.7	2.43	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

= Cooling system seasonal energy efficiency ratio = Heating generator seasonal efficiency Cool SSEER

Heat gen SSEFF

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

ST HS HFT CFT = System type = Heat source = Heating fuel type = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U i-Тур	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.28	01 Ground Floor - Office_W_8
Floor	0.2	0.22	01 Ground Floor - Office_F_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.3	01 Ground Floor - Office_G_12
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"
U _{I-Typ} = Typical individual element U-values [W/(m ² K	j		U _{I-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the r	ninimum L	J-value oc	curs.

Air Permeability	Typical value	This building
m ³ /(h.m ²) at 50 Pa	5	25

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Appendix F

Low and Zero Carbon Technology Feasibility Table

Appendix F - Low Carbon and Renewable Energy Technology Feasibility Study

Feasibility Study Table										
Technology	Sufficient Energy Generated?	Payback	Land Use Issues	Local Planning Requirements	Noise	Carbon Payback	Available Grants	Feasible?	Reason not Feasible or Selected	
Combined Heat & Power (CHP)	Yes	Medium	Air quality in residential area	Encouraged for large scale developments	In Plant Room	Yes	Tax Relief - ECA, RHI	No	No available connection. High maintennce costs increaing resident bills.	
Biomass	Yes	None	Air quality in residential area	Encouraged for large scale developments	In Plant Room	Yes	RHI; Bio-energy Capital Grants Scheme	No	Requires distirct heating to be suitable. District heating not suitable due to high costs (as CHP).	
Solar Thermal	Yes	High	Sufficient roof space required	Encouraged	None	~2 years	RHI	No	No suitable roof space (green roof instead), technical difficulties for in dwelling use.	
Solar Photovoltaic (PV)	Yes	Very High	Sufficient roof space required	Encouraged	None	2-5 years	No	No	No suitable roof space (green roof instead)	
Ground Source Heat Pumps (GSHPs)	Yes	High	Requires large area for coils or borehole	Encouraged	None	Low	RHI	No	No suitable space (expensive boreholes required) High resident costs.	
Air Source Heat Pumps (ASHPs)	Yes	Very High	Visual intrusion of external units	None	Low	Low	RHI	No	No suitable external space for domestic areas High resident costs.	
Wind Power	No	Low	Urban Area - low and turbulent wind; Visual impact	Encouraged for large scale developments	Yes	~1 year	No	No	Wind speeds in area insufficient	
Hydro Power	No	Medium	Requires suitable water resource; Visual impact	None	Low	~1 year	No	No	No nearby sources	



Appendix G

Roof Plans

