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About MES Building Solutions

MES Building Solutions is an established consultancy practice specialising in providing building solutions throughout the UK.

We offer a full range of services for both residential and commercial buildings from small individual properties through to highly complex mixed use developments.

We are an industry leader in delivering a professional, accredited and certified service to a wide range of clients including architects, developers, builders, housing associations, the public sector and private householders.

Employing highly qualified staff, our team comes from a variety of backgrounds within the construction industry with combined knowledge of building design, engineering, assessment, construction, development, research and surveying.

We are renowned for our creative thinking and provide a high quality, honest and diligent service.

MES Building Solutions maintains its position at the forefront of changes in planning, building regulations and neighbourly matters, as well as technological advances. Our clients, large or small are therefore assured of a cost effective, cohesive and fully integrated professional service.





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Section 1: Introduction

1.1 Executive Summary

To ensure compliance with London Borough of Camden Core Strategy and Local Plan a number of sustainable construction strategies will be incorporated in the design and construction of the development. These will include, amongst others, minimum standards relating to energy and water use which will reduce the developments environmental impact over its lifetime, which assists in ensuring a sustainable development for both current and future users.

To ensure compliance with London Borough of Camden Local Plan (2017), Camden Planning Guidance- Energy Efficiency and Adaptation (March 2019) and the London Plan the energy strategy proposed for the development at 154 Royal College Street, NW1 is the specification of an air source heat pump and solar PV.

This approach results in an overall reduction in emissions of 35.77% and if SAP10 emission factors are used it is increased to 68.72% which complies with both the London Plan and the Camden Local Plan.

Table 1a shows the reduction in tonnes of CO_2 and kWh per year through the recommended fabric improvements, energy efficiency measures and LZC technologies.

1a: Improvement over Part L and SAP 10		
	Part L	SAP 10
Total Baseline Emissions (Tonnes CO ₂ /yr)	7.38	6.81
Total Be Lean & Be Clean Emissions (Tonnes CO ₂ /yr)	5.21	2.34
Total Be Lean, Be Clean & Be Green Emissions (Tonnes CO ₂ /yr)	4.74	2.13
Contribution from PV (Tonnes CO ₂ /yr)	-0.47	-0.21
Total improvement over baseline (%)	35.77%	68.72%



1.2 Introduction

MES Building Solutions has been to provide an energy statement in order to address the requirements of requirements of Camden Council. The purpose of this Energy and Sustainability Statement is to establish the predicted energy requirements for the proposed development illustrating how energy efficiency measures in conjunction with renewable generation can be used to reduce the predicted energy consumption and associated carbon dioxide emissions.

This is achieved by following the energy hierarchy which includes:

- Calculation of baseline energy consumption & CO₂ emissions using SBEM calculations
- Implementation of the energy hierarchy (be lean, be clean, be green)
- Calculation of energy consumption & CO₂ emissions at each stage of energy hierarchy
- Calculation of final energy consumption & CO₂ emissions
- Calculation of reduction in emissions achieved
- Calculation of contribution from renewable generation

The report also addresses wider sustainability principles, looking at the following areas:

- Energy use
- Water conservation
- Materials selection
- Flood risk & surface water management
- Waste management
- Pollution mitigation
- Health & Wellbeing
- Construction & building management
- Site ecology





1.2 Planning Policy

National Policy

In February 2019, the Government published the National Planning Policy Framework (NPPF) which superseded a number of planning policies including the Planning Policy Statement (PPS) suite.

The NPPF outlines the Government's planning policies for England. It provides a framework within which local people and accountable councils can produce their own distinctive local plan which reflect the needs and priorities of their neighbourhoods and communities. The purpose of the NPPF is to contribute to the achievement of sustainable development.

The NPPF aims to strengthen local decision making as a way to foster the delivery of sustainable developments. However, the NPPF also outlines that sustainable developments require careful attention to viability and costs in plan-making and decision-taking processes. Over everything else, plans should be deliverable. Therefore, the size and scale of development within the plan should not be subjected to large scale obligations and burdens, so that their ability to be developed viably is threatened.

The NPPF guidance promotes planning for climate change. Chapter 14 of the NPPF, Meeting the Challenge of Climate Change, Flooding and Coastal Change (paragraphs 149 to 154) state that:

Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

- New development should be planned for in ways that:
 - o Avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and





- Can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.
- To help increase the use and supply of renewable and low carbon energy and heat, plans should:
 - Provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
 - o Consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
 - Identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.
- Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.
- In determining planning applications, local planning authorities should expect new development to:
 - Comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
 - o Take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.
- When determining planning applications for renewable and low carbon development, local planning authorities should:
 - Not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

Approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon





energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

Camden Local Plan 2017

Policy CC1 Climate change mitigation

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



We will:

- a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
- b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;
- c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
- d. support and encourage sensitive energy efficiency improvements to existing buildings;
- e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
- f. expect all developments to optimise resource efficiency. For decentralised energy networks, we will promote decentralised energy by:
- g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
- h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and





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

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

Policy CC2 Adapting to climate change

The Council will require development to be resilient to climate change.

All development should adopt appropriate climate change adaptation measures such as:

- a. the protection of existing green spaces and promoting new appropriate green infrastructure;
- b. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;
- c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and
- d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

Sustainable design and construction measures

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

- e. ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;
- f. encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;





g. encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and

h. expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.

London Plan (2016)

Policy 5.2 Minimising Carbon Dioxide Emissions Planning decisions

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

1 Be lean: use less energy

2 Be clean: supply energy efficiently 3 Be green: use renewable energy

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

Residential buildings:

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

Non-domestic buildings:

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

C Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide





emissions reduction outlined above are to be met within the framework of the energy hierarchy.

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

- a calculation of the energy demand and carbon dioxide emissions covered by Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy
- b proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services
- c proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)
- d proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

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

Policy 5.3 Sustainable Design and Construction

Strategic

A 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.

Planning decisions

B 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.

C 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 this Plan and the following sustainable design principles:





- a minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
- b avoiding internal overheating and contributing to the urban heat island effect
- c efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
- d minimising pollution (including noise, air and urban runoff)
- e minimising the generation of waste and maximising reuse or recycling
- f avoiding impacts from natural hazards (including flooding)
- g ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
- h securing sustainable procurement of materials, using local supplies where feasible, and
- i promoting and protecting biodiversity and green infrastructure.

LDF preparation

D Within LDFs boroughs should consider the need to develop more detailed policies and proposals based on the sustainable design principles outlined above and those which are outlined in the Mayor's supplementary planning guidance that are specific to their local circumstances.

Policy 5.6 Decentralised Energy in Development Proposals

Planning decisions

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

- B Major development proposals should select energy systems in accordance with the following hierarchy:
- 1 Connection to existing heating or cooling networks;
- 2 Site wide CHP network;
- 3 Communal heating and cooling;
- C Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.





Policy 5.7 Renewable Energy

Strategic

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

Planning decisions

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

LDF preparation

C Within LDFs boroughs should, and other agencies may wish to, develop more detailed policies and proposals to support the development of renewable energy in London – in particular, to identify broad areas where specific renewable energy technologies, including large scale systems and the large scale deployment of small scale systems, are appropriate. The identification of areas should be consistent with any guidelines and criteria outlined by the Mayor.

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





London Plan (December 2019) - Intend to publish version

A draft new London Plan was published by the Mayor for consultation in December 2017, although the current 2016 Plan is still the adopted Development Plan, the proposed document is given significant weight.

Policy SI 2 Minimising greenhouse gas emissions

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

- 1) be lean: use less energy and manage demand during operation
- 2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
- 3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
- 4) be seen: monitor, verify and report on energy performance.

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

C A minimum on-site reduction of at least 35 per cent beyond Building Regulations156 is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:

- 1) through a cash in lieu contribution to the borough's carbon offset fund, or
- 2) off-site provided that an alternative proposal is identified and delivery is certain.

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

E Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.





F Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

Policy SI 3 Energy infrastructure

A Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

- B Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities) which establish the most effective energy supply options. Energy masterplans should identify:
- 1) major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
- 2) heat loads from existing buildings that can be connected to future phases of a heat network
- 3) major heat supply plant including opportunities to utilise heat from energy from waste plants
- 4) secondary heat sources, including both environmental and waste heat
- 5) opportunities for low and ambient temperature heat networks
- 6) possible land for energy centres and/or energy storage
- 7) possible heating and cooling network routes
- 8) opportunities for future proofing utility infrastructure networks to minimise the impact from road works
- 9) infrastructure and land requirements for electricity and gas supplies
- 10) implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector
- 11) opportunities to maximise renewable electricity generation and incorporate demand-side response measures.

C Development Plans should:

- 1) identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure
- 2) identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.





- D Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:
- 1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
- a) connect to local existing or planned heat networks
- b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
- c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
- d) use ultra-low NOx gas boilers
- 2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality 3) where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.
- E) Heat networks should achieve good practice design and specification standards for primary, secondary and tertiary systems comparable to those set out in the CIBSE/ADE Code of Practice CP1 or equivalent.

Policy SI 4 Managing heat risk

A Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

- B Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
- 1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
- 2) minimise internal heat generation through energy efficient design
- 3) manage the heat within the building through exposed internal thermal mass and high ceilings
- 4) provide passive ventilation
- 5) provide mechanical ventilation
- 6) provide active cooling systems.





Policy SI 12 Flood risk management

A Current and expected flood risk from all sources (as defined in paragraph 9.12.2) across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.

B Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should co-operate and jointly address cross-boundary flood risk issues including with authorities outside London.

C Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

D Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier.

E Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

F Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.

G Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat.





1.3 SAP 10

The following guidance was issued by the GLA, in October 2018, for all new developments.

'Grid electricity has been significantly decarbonised since the last update of Part L in April 2014 and in July 2018 the Government published updated carbon emission factors (SAP 10) demonstrating this. These new emission factors will however not be incorporated into Part L of the Building Regulations until the Government has consulted on new Building Regulations.

The impact of these new emission factors is significant in that technologies generating on-site electricity (such as gas-engine CHP and solar PV) will not achieve the carbon savings they have to date. It is therefore anticipated that developments will need to utilise alternative or additional technologies to meet the 35 per cent on-site carbon reduction target, including using zero emission or local secondary heat sources.

The GLA has decided that from January 2019 and until central Government updates Part L with the latest carbon emission factors, planning applicants are encouraged to use the SAP 10 emission factors for referable applications when estimating CO₂ emission performance against London Plan policies. This will ensure that the assessment of new developments better reflects the actual carbon emissions associated with their expected operation'.

As a result of the above guidance, MES have based the reduction targets on the proposed SAP 10 emission factors, as these are considered more accurate although it is acknowledged that the EPC certificates are currently assessed against SAP 2012.

	Emissions kg CO₂ per kWh					
	SAP 2012	SAP 10				
Mains Gas	0.216	0.210				
Electricity	0.519	0.233				

1c: SAP 2012 and SAP 10 emission factors

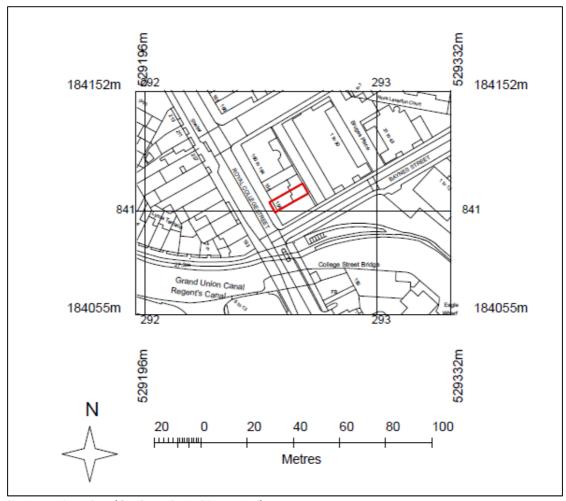




Section 2: Description of development

2.1 Location

The development site is located at 154 Royal College Street, NW1 0TA, which is an established residential street containing predominately two and three storey terraced dwellings, with an element of ground floor retail.

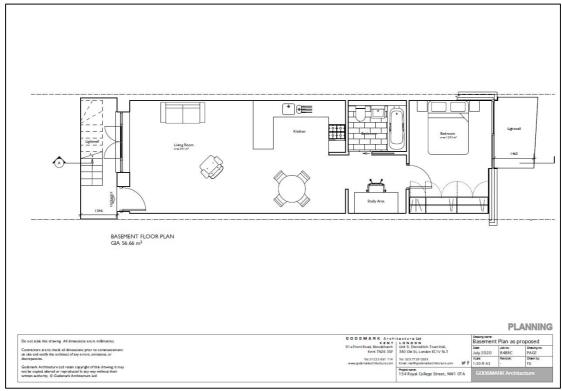


Site Location Plan (Godsmark Architects Ltd)



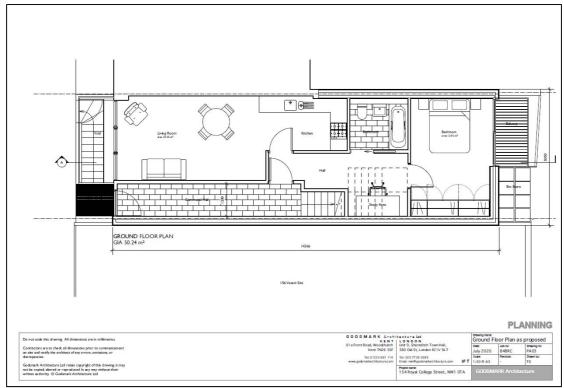
2.2 Details of development

The application is for the construction of four flats on the existing site, which will be demolished and rebuilt. In line with London Borough of Camden planning policy this is to be considered a minor development.

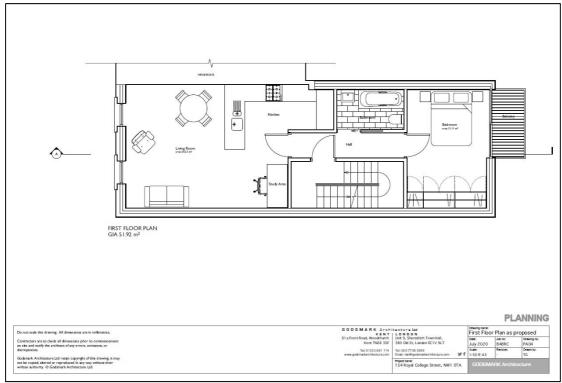


Proposed Basement Floor Plan (Godsmark Architecture Ltd)





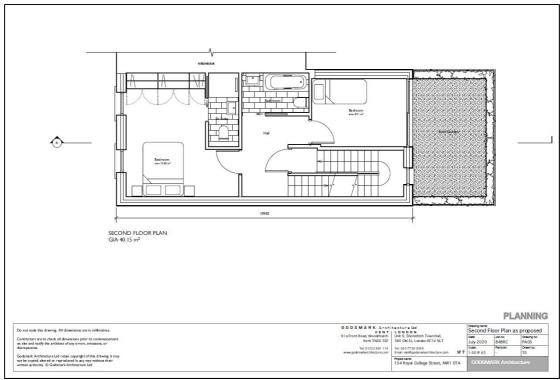
Proposed Ground Floor Plan (Godsmark Architecture Ltd)



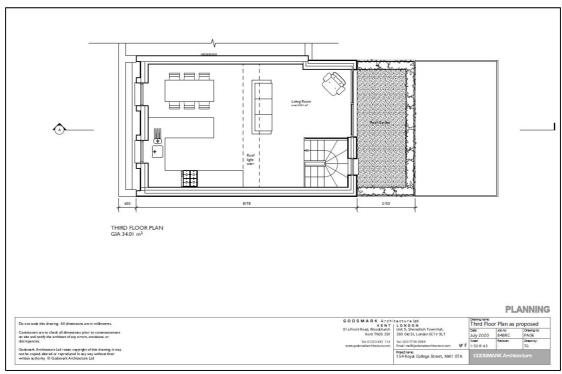
Proposed First Floor Plan (Godsmark Architecture Ltd)







Proposed Second Floor Plan (Godsmark Architecture Ltd)

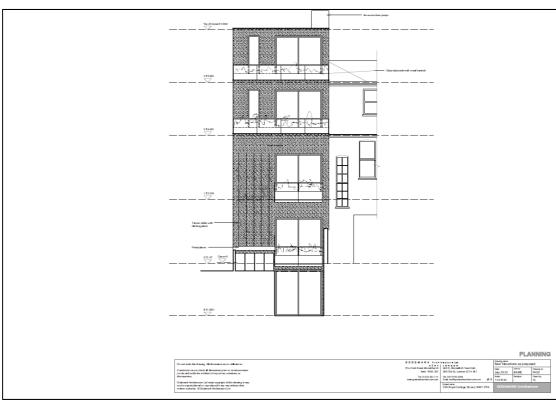


Proposed Third Floor Plan (Godsmark Architecture Ltd)









Proposed Elevations (Godsmark Architecture Ltd)





Section 3: Energy

3.1 The Energy Hierarchy

The energy hierarchy is generally accepted as the most effective way of reducing building carbon emissions.

- 1. Be lean: use less energy
- 2. Be clean: supply energy efficiently
- 3. Be green: use renewable energy
- 4. Be seen: monitor, verify and report on energy performance

Development proposals should:

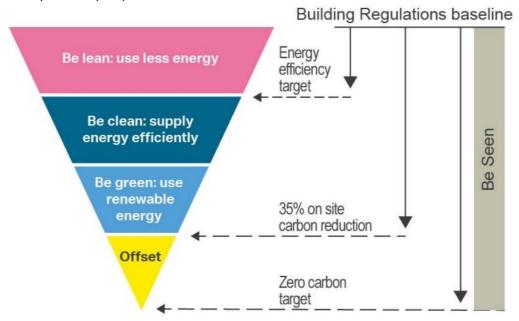


Figure 3.1: The Energy Hierarchy

• Reducing energy demand

The first step in the process of reducing the overall energy used and CO_2 produced by the building is to minimise the energy required to heat it. A well-insulated building envelope and passive design will reduce the energy requirement for heating and ventilating the building.

• Energy efficient systems

The second step is to specify services and controls, lighting and appliances that are energy efficient and which result in further reduction in energy requirements.

Making use of Low or zero-carbon (LZC) technologies

When the energy demand has been reduced by implementing the processes of improving the fabric and energy efficiency, then LZC





technologies can be employed to reduce the environmental impact of the remaining energy consumption.

• Monitoring and reporting

Ensure comprehensive monitoring and reporting of energy demand and carbon emissions. Major developments are required to undertake this process for at least five years.





3.2 Calculating Baseline Energy Demand

Energy used in a building is divided between that which is regulated (Heating, Cooling, Hot water, Ventilation & Lighting) and that which is said to be associated with the building in use (Equipment and Appliances).

3a: Unregulated Energy Use and Emissions						
	Part L	SAP 10				
Emissions (Tonnes CO ₂ per year)	4.61	10,672				
Energy (kWh per year)	19,940	10,672				

The first step is to calculate a Building Regulations Part L1A 2013 compliant specification in order to establish baseline emissions for the development. In order to comply with Camden's planning requirements, the development must achieve targets based on a Part L 2010 baseline. However; the development will be required to comply with 2013 Building Regulations and as such baseline figures are calculated using the most appropriate SAP model. Full SAP calculations have been undertaken on the government approved SAP2012 software and the current methodology has been used to establish baseline energy requirements which comply with the 2013 edition of Part L1A, along with applying the conversion factor to the SAP 10 emissions.

		Part L Carbon Emissions (tonnes CO₂ per year)								
House Type	Space Heating (Gas)	Space Heating (Electricity)	Secondary Heating	Water Heating (Gas)	Water Heating (Electricity)	Pumps & Fans	Lighting	Additional Allowable Generation	Total Emissions (tonnes CO ₂ per year)	
Flat 1	0.77	0.00	0.00	0.72	0.00	0.04	0.13	0.00	1.66	
Flat 2	0.78	0.00	0.00	0.70	0.00	0.04	0.12	0.00	1.64	
Flat 3	0.93	0.00	0.00	0.70	0.00	0.04	0.12	0.00	1.79	
Flat 4	1.29	0.00	0.00	0.79	0.00	0.04	0.17	0.00	2.28	
Total:	3.76	0.00	0.00	2.91	0.00	0.16	0.55	0.00	7.38	
								Total:	7.38	

Table 3.b: Part L Baseline carbon dioxide (CO₂) emissions. (Tonnes CO₂ per year)





		SAP 10 Carbon Emissions (tonnes CO ₂ per year)								
House Type	Space Heating (Gas)	Space Heating (Electricity)	Secondary Heating	Water Heating (Gas)	Water Heating (Electricity)	Pumps & Fans	Lighting	Additional Allowable Generation	Total Emissions (tonnes CO ₂ per year)	
Flat 1	0.75	0.00	0.00	0.70	0.00	0.02	0.06	0.00	1.53	
Flat 2	0.76	0.00	0.00	0.68	0.00	0.02	0.05	0.00	1.51	
Flat 3	0.90	0.00	0.00	0.68	0.00	0.02	0.06	0.00	1.65	
Flat 4	1.25	0.00	0.00	0.77	0.00	0.02	0.08	0.00	2.11	
Total:	3.66	0.00	0.00	2.83	0.00	0.07	0.25	0.00	6.81	
								Total:	6.81	

Table 3c: SAP 10 'Baseline' carbon dioxide (CO₂) emissions. (Tonnes CO₂ per year)

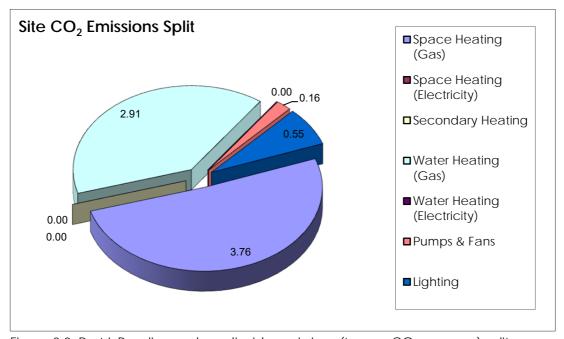


Figure 3.2: Part L Baseline carbon dioxide emissions (tonnes CO₂ per year) split.





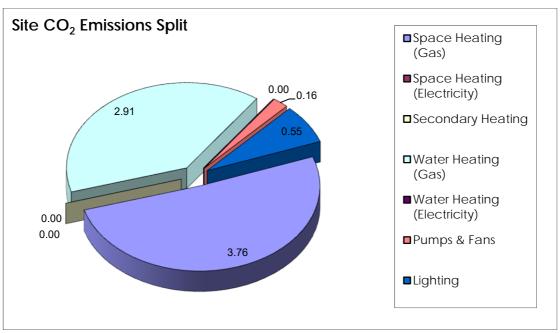


Figure 3.3: SAP 10 Baseline CO₂ emissions split

Figures 3.2 and 3.3 show how the CO_2 emissions are split between individual energy end uses.





3.3 Emission reduction targets

London Borough of Camden requires this minor development to achieve a 35% reduction over 2013 Part L minimum standards. We are aiming to accomplish this through a holistic, fabric first approach that will only require a limited amount of additional renewable technology. The TER accounts for REGULATED energy only and as such the emissions for appliances & cooking are discounted when calculating the planning target.

3.4 Energy Efficiency Measures (Be lean & be clean)

The first two steps of the Mayor's energy hierarchy require the reduction of energy consumption in the building through improvements to its fabric and by increasing the efficiency of the building services. This reduces the energy required to run the building and thus the emissions associated with that energy use. As the new 2013 Part L1A is already very stringent in terms of fabric performance targets, the reduction possible from further improvement to the building fabric and services is limited when compared those which may be expected from buildings constructed to earlier versions of Building Regulations.

The increase in Building Regulation targets has meant that we have had to combine stages one and two of the hierarchy to try and achieve a Part L compliant specification. A summary of the specification as used in the compliant model is shown in table 3d, below.

3d: Building Regulations Specification (Lean & Clean)						
Element	Specification					
External Walls	0.11-0.23W/m ² K					
Corridor Walls	0.44/m²K					
Flat Roof	0.24/m²K					
Floor	0.12-0.26W/m ² K					
Solid Doors	1.40W/m²K					
Windows/Fully Glazed Doors	1.40W/m²K					
Air Permeability	5.1m³/m²/hr					
Ventilation	Intermittent extract ventilation					
Thermal Bridging	Calculated Y-Value					
Lighting	100% low energy lamps					
Space Heating	Low temp <=35 degree Air source heat pump					
Heating Controls	Time and temperature zone control					
DHW	Via main heating					
Secondary Heating	None					





		Part L Carbon Emissions (tonnes CO ₂ per year)								
House Type	Floor Area (m²)	Space Heating (Gas)	Space Heating (Electricity)	Secondary Heating	Water Heating (Gas)	Water Heating (Electricity)	Pumps & Fans	Lighting	Additional Allowable Generation	Total Emissions (tonnes CO ₂ per year)
Flat 1	56	0.00	0.38	0.00	0.00	0.57	0.02	0.13	0.00	1.10
Flat 2	50	0.00	0.54	0.00	0.00	0.55	0.02	0.12	0.00	1.23
Flat 3	51	0.00	0.62	0.00	0.00	0.56	0.02	0.12	0.00	1.32
Flat 4	74	0.00	0.76	0.00	0.00	0.62	0.02	0.17	0.00	1.56
Total:	231	0.00	2.30	0.00	0.00	2.30	0.06	0.55	0.00	5.21
									Total:	5.21

Table 3.e: Part L 'Lean & Clean' carbon dioxide (CO₂) emissions. (Tonnes CO₂ per year)

			SAP 10 Carbon Emissions (tonnes CO ₂ per year)							
House Type	Floor Area (m²)	Space Heating (Gas)	Space Heating (Electricity)	Secondary Heating	Water Heating (Gas)	Water Heating (Electricity)	Pumps & Fans	Lighting	Additional Allowable Generation	Total Emissions (tonnes CO ₂ per year)
Flat 1	56	0.00	0.17	0.00	0.00	0.26	0.01	0.06	0.00	0.50
Flat 2	50	0.00	0.24	0.00	0.00	0.25	0.01	0.05	0.00	0.55
Flat 3	51	0.00	0.28	0.00	0.00	0.25	0.01	0.06	0.00	0.59
Flat 4	74	0.00	0.34	0.00	0.00	0.28	0.01	0.08	0.00	0.70
Total:	231	0.00	1.03	0.00	0.00	1.03	0.03	0.25	0.00	2.34
									Total:	2.34

Table 3f: SAP 10 'Lean & Clean' carbon dioxide (CO₂) emissions. (Tonnes CO₂ per year)



3.5 Be Clean (District Heating & CHP)

District heating

It is a requirement of the London Plan (Policy 5.6) to consider the application of both a district heating scheme and/or CHP technology on all new developments unless it is not possible on the application site.

As can be seen from the London Heat Map extract in Figure 3.4 below, there are no existing, or proposed heating networks within a feasible distance of the site, the closest proposed network being over 800m away. Space would be required for incoming pipework, and may need to be laid during the project for future use, with no guarantee it will be suitable or compatible at such time a connection may be available. Space would also be required for a plant room, to fit the heat exchangers, pump controls and ancillaries as well as riser space for the distribution pipework.

As such, connection to a district heating network is not a viable option on this occasion.

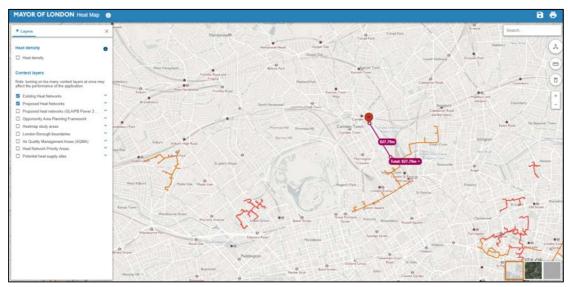


Figure 3.4 London Heat map showing the lack of a potential district heating network within the site boundary.



Communal heating scheme

The benefit of communal heating systems becomes questionable for small scale residential installation when compared to more traditional self-contained individual boilers. Additional space is required for centralised plant rooms and ducting/pipework. The increased cost and complexity of such systems is not offset by the minimal performance improvement that may be achieved and given this; communal heating is not proposed for the development.

Combined heat & power (CHP)

Combined heat and power uses an electricity generator, generally a gas powered internal combustion engine, with heat recovery on the exhaust used to heat water for heating and domestic hot water supply.

The proportions of heat and electricity produced are normally in

cold water

waste-gas heat exchanger

warm water

engine

engine

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the region of 65:35. This requires a constant heat load throughout the year for the system to perform efficiently.

For CHP to be viable on residential developments a minimum of 100 units is usually required in order to generate sufficient heating baseload. As this is not the case on this occasion CHP is not viable for consideration.

In this case, CHP is not considered suitable given the lack of a district heating network within feasible reach of the site. The London Heat map indicates that there is currently no potential future district heating network for this site. The red line, indicated above, has been identified as a route that the decentralised energy network may eventually be extended into but the timescale for delivery is as yet unclear and as this is still too far away the use of this technology is discounted for this development.

An evaluation of the potential of renewable technology for this site is discussed in section 3.7 as this development will require a contribution to achieve the 35% reduction target.





3.6 The Cooling Hierarchy

Overheating within dwellings has become a more prevalent issue and steps to mitigate this risk are included within the steps over the cooling hierarchy listed below.

- 1. Minimising internal heat generation through energy efficient design: For example, heat distribution infrastructure within buildings should be designed to minimise pipe lengths, particularly lateral pipework in corridors of apartment blocks, and adopting pipe configurations which minimise heat loss e.g. twin pipes.
- 2. Reducing the amount of heat entering the building in summer: For example, through use of carefully designed shading measures, including balconies, louvres, internal or external blinds, shutters, trees and vegetation.
- 3. Use of thermal mass and high ceilings to manage the heat within the building: Increasing the amount of exposed thermal mass can help to absorb excess heat within the building.
- 4. Passive ventilation: For example, through the use of openable windows, shallow floorplates, dual aspect units, designing in the 'stack effect'
- 5. Mechanical ventilation: Mechanical ventilation can be used to make use of 'free cooling' where the outside air temperature is below that in the building during summer months. This will require a by-pass on the heat recovery system for summer mode operation.

For this development the average risk of over overheating has been assessed by the SAP software as being 'slight'. This is a result of the high standard of insulation specification and windows.





3.7 CO₂ reduction through the use of renewable or low carbon technology (Be green)

Energy resources accepted as renewable or low carbon technologies are defined by the Department of Energy & Climate Change Low Carbon Buildings Program as:

- Solar photovoltaics
- Wind turbines
- Small hydro
- Solar thermal hot water
- Ground source heat pumps
- Air source heat pumps
- Bio-energy
- Renewable CHP
- Micro CHP (Combined heat and power)

Given the nature of the site, and in attempting to meet the Future Home Standards, solar photovoltaics and air source heat pumps have been specified.

Solar Photovoltaics

Solar panel electricity systems, also known as solar photovoltaics (PV), capture the sun's energy using photovoltaic cells. These cells do not need direct sunlight to work – they can still generate some electricity on a cloudy day. The cells convert the sunlight into electricity, which can be used to run household appliances and lighting.



This will be one of the recommended renewable technologies on the site, with the installation of 4 x 300W panels giving 1.2kW peak.





Wind Turbines

Wind turbines harness the power of the wind and use it to generate electricity. Forty percent of all the wind energy in Europe blows over the UK, making it an ideal country for domestic turbines. Urban sites such as the location of this development are generally unsuitable for wind turbine installations due to the interrupted turbulent wind flows caused by surrounding buildings and large obstacles. There are also possible issues with noise and 'flicker' for the neighbouring buildings.



The NOABL wind resource database for the site location records average wind speeds as shown in Table 3g below. The British Wind Energy Association (BWEA) generally recommends an average wind speed of at least 7m/s for viable system performance.

Table 3g: Average wind speeds for the site								
45m above ground level	6.1m/s							
25m above ground level	5.6m/s							
10m above ground level	4.8m/s							

The urban nature of the site, lack of space and low average wind speeds mean that a wind turbine cannot be recommended as a viable option for this development. There are also general issues surrounding the use of building mounted turbines with the potential for excessive noise and vibration within the building.

Small Hydro Generation

Hydroelectricity generation uses running water to generate electricity, whether it is a small stream or a larger river. All streams and rivers flow downhill. Before the water flows down the hill, it has potential energy because of its height. Hydro power systems



convert this potential energy into kinetic energy in a turbine, which drives a generator to produce electricity. Small, or 'micro' hydro generation requires a reliable source of flowing water with a





reasonably constant flow velocity. Systems of this nature are normally installed in locations with a natural moving water source such as a river, stream or spring where part of the flow can be diverted through a generator.

There is no such source of flowing water in this case and small hydro generation is not an option for this development.

Solar Water heating



Solar water heating systems use free heat from the sun to warm domestic hot water. Solar hot water heating can generate a large proportion of a dwelling's annual DHW requirement. The displaced fuel would be mains gas meaning that the CO₂ savings of this type of system would be relatively low due to the low carbon intensity of the displaced fuel.

Consequently, solar thermal is not considered to be a suitable system for this development and the roof space would be better used for PV as it offsets electricity meaning the CO₂ saving is considerably more than solar thermal, although

SAP 10 emission factors will alter this going forward.

Heat Pumps

Heat pumps use similar technology as refrigerators but reversed. A refrigerant liquid is used as a medium to extract heat from a source and convert it into useful heat energy. The heat source used can be generally one of three types; the ground, the air or a body of water. Both



ground and water sourced heat pumps use a long circuitous pipe through which a refrigerant is pumped. In ground sourced heat pumps this can be either a coiled pipe or 'slinky' that is buried in a series of horizontal trenches or a loop inside a vertical bore hole to depths that can be up to 200m or deeper. Water sourced heat pumps generally use a similar system to the 'slinky' used for ground sourced systems but either floated on or submerged in a body of water (either a large pool





or running water source). Air source heat pumps have a refrigerant coil mounted outside the building through which is passed air so that heat can be extracted. All three types of heat pump generally use the collected heat from the source to heat water. The heated water can then be used for space heating and DHW. Heat pumps require an input of energy to drive pumps, this is usually electricity and so they cannot be considered to be zero carbon unless the supplied electricity is from renewable sources; they do however have very good efficiencies; energy produced by heat pumps is typically in the region of 2.5 times that which is required to run them, giving efficiencies of 250%.

The 'fuel' for heat pumps is usually grid supplied electricity which does not demonstrate any significant reductions when compared to efficient gas boilers under current Part L, however, this will change with the introduction of SAP 10. This is a chosen technology for this development.

Bio Energy

The Low Carbon Buildings Program (LCBP) defines biomass as follows:

"Biomass is often called 'bioenergy' or 'biofuels'. These biofuels are produced from organic materials, either directly from plants or indirectly from industrial, commercial, domestic or agricultural products. Biofuels fall into two main categories:



- Woody biomass includes forest products, untreated wood products, energy crops, short rotation coppice (SRC), e.g. willow.
- Non-woody biomass includes animal waste, industrial and biodegradable municipal products from food processing and high energy crops, e.g. rape, sugar cane, maize."

For small-scale domestic [and small scale commercial] applications of biomass the fuel usually takes the form of wood pellets, wood chips and logs. The LCBP goes on to state:

"There are two main ways of using biomass to heat a domestic property:

Stand-alone stoves providing space heating for a single room.
 These can be fuelled by logs or pellets but only pellets are suitable for automatic feed. Generally they are 5-11 kW in output,





- and some models can be fitted with a back boiler to provide water heating.
- Boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW"

This technology is dismissed as the space requirements needed for the boiler and pellet store make this impractical along with complying with the clean air zone requirements.

3h: Building Regulations Sp	ecification (Lean, Clean & Green)
Element	Specification
External Walls	0.11-0.23W/m ² K
Corridor Walls	0.44/m²K
Flat Roof	0.24/m²K
Floor	0.12-0.26W/m ² K
Solid Doors	1.40W/m²K
Windows/Fully Glazed Doors	1.40W/m²K
Air Permeability	5.1m ³ /m ² /hr
Ventilation	Intermittent extract ventilation
Thermal Bridging	Calculated Y-Value
Lighting	100% low energy lamps
Space Heating	Low temp <=35 degree Air source heat pump
Heating Controls	Time and temperature zone control
DHW	Via main heating
Secondary Heating	None
Renewable Technology	4 x 300W PV panels



		Par	t L Carbor	n Emissions	s (tonnes (CO₂ per ye	ear)		
House Type	Space Heating (Gas)	Space Heating (Electricity)	Secondary Heating	Water Heating (Gas)	Water Heating (Electricity)	Pumps & Fans	Lighting	Additional Allowable Generation	Total Emissions (tonnes CO ₂ per year)
Flat 1	0.00	0.38	0.00	0.00	0.57	0.02	0.13	-0.12	0.98
Flat 2	0.00	0.54	0.00	0.00	0.55	0.02	0.12	-0.12	1.11
Flat 3	0.00	0.62	0.00	0.00	0.56	0.02	0.12	-0.12	1.20
Flat 4	0.00	0.76	0.00	0.00	0.62	0.02	0.17	-0.12	1.44
Total:	0.00	2.30	0.00	0.00	2.30	0.06	0.55	-0.47	4.74
								Total:	4.74

Table 3i: Part L 'Be lean be clean & be green' carbon dioxide (CO_2) emissions. (Tonnes CO_2 per year)

		SAP	10 Carbo	n Emission	s (tonnes	CO₂ per y	ear)		
House Type	Space Heating (Gas)	Space Heating (Electricity)	Secondary Heating	Water Heating (Gas)	Water Heating (Electricity)	Pumps & Fans	Lighting	Additional Allowable Generation	Total Emissions (tonnes CO ₂ per year)
Flat 1	0.00	0.17	0.00	0.00	0.26	0.01	0.06	-0.05	0.44
Flat 2	0.00	0.24	0.00	0.00	0.25	0.01	0.05	-0.05	0.50
Flat 3	0.00	0.28	0.00	0.00	0.25	0.01	0.06	-0.05	0.54
Flat 4	0.00	0.34	0.00	0.00	0.28	0.01	0.08	-0.05	0.65
Total:	0.00	1.03	0.00	0.00	1.03	0.03	0.25	-0.21	2.13
								Total:	2.13

Table 3j: SAP 10 'Be lean be clean & be green' carbon dioxide (CO_2) emissions. (Tonnes CO_2 per year)





			E	nergy (kW	h per year	r)			
House Type	Space Heating (1) SAP (261)	Space Heating (2) SAP (262)	Secondary Heating SAP (263)	Water Heating SAP (264)	Space Cooling SAP (266)	Pumps & Fans SAP (267)	Lighting SAP (268)	Additional Allowable Generation	Total Energy (KWh per year)
Flat 1	0	741	0	0	1,097	30	258	-228	1,898
Flat 2	0	1,041	0	0	1,064	30	234	-228	2,140
Flat 3	0	1,200	0	0	1,070	30	240	-228	2,312
Flat 4	0	1,458	0	0	1,199	30	324	-228	2,783
Total:	0	4,440	0	0	4,429	120	1,056	-913	9,132
								Total:	9,132

Table 3k: 'Be lean be clean & be green' Energy demand (kWh per year)

31: Contribution from renewables & total improve	ement over F	Part L
	Part L	SAP 10
Total Baseline Emissions (Tonnes CO ₂ /yr)	7.38	6.81
Total Be Lean & Be Clean Emissions (Tonnes CO ₂ /yr)	5.21	2.34
Total compliant Be Green Emissions (Tonnes CO ₂ /yr)	4.74	2.13
Contribution from PV (Tonnes CO ₂ /yr)	-0.47	-0.21
Percentage reduction achieved from PV	9.02%	8.97%
Total improvement over baseline (%)	35.77%	68.72%



Section 4: Sustainability

4.1 Land Use & Ecology

Sustainability Objective:

To protect, maintain and enhance existing biodiversity and habitats. To create new habitats to add value to the landscape in order to improve the urban environment.

This is an urban location with the potential site currently containing an existing building and is assumed to have minimal ecological value. The nature of the development means there may be opportunity to improve the ecology of the site by incorporating areas of planting. Efforts will be made to protect any existing urban habitats while encouraging new ones.

As the current site may have limited ecological value any undertaking to improve upon this will have a positive ecological impact.

4.2 Materials

Sustainability Objective:

To reduce the impact of construction on natural resources by using sustainable, legally sourced product.

Building materials have a significant impact when the embodied energy and resources used in their manufacture, transport and disposal are considered. Responsible sourcing of materials can have a real beneficial effect on the embodied impact of the final development.

All relevant materials in basic and finishing elements will be responsibly and legally sourced from certified suppliers using sustainable raw materials where possible.

Wherever possible reused and recycled materials will be sourced.

All materials will be sourced from local suppliers where possible to reduce transport miles and support the local supply chain.

Materials containing chemicals which are harmful to health or the environment will be avoided wherever possible.





4.3 Pollution

Sustainability Objective:

To reduce the environmental impact of atmospheric, watercourse, noise and sound pollution.

There are a variety of forms of environmental pollution that can potentially arise from the construction and use of buildings. A significant proportion is airborne in the form of dust, fumes and chemicals. Other forms of pollution include unwanted noise or light.

Best practice will be used during the construction phase to ensure that environmental pollution due to construction work will be minimised. This site, being on a former petrol station forecourt, will have a specific strategy for dealing with the removal of this contaminated material.

Efforts will be made to ensure the environmental impact of the materials used for the build will be reduced through responsible sourcing and reduced wastage.

The use of materials whose manufacture or installation requires the use of harmful global warming chemicals will be avoided.

Any cooling systems will be specified to either contain no potentially damaging chemicals, or where this is unavoidable to minimise the risk of environmental contamination due to accidental spillage.

4.4 Site Management

Sustainability Objective:

To use sustainable construction methods and encourage best practice in building delivery.

Best practice will be used during construction so as to reduce the impact of works on the surrounding environment.

The construction site will be managed so as to reduce resource use, energy for site operations, water consumption, waste and pollution.

A system of monitoring, target setting and reporting could be put in place to ensure standards are met.

Home and building user guides could be provided to building end users, if requested, to ensure they are provided with adequate information to enable effective use of the building and its systems. These will be tailored to ensure all building users fully understand the buildings operation so as to encourage efficient use.





4.5 Transport

Sustainability Objective:

To reduce pollution and congestion levels. To encourage walking, cycling and the use of public transport.

As around 30% of UK energy use is associated with transport. Developments of this nature that can encourage a reduction in car use have a positive impact on the environment both through a reduced reliance on precious fossil fuel resources and a reduction in harmful emissions.

The location of the development means that it is close to local amenities and has excellent public transport links, with regular bus services on Royal College Street and Camden Road Overground Station within walking distance of approximately 150m away.

4.6 Waste Management

Sustainability Objective:

To reduce waste going to landfill through material efficiency, recycling and sustainable construction methods.

A key part of sustainability is to manage resources efficiently. Reducing the amount of waste created and maximising resource efficiency during demolition, construction and during the building's lifetime is fundamental to providing sustainable developments.

Efforts to reduce construction waste generally will concentrate on reducing site waste together with increasing reuse and recycling of waste that cannot be avoided in an effort to reduce volumes going to landfill. This could be implemented through a Site Waste Management Plan.

Adequate facilities will be provided for the storage and recycling of household waste and this in conjunction with the adoption of the Local Authority collection scheme for waste and recycling will encourage occupants to minimise waste going to landfill.





4.7 Water Use

Sustainability Objective:

Conserve water through efficiency measures and recycling. Mitigating against increases in flood risk due to reduction in permeable areas and climate change.

Water is a precious commodity even in the UK and with ever increasing demand for clean drinking water measures need to be taken to safeguard future supplies.

Approximately 50% of the water consumed in domestic dwellings is not used for consumption, (the percentage is even higher in many commercial buildings) it is for washing and flushing of toilets etc. Measures to reduce the amount of potable water used for these activities reduce the demand for potable water and make better use of this limited resource.

A reduction in water use will be achieved through a combination of efficiency measures, including the specification of efficient fittings, lower capacity baths and dual flush toilets.

Development of previously open land and climate change increases the chance of flash flooding and the management of surface water run-off is to be considered seriously in order to mitigate these effects.

Initial investigations of the Environment Agency Flood Map suggest that the site is in Zone 1 with a low risk of flooding.

As the site currently contains an existing building, if the new proposals are surfaced with impermeable materials, it is not anticipated that redevelopment would cause any significant increase in run-off from the site with correct planning and design. A full SuDS design could be undertaken to further confirm this and influence design choices.







Figure 4.1: Environment Agency Flood Map for the development

4.8 Health & Wellbeing

Sustainability Objective:

To provide comfortable working and living spaces that promotes a healthy environment and which is adaptable to changing needs.

Health and wellbeing considers the environment provided for building users and how this promotes healthy happy lives.

The dwellings are designed and orientated wherever possible in such a way as to provide natural daylight, sunlight and external views to occupied spaces thus adding to the internal environment.

Finishing elements will be chosen which do not contain harmful chemicals.

Every practical effort will be made to minimise sound transmission both from the external environment and between individual dwellings. The measures employed will aim to go beyond current Building Regulation standards for minimising sound transmission.





Section 5: Summary

For this development the recommended strategy is the implementation of a 'fabric first' holistic approach that is based on ensuring the building fabric and core services are designed and installed correctly. This has allowed the proposed dwelling to achieve a compliant Fabric Energy Efficiency specification and to exceed the 35% requirement required from Camden. The design proposals of high quality building fabric, efficient mechanical services along with the installation of an air source heat pump and solar PV have achieved the Camden Council requirement with a 35.77% reduction over current Part L.

Table 4.a shows the reduction in kWh and tonnes of CO₂ per year through the recommended fabric improvements and energy efficiency system measures which ensure the development will meet and exceed current building regulations.

Table 4a: Total anticipated reduction in regulated emissions & energy use											
	Pa	rt L	SAP 10								
	kWh/year	Tonnes CO ₂ per year	kWh/year	Tonnes CO ₂ per year							
Total Part L1A 'Baseline' annual figures	32,259	7.38	40,380	6.81							
Total 'be lean, be clean' annual figures	10,045	5.21	39,490	2.34							
Total 'be lean, be clean & be green' annual figures	9,132	4.74	36,165	2.13							
Contribution from PV	-913	-0.47	-4,215	-0.21							
Total reduction over Baseline	71.69%	35.77%	71.69%	68.72%							

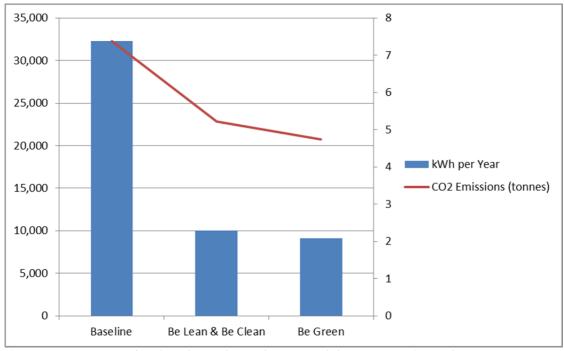


Figure 5.1: Part L Reduction through each stage of the Energy Hierarchy

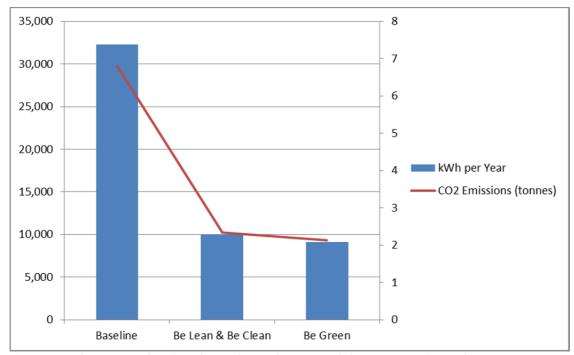


Figure 5.2: SAP 10 Reduction through each stage of the Energy Hierarchy







Property Reference	0007-Godsmark-Royal-Co	llege-F1			Issued on Date	13/08/2020		
Assessment	AD			Prop Type Ref	f Flat 1			
Reference								
Property	Flat 1, 154, Royal College	Street, Londo	n, NW1 0TA					
SAP Rating		87 B	DER	17.66	TER	29.83		
Environmental		88 B	% DER <ter< th=""><th></th><th colspan="4">40.80</th></ter<>		40.80			
CO ₂ Emissions (t/y	ear)	0.81	DFEE	42.14	TFEE	54.19		
General Requireme	ents Compliance	Pass	% DFEE <tfe< th=""><th>Ε</th><th>22.24</th><th></th></tfe<>	Ε	22.24			
Assessor Details	Mr. Andrew Gwynne, Andrew Gwynne, Tel: 01636 653055, andrew.gwynne@mesenergyservices.co.uk							
Client								





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

REGULATIONS COMPLIANCE REPORT - Approve	d Document L1A, 2013 Edition, England						
DWELLING AS DESIGNED							
Basement flat, total floor area 56 $\ensuremath{\text{m}}^2$							
This report covers items included within It is not a complete report of regulations.							
la TER and DER Fuel for main heating:Electricity Fuel factor:1.55 (electricity) Target Carbon Dioxide Emission Rate (TE Dwelling Carbon Dioxide Emission Rate (DER) 17.66 kgCOU/m²OK						
1b TFEE and DFEE Target Fabric Energy Efficiency (TFEE)5 Dwelling Fabric Energy Efficiency (DFEE	4.2 kWh/m²/yr)42.1 kWh/m²/yrOK						
2 Fabric U-values Element Average External wall 0.11 (max. 0.30) Party wall 0.00 (max. 0.20) Floor 0.12 (max. 0.25) Roof 0.20 (max. 0.20) Openings 1.40 (max. 2.00)	Highest 0.13 (max. 0.70) OK OK OK 0.12 (max. 0.70) OK OK 0.20 (max. 0.35) OK 1.40 (max. 3.30) OK						
2a Thermal bridging Thermal bridging calculated using user-							
3 Air permeability Air permeability at 50 pascals: Maximum	5.10 (design value) 10.0	OK					
4 Heating efficiency	Heat pump with radiators or underfloor - Electric						
Secondary heating system:	None						
5 Cylinder insulation Hot water storage Permitted by DBSCG 2.10 Primary pipework insulated:	Measured cylinder loss: 2.10 kWh/day OK Yes OK						
6 Controls Space heating controls:	Time and temperature zone control	OK					
Hot water controls:	Cylinderstat Independent timer for DHW	OK OK					
7 Low energy lights Percentage of fixed lights with low-ene	rgy fittings:100% 75%	OK					
8 Mechanical ventilation Not applicable							
9 Summertime temperature Overheating risk (Thames Valley): Based on: Overshading: Windows facing East: Windows facing West: Air change rate: Blinds/curtains:	No overhang 4.73 m², No overhang 4.73 m², No overhang 6.00 ach	OK					
10 Key features External wall U-value External wall U-value Party wall U-value Floor U-value Photovoltaic array	0.13 W/m²K 0.11 W/m²K 0.00 W/m²K 0.12 W/m²K 0.30 kW						





CALCULATIO	ON OF D	WELLING	S EMISSI	ONS FOR	REGULAT	IONS CC	OMPLIAN	CE 09	Jan 2014				
SAP 2012 WORKSHI CALCULATION OF I	DWELLING E	MISSIONS FO	R REGULATI			ry 2014) Jan 2014							
1. Overall dwel													
Basement floor Total floor area Dwelling volume		a)+(1b)+(1c	:)+(1d)+(1e)(ln)	5	55.7700		Area (m2) 55.7700		y height (m) 2.4200		Volume (m3) 134.9634 134.9634	(1a) - (3a
2. Ventilation													
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 =	tota	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) =	0.1482 Yes 5.1000 0.4032	(8)
Shelter factor Infiltration rate	te adjuste	d to includ	e shelter	factor					(20) = 1 - (21	[0.075 x) = (18) x		0.7000 0.2822	
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	0.3598 0.5647	0.3528 0.5622	0.3457 0.5598	0.3105 0.5482	0.3034 0.5460	0.2681 0.5359	0.2681 0.5359	0.2611 0.5341	0.2822 0.5398	0.3034 0.5460	0.3175 0.5504	0.3316 0.5550	
3. Heat losses at Element Door Glazed Door (Uw Basement Wall 1 - To Light Wall 2 - Basemer Flat Ceiling - Total net area of Fabric heat loss Party Wall 1	= 1.40) htwell To Stairwe pof externa s, W/K = S	oss paramet 11 1 elements	er 		Openings m2	Net 1. 10 55. 3. 50. 8. 131.	2Area m2 9700 8300 7700 9000 2400 (26)(36800		A x U W/K 2.7580 14.3580 6.6924 0.4550 5.5990 1.6524 = 31.5148 0.0000	75 60 60 9	-value kJ/m2K 5.0000 0.0000 0.0000 9.0000	A x K kJ/K 4182.7500 210.0000 3054.0000 74.1600	(26) (27) (28) (29a) (29a) (30) (31) (33) (32)
Party Ceilings Stud Wall Heat capacity Cr Thermal mass par Thermal bridges	m = Sum(A :	MP = Cm / T			area)		.3300 .2500	(28).	(30) + (32)	9	0.0000 9.0000 (32e) =	3706.4000 434.2500 12457.1600 223.3667 6.4293	(32c) (34) (35)
Total fabric heat Ventilation heat (38)m Heat transfer co	t loss cal Jan 25.1525	culated mon Feb 25.0406 62.9846	thly (38)m Mar 24.9308 62.8749	= 0.33 x (2 Apr 24.4153 62.3593	25)m x (5) May 24.3188 62.2629	Jun 23.8698 61.8139	Jul 23.8698 61.8139	Aug 23.7867 61.7307	Sep 24.0428 61.9868	Oct 24.3188 62.2629	+ (36) = Nov 24.5140 62.4580	37.9441 Dec 24.7180 62.6620	(38)
Average = Sum(3			Mar 1.1274	Apr 1.1182	May 1.1164	Jun 1.1084	Jul 1.1084	Aug 1.1069	Sep 1.1115	Oct 1.1164	Nov 1.1199	62.3589 Dec 1.1236	(39)
HLP (average) Days in month	31	28	31	30	31	30	31	31	30	31	30	1.1181	
4. Water heating Assumed occupang Average daily ho	g energy r cy	equirements	(kWh/year)								1.8599 78.3722	
crage daily H	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(20)
Daily hot water Energy conte Energy content	86.2094 127.8461	83.0745 111.8150	79.9397 115.3831	76.8048 100.5938	73.6699 96.5221	70.5350 83.2912	70.5350 77.1816	73.6699 88.5670	76.8048 89.6248	79.9397 104.4490			(45)
Distribution los		= 0.15 x (4 16.7723		15.0891	14.4783	12.4937	11.5772	13.2850	13.4437	15.6674	17.1021	18.5718	





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014												
Water storage loss: Store volume a) If manufacturer of Temperature factor Enter (49) or (54) is	from Table 2k		own (kWh/d	ay):							180.0000 2.1000 0.5400 1.1340	(48) (49)
Total storage loss		35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains 35.1 Primary loss 23.2	540 31.7520	35.1540 2 23.2624	34.0200 22.5120		34.0200 22.5120	35.1540 23.2624	35.1540 23.2624	34.0200 22.5120	35.1540 23.2624	34.0200 22.5120	35.1540 23.2624	
Total heat required	for water heat 625 164.5782	ing calculat 2 173.7995	ed for each		139.8232	135.5980		146.1568 0.0000	162.8654 0.0000	170.5463 0.0000	182.2285 0.0000	(62)
Output from w/h	625 164.5782	2 173.7995	157.1258	154.9385	139.8232	135.5980	_		months) = Si 162.8654		0.0000	
Heat gains from wate:	r heating, kWh	n/month					Total p	er year (kW	h/year) = Si	ım (64) m =		
89.2	419 79.3891	L 85.0980	78.6730	78.8267	72.9199	72.3960	76.1816	75.0258	81.4624	83.1353	87.9007	(65)
5. Internal gains (se												
Metabolic gains (Tab	le 5), Watts							0	0-1		D	
Jan (66)m 92.9 Lighting gains (calc	941 92.9943				Jun 92.9941 see Table 5	Jul 92.9941	Aug 92.9941	Sep 92.9941	Oct 92.9941	Nov 92.9941	Dec 92.9941	(66)
14.6 Appliances gains (ca	080 12.974 lculated in Ap	7 10.5517 opendix L, eq	7.9883 uation L13	5.9714 or L13a), a	5.0413 Lso see Tab	5.4473 le 5	7.0806	9.5035	12.0669	14.0839	15.0140	(67)
Cooking gains (calcu		ndix L, equat	ion L15 or	L15a), also	see Table	5				144.3019 32.2994	155.0124	
Pumps, fans 3.0 Losses e.g. evaporat.	000 3.0000	3.0000	32.2994 3.0000 le 5)	32.2994 3.0000	3.0000	32.2994	32.2994	32.2994 3.0000	32.2994 3.0000	3.0000	32.2994 3.0000	
	953 -74.3953			-74.3953	-74.3953	-74.3953	-74.3953	-74.3953	-74.3953	-74.3953	-74.3953	(71)
Total internal gains	489 118.1385			105.9499	101.2777	97.3064	102.3947	104.2025	109.4925	115.4658	118.1460	
350.6	227 348.8618	3 338.4388	321.7368	305.0058	288.6930	277.9725	283.0113	291.4827	308.3637	327.7498	342.0706	(73)
6. Solar gains												
[Jan]			rea	Solar flux		q		FF	Acces	3S	Gains	
				Table 6a W/m2	Speci: or '	fic data Table 6b	Specific or Tab		facto Table (or	W	
East West			000	19.6403 19.6403		0.7600 0.7600	0	.7000 .7000	0.770 0.770		44.1695 34.2494	
Solar gains 78.4 Total gains 429.0		252.6345 3 591.0733						293.8244 585.3070		97.7791 425.5289	64.4879 406.5585	
7. Mean internal tem	perature (heat	ing season)										
Temperature during he Utilisation factor fo	eating periods	s in the livi	ng area fro	m Table 9, 5							21.0000	(85)
Jan	Feb 417 54.9392	Mar 2 55.0351	Apr	May	Jun 55.9797 4.7320	Jul 55.9797 4.7320	Aug 56.0551 4.7370	Sep 55.8235 4.7216	Oct 55.5760 4.7051	Nov 55.4024 4.6935	Dec 55.2220 4.6815	
util living area 0.9			0.8592	0.7001	0.5145	0.3764	0.4251	0.6771	0.9175	0.9817	0.9928	(86)
MIT 20.0 Th 2 19.9			20.7181 19.9860	20.8739 19.9874	20.9298 19.9940	20.9403 19.9940	20.9386 19.9952	20.8989 19.9915	20.6680 19.9874	20.3173 19.9846	20.0422 19.9816	
util rest of house 0.9 MIT 2 18.7			0.8252 19.6540	0.6417 19.8409	0.4387 19.9019	0.2916 19.9092	0.3345 19.9097	0.5968 19.8750	0.8886 19.6006	0.9757 19.1083	0.9908 18.7066	
Living area fraction MIT 19.5	414 19.7160	19.9925	20.2930	20.4612	20.5192	20.5284	20.5275	fLA = 20.4899	Living area 20.2416	19.8343	0.6005 19.5086	
Temperature adjustment adjusted MIT 19.5		19.9925	20.2930	20.4612	20.5192	20.5284	20.5275	20.4899	20.2416	19.8343	0.0000 19.5086	(93)
8. Space heating reg												
Utilisation 0.90 Useful gains 423.4 Ext temp. 4.30	869 0.9735 398 488.9558	552.9929	Apr 0.8363 577.1758 8.9000			Jul 0.3369 241.8754 16.6000			Oct 0.8967 439.7431 10.6000	Nov 0.9746 414.7154 7.1000	Dec 0.9896 402.3155 4.2000	(95)
Month fracti 1.0	824 933.1823 000 1.0000		710.4586 1.0000	545.4977 1.0000	365.8866 0.0000	242.8278	254.7963 0.0000	396.0886 0.0000	600.3120	795.3609 1.0000	959.2697 1.0000	
Space heating kWh 400.4	525 298.520	1 219.7395	95.9637	28.7467	0.0000	0.0000	0.0000	0.0000	119.4633	274.0648	414.3739	(98)
Space heating Space heating per m2									(98)	/ (4) =	1851.3244 33.1957	





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement 9a. Energy requirements - Individual heating systems, including micro-CHP Fraction of space heat from secondary/supplementary system (Table 11)
Fraction of space heat from main system(s)
Efficiency of main space heating system 1 (in %)
Efficiency of secondary/supplementary heating system, %
Space heating requirement 0.0000 (201) 1 0000 (202) 249.9000 (206) 0.0000 (208) 740.8261 (211) Feb Mar May Jun Jul Aug Sep Oct Nov Dec Apr Space heating requirement 400.4525 298.5201 219.7395 95.9637 28.7467 0.0000 119.4633 274.0648 414.3739 (98) Space heating efficiency (main heating system 1) 249.9000 249.9000 249.9000 249.9000 249.9000 0 0000 0 0000 0 0000 0 0000 249.9000 249.9000 249.9000 (210) 38.4008 0.0000 0.0000 0.0000 0.0000 47.8044 109.6698 165.8159 (211) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (215) Water heating Water neating Water heating requirement

186.2625 164.5782 173.7995 157.1258 154.9385 139.8232 135.5980 146.9834 146.1568 162.8654 170.5463 182.2285 (64)

175.1000 (216 186.2625 164.5782 173.7995 157.1258 154.9385 139.8232

Effficiency of water heater
(217)m 175.1000 175.1000 175.1000 175.1000 175.1000

Fuel for water heating, kWh/month
106.3749 93.9910 99.2573 89.7349 88.4857 79.8534

Water heating fuel used
Annual totals kWh/year

Space heating fuel - main system
Space heating fuel - secondary 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 (217) 77.4403 83.9425 83.4705 93.0128 97.3994 1097.0337 (219) 740.8261 (211) 0.0000 (215) Electricity for pumps and fans: central heating pump Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L) 30.0000 (230c) 30.0000 (231) 257.9812 (232) Energy saving/generation technologies (Appendices M ,N and Q) PV Unit 0 (0.80 * 0.30 * 951 * 1.00) = Total delivered energy for all uses -228.1478 (233) 1897.6932 (238) -228.1478 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Energy kWh/year 740.8261 Emission factor Emissions Emissions
kg CO2/year
384.4887 (261)
0.0000 (263)
569.3605 (264)
953.8492 (265)
15.5700 (267)
133.8923 (268) kg CO2/kWh 0.5190 0.0000 Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans 0.0000 1097.0337 0.5190 30.0000 257.9812 Energy for lighting 0.5190 Energy saving/generation technologies PV Unit
Total CO2, kg/year -118.4087 (269) 984.9028 (272) 17.6600 (273) -228.1478 0.5190 Dwelling Carbon Dioxide Emission Rate (DER) 16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES 17.6600 ZC1 55.7700 1.8599 0.5190 17.2310 ZC2 Total Floor Area TFA Assumed number of occupants
CO2 emission factor in Table 12 for electricity displaced from grid
CO2 emissions from appliances, equation (L14)
CO2 emissions from cooking, equation (L16) 2.9341 ZC3 37.8251 ZC4 Total CO2 emissions
Residual CO2 emissions offset from biofuel CHP
Additional allowable electricity generation, kWh/m²/year
Resulting CO2 emissions offset from additional allowable electricity generation 0.0000 ZC5 0.0000 ZC6 0.0000 ZC7 Net CO2 emissions 37.8251 ZC8





CALCULATION OF TARGET EMISSIONS 09	Jan 2014
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SAP 2012 WORKSH CALCULATION OF					9.92, Januar	y 2014)							
1. Overall dwel													
Basement floor Total floor are Dwelling volume		a)+(1b)+(1	lc)+(1d)+(1e)(ln)	5	55.7700		Area (m2) 55.7700	(1a) x	torey height (m) 2.4200 (3c)+(3d)+(3e)	(2a) =	Volume (m3) 134.9634	(1a) - (3a) (4) (5)
2. Ventilation													
					main heating		secondary heating		other	to	tal n	m3 per hour	
Number of chimm Number of open Number of inter Number of passi Number of fluel	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 du Pressure test Measured/design Infiltration ra Number of sides	AP50		s and fans	= (6a)+(6b))+(7a)+(7b)+((7c) =				20.000	Air change 0 / (5) =	0.1482 Yes 5.0000 0.3982	, , ,
Shelter factor Infiltration ra			ude shelter	factor					(20) = 1	- [0.075 (21) = (18)		0.7000 0.2787	(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					
Adj infilt rate Effective ac	0.3554 0.5631	0.3484 0.5607		0.3066 0.5470	0.2996 0.5449	0.2648 0.5351	0.2648 0.5351	0.2578 0.5332					
3. Heat losses													
Element TER Opaque door TER Opening Typ Basement		40)		Gross m2	Openings m2	1	m2 L.9700 D.8300 5.7700	U-value W/m2K 1.0000 1.3258 0.1300	1. 14.	X U W/K 9700 3580 2501	K-value kJ/m2K	A x K kJ/K	
Wall 1 - To Lig Wall 2 - Baseme Flat Ceiling - Total net area	ent To Stairwe of externa	l elements		16.3000 50.9000 8.2400	12.8000	5 5 8	3.5000 0.9000 3.2400 1.2100	0.1800 0.1800 0.1300	0. 9. 1.	6300 1620 0712			(29a) (29a) (30) (31)
Fabric heat los Thermal mass pa				m2K			(26)(30) + (32)	= 34.	4413		250.0000	(33)
Thermal bridges Total fabric he Ventilation hea	(Sum(L x	Psi) calcu	ılated using	Appendix K)						(33) + (36) =	6.9177 41.3590	(36)
(38)m			Mar 24.8652			Jun 23.8304	Jul 23.8304	Aug 23.7493	Sep 23.999	Oct 1 24.2683	Nov 24.4586	Dec 24.6576	(38)
Heat transfer of Average = Sum(3	66.4404	66.3312	66.2242	65.7213	65.6273	65.1893	65.1893	65.1082	65.358	0 65.6273	65.8176	66.0165 65.7209	
HLP HLP (average) Days in month	Jan 1.1913	Feb 1.1894	Mar 1.1875	Apr 1.1784	May 1.1767	Jun 1.1689	Jul 1.1689	Aug 1.1674	Sep 1.171	Oct 9 1.1767	Nov 1.1802	Dec 1.1837 1.1784	
bayo in monen	31	28	31	30	31	30	31	31	3	0 31	30	31	(41)
4. Water heatin													
Assumed occupan Average daily h	су											1.8599 78.3722	
Daily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte Energy content Distribution lo	86.2094 127.8461 (annual)	83.0745 111.8150		76.8048 100.5938	73.6699 96.5221	70.5350 83.2912	70.5350 77.1816	73.6699 88.5670		8 104.4490		86.2094 123.8121 1233.1001	(45)
Water storage 1	19.1769	16.7723		15.0891	14.4783	12.4937	11.5772	13.2850	13.443	7 15.6674	17.1021	18.5718	(46)
Store volume a) If manufact Temperature f	urer decla		factor is kn	own (kWh/da	эy):							180.0000 1.5520 0.5400	(48)





CALCULAT	ION OF 1	TARGET E	MISSION	IS 09 J	lan 2014								
Enter (49) or Total storage		5)										0.8381	(55)
If cylinder co	25.9803			25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
Primary loss	25.9803 23.2624	23.4661 21.0112	25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	
Total heat req			ng calculat 164.6258 0.0000	ed for each 148.2480 0.0000		130.9454	126.4243	137.8097	137.2790 0.0000	153.6917 0.0000	0.0000	173.0548 0.0000	(63)
Output from w/		156.2923	164.6258	148.2480	145.7648	130.9454	126.4243	137.8097	137.2790	months) = St	161.6685		(64)
Heat gains fro	m water he 81.9030	ating, kWh/ 72.7603	month 77.7590	71.5708	71.4877	65.8177	65.0570	68.8427	er year (kw 67.9236	h/year) = St 74.1234	m(64)m = 76.0331	80.5617	
5. Internal ga	ins (see T	able 5 and	5a)										
Metabolic gain			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gains	92.9941	92.9941	92.9941	92.9941	92.9941	92.9941	92.9941	92.9941	92.9941	92.9941	92.9941	92.9941	(66)
Appliances gai	14.6080	12.9747	10.5517	7.9883	5.9714	5.0413	5.4473	7.0806	9.5035	12.0669	14.0839	15.0140	(67)
Cooking gains		d in Append	ix L, equat	ion L15 or		see Table		119.6378	123.8783	132.9060	144.3019	155.0124	(68)
Pumps, fans	32.2994	32.2994 3.0000	32.2994 3.0000	32.2994 3.0000	32.2994 3.0000	32.2994 3.0000	32.2994 3.0000	32.2994 3.0000	32.2994 3.0000	32.2994 3.0000	32.2994 3.0000	32.2994 3.0000	
Losses e.g. ev	-74.3953	-74.3953		le 5) -74.3953	-74.3953	-74.3953	-74.3953	-74.3953	-74.3953	-74.3953	-74.3953	-74.3953	(71)
Water heating	110.0846		104.5148	99.4039	96.0857	91.4135	87.4422	92.5305	94.3383	99.6283	105.6015	108.2818	(72)
Total internal		338.9976	328.5746	311.8726	295.1416	278.8288	268.1083	273.1470	281.6184	298.4995	317.8855	332.2064	(73)
6. Solar gains													
[Jan]				rea m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab		Acces facto Table	or	Gains W	
East West			6.1 4.7	000 300	19.6403 19.6403		0.6300 0.6300	0	.7000 .7000	0.770 0.770		36.6142 28.3910	
Solar gains Total gains	65.0051 405.7636	127.1638 466.1614	209.4207 537.9953	305.4276 617.3002		383.1759 662.0047	364.7991 632.9074		243.5649 525.1834	150.8906 449.3901	81.0537 398.9393	53.4571 385.6635	
7. Mean intern Temperature du												21.0000	(05)
Utilisation fa						Jun	Jul	Aug	Sep	Oct	Nov	Dec	(03)
tau alpha	58.2916 4.8861	58.3875 4.8925	58.4819 4.8988	58.9294 4.9286	59.0138 4.9343	59.4103 4.9607	59.4103 4.9607	59.4843	59.2569 4.9505	59.0138 4.9343	58.8432 4.9229	58.6658 4.9111	
util living ar	ea 0.9953	0.9902	0.9734	0.9174	0.7909	0.6050	0.4483	0.5016	0.7629	0.9526	0.9905	0.9963	(86)
MIT Th 2	19.8205 19.9269	19.9862	20.2698	20.6165	20.8645	20.9720	20.9948	20.9911	20.9156	20.5736	20.1296	19.7869	
util rest of h	ouse 0.9938	19.9285	19.9301	19.9373	19.9386	19.9450	19.9450	19.9461	19.9425	19.9386	19.9359		
MIT 2 Living area fr			19.0224	19.5066		19.9278	19.9432	19.9428		19.4617 Living area		0.6005	(91)
MIT Temperature ad			19.7715	20.1731	20.4451	20.5548	20.5747	20.5723	20.5020			0.0000	
adjusted MIT	19.2420	19.4380	19.7715	20.1731	20.4451	20.5548	20.5747	20.5723	20.5020	20.1294	19.6100	19.2039	(93)
8. Space heati	ng require	ment											
Heiliaati	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(0.4)
Utilisation Useful gains Ext temp.			0.9629 518.0448 6.5000	0.8973 553.9331 8.9000	509.9558	0.5685 376.3317 14.6000	0.4065 257.2737 16.6000	0.4577 268.4259 16.4000	0.7258 381.1762 14.1000	0.9359 420.5738 10.6000	0.9852 393.0521 7.1000	0.9940 383.3629 4.2000	(95)
Heat loss rate	992.7529	964.3220	878.8925	740.8821	573.9193	388.1920	259.1053	271.6504	418.4251	625.3893	823.3809	990.5087	(97)
Month fracti Space heating		1.0000	1.0000	1.0000		0.0000	0.0000	0.0000	0.0000	1.0000 152.3827	1.0000	1.0000 451.7165	(98)
Space heating Space heating	per m2									(98)	/ (4) =	2143.0325 38.4263	
8c. Space cool	ing requir	ement											
Not applicable													



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.12r02



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy re	quirements -	Individua	l heating s	ystems, inc	luding micr	o-CHP							
Fraction of s Fraction of s Efficiency of Efficiency of Space heating	pace heat fr pace heat fr main space secondary/s	om seconda: om main sy: heating sy: upplementa:	ry/supplemen stem(s) stem 1 (in ^s	ntary system								0.0000 1.0000 93.5000 0.0000 2292.0134	(202) (206) (208)
Control booking	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	438.9862	339.4477		134.6033	47.5888	0.0000	0.0000	0.0000	0.0000	152.3827	309.8367	451.7165	(98)
Space heating	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating	469.5040	363.0456	287.1344	143.9607	50.8971	0.0000	0.0000	0.0000	0.0000	162.9761	331.3762	483.1192	(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	177.0888	156.2923	164.6258	148.2480	145.7648	130.9454	126.4243	137.8097	137.2790	153.6917	161.6685	173.0548	
Efficiency of (217)m	87.1414	86.8294	86.1111	84.5576	82.1918	79.8000	79.8000	79.8000	79.8000	84.7911	86.5222	79.8000 87.2592	
Fuel for wate. Water heating	203.2201	179.9992	191.1783	175.3219	177.3472	164.0920	158.4264	172.6938	172.0288	181.2593	186.8521	198.3227 2160.7418	
Annual totals Space heating Space heating	kWh/year fuel - main											2292.0134	(211)
Electricity for central hemain heating Total electricity for Total delivered	ating pump ng flue fan city for the or lighting	above, kWl		ix L)								30.0000 45.0000 75.0000 257.9812 4785.7364	(230e) (231) (232)
12a. Carbon d													
Space heating Space heating Water heating Space and wat Pumps and fan	- secondary (other fuel er heating							Energy kWh/year 2292.0134 0.0000 2160.7418		ion factor kg CO2/kWh 0.2160 0.0000 0.2160	k	Emissions cg CO2/year 495.0749 0.0000 466.7202 961.7951 38.9250	(261) (263) (264) (265)
Energy for li Total CO2, kg Emissions per Fuel factor (Emissions per Emissions per Target Carbon	ghting /m2/year m2 for spac electricity) m2 for ligh m2 for pump	ting s and fans	-	7.2457 * 1.	55) + 2.400	8 + 0.6980,	rounded to	257.9812		0.5190		133.8923 1134.6124 17.2457 1.5500 2.4008 0.6980 29.8300	(268) (272) (272a) (272b) (272c)





Property Reference	0007-Godsmark-Royal-Co	llege-F2			Issued on Date	13/08/2020			
Assessment Reference	AD		Pro	op Type Ref	Flat 2				
Property	Flat 2, 154, Royal College	Street, Londo	n, NW1 0TA						
SAP Rating		84 B	DER	22.01	TER	32.54			
Environmental		86 B	% DER <ter< th=""><th></th><th colspan="5">32.37</th></ter<>		32.37				
CO ₂ Emissions (t/ye	ear)	0.91	DFEE	61.74	TFEE	60.98			
General Requireme	ents Compliance	Fail	% DFEE <tfee< th=""><th></th><th>-1.25</th><th></th></tfee<>		-1.25				
Assessor Details	Mr. Andrew Gwynne, Andrew andrew.gwynne@mesenergy	, ,	,		Assessor ID	P741-0001			
Client									





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

REGULATIONS COME	PLIANCE REPORT - Approve	d Document L	1A, 2013 Editi	on, England	
DWELLING AS DESI	GNED				
Ground-floor fla	at, total floor area 50 m	m²			
It is not a comp	ers items included within	ons complian			
la TER and DER Fuel for main he Fuel factor:1.55 Target Carbon Di Dwelling Carbon	eating:Electricity	R) 32.54 kgC			
1b TFEE and DFEE Target Fabric Er Dwelling Fabric					
External wall Party wall Floor Roof Openings	Average 0.25 (max. 0.30) 0.00 (max. 0.20) 0.12 (max. 0.25) 0.20 (max. 0.20) 1.40 (max. 2.00)		0.70) 0.35) 3.30)	OK OK OK OK	
Maximum		5.10 (desig			OK
4 Heating effici Main heating sys Air-to-water hea	ency	Heat pump w	ith radiators	or underfloor - Ele	ctric
Secondary heatir	ng system:	None			
5 Cylinder insul Hot water storag Permitted by DBS Primary pipework	ation ge SCG 2.10	Measured cy C Yes	linder loss: 2 K	.10 kWh/day	OK
6 Controls Space heating co	ontrols:	Time and te	mperature zone	control	OK
Hot water contro	ols:	Cylindersta Independent	t timer for DHW		OK OK
7 Low energy lig	xed lights with low-ene:		:100%		OK
8 Mechanical ver Not applicable					
9 Summertime ten	mperature (Thames Valley): Cast: West:	Slight Average 6.10 m², No 7.50 m², No 6.00 ach None	overhang		OK
10 Key features External wall U- Party wall U-val Floor U-value Photovoltaic arm	ue	0.13 W/m²K 0.00 W/m²K 0.12 W/m²K 0.30 kW			





CALCULATIO	ON OF D	WELLING	G EMISSI	ONS FOR	REGULAT	IONS CO	OMPLIAN	CE 09	9 Jan 2014				
SAP 2012 WORKSHI	OWELLING E	MISSIONS FO	OR REGULATIO	ONS COMPLIAN	ICE 09 J	Tan 2014							
1. Overall dwell	-												
Ground floor Total floor area Dwelling volume	a TFA = (1	a) + (1b) + (1c	c)+(1d)+(1e))(ln)	5	0.4500		Area (m2) 50.4500		y height (m) 3.0500 (3d)+(3e)		Volume (m3) 153.8725 153.8725	(1b) - (3b (4) (5)
2. Ventilation	rate												
					main heating	se	econdary heating		other	tota	al mi	B per hour	
Number of chimne Number of open : Number of intern Number of passis Number of fluele	flues mittent fa ve vents				0 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 te		and fans	= (6a)+(6b)	+(7a)+(7b)+((7c) =					Air changes / (5) =	0.1300 Yes 5.1000 0.3850	
Shelter factor Infiltration rat			de shelter i	factor					(20) = 1 - (21	[0.075 x) = (18) x		0.9250 0.3561	(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		Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	0.4540 0.6031	0.4451 0.5991	0.4362 0.5951	0.3917 0.5767	0.3828 0.5733	0.3383 0.5572	0.3383 0.5572	0.3294 0.5543		0.3828 0.5733	0.4006 0.5802	0.4184 0.5875	
3. Heat losses	and heat 1	oss paramet	 :er										
Element				Gross	Openings	Net	tArea	U-value	A x U		-value	АхК	
Window (Uw = 1.	10)			m2	m2	7.	m2 .5000	W/m2K 1.3258	W/K 9.9432		kJ/m2K	kJ/K	(27)
Door Glazed Door (Uw Ground Floor	= 1.40)					6.	.9100 .1000 .2500	1.4000 1.3258 0.1200	2.6740 8.0871 0.5100		5.0000	318.7500	(26) (27)
Wall 1 Wall 3 - Stairwe Flat Ceiling - ! Flat Roof	To Stairwe			61.0600 30.5300 5.8000 1.3000	15.5100	45 30 5	.5500 .5300 .8000 .3000	0.1300 0.4400 0.2107 0.1400	5.9215 13.4332 1.2220 0.1820	60 2 2	0.0000 9.0000 9.0000	2733.0000 274.7700 52.2000 11.7000	(29a) (29a) (30) (30)
Total net area of Fabric heat loss Party Wall 1 Party Floor 1 Party Ceilings 1 Stud Wall	s, W/K = S		Aum(A, m2)			20 46 43	.9400 (26)(3 .8900 .2400 .3800 .5900	0.0000	= 41.9730 0.0000	45 80 80	5.0000 0.0000 0.0000 9.0000	940.0500 3699.2000 3470.4000 698.3100	(32d) (32b)
Heat capacity Cr Thermal mass par Thermal bridges Total fabric hea	rameter (T (User def	MP = Cm / T			area)			(28)	(30) + (32)		(32e) = 3 + (36) =	12198.3800 241.7915 6.9999 48.9730	(35) (36)
Ventilation head	Jan 30.6228	culated mor Feb 30.4196	nthly (38)m Mar 30.2203	= 0.33 x (2 Apr 29.2847	25)m x (5) May 29.1096	Jun 28.2946	Jul 28.2946	Aug 28.1437	Sep 28.6085	Oct 29.1096	Nov 29.4637	Dec 29.8340	(38)
Heat transfer co Average = Sum (3)	79.5958	79.3925	79.1933	78.2576	78.0826	77.2676	77.2676	77.1167	77.5815	78.0826	78.4367	78.8070 78.2568	
HLP HLP (average)	Jan 1.5777	Feb 1.5737	Mar 1.5697	Apr 1.5512	May 1.5477	Jun 1.5316	Jul 1.5316	Aug 1.5286	Sep 1.5378	Oct 1.5477	Nov 1.5547	Dec 1.5621 1.5512	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30		(41)
4. Water heating	g energy r	equirements	s (kWh/year)										
Assumed occupand Average daily ho		se (litres/	/day)									1.7034 74.6547	
Daily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
,	82.1202	79.1340	76.1478	73.1616	70.1754	67.1892	67.1892	70.1754	73.1616	76.1478	79.1340	82.1202	(44)





CALCULATI	ION OF I	DWELLIN	G EMISSI	ONS FO	R REGULA	TIONS CO	OMPLIAN	ICE 09	Jan 2014	ļ.			
_													
Energy content Distribution lo	oss (46) m											1174.6093	
Water storage		15.9767	16.4865	14.3733	13.7916	11.9011	11.0281	12.6549	12.8060	14.9242	16.2909	17.6909	
Store volume a) If manufact Temperature:	factor fro	m Table 2b	actor is kno	own (kWh/	day):							180.0000 2.1000 0.5400	(48) (49)
Enter (49) or Total storage	loss											1.1340	
If cylinder co	35.1540 ntains ded		35.1540 r storage	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
Primary loss	35.1540 23.2624	31.7520 21.0112		34.0200 22.5120		34.0200 22.5120	35.1540 23.2624	35.1540 23.2624	34.0200 22.5120	35.1540 23.2624	34.0200 22.5120		
Total heat requested Solar input					n month 150.3601 0.0000	135.8724	131.9370		141.9055 0.0000	157.9110 0.0000		176.3556 0.0000	
Output from w/l		159.2744	168.3264	152.3542	150.3601	135.8724	131.9370	_		months) = Si 157.9110		0.0000 176.3556	
Heat gains from		ating, kWh/		77.0865	77.3044	71.6063	71.1787	Total p	er year (kW 73.6123	h/year) = Si 79.8151	um(64)m = 81.3371		
									73.0123	73.0131	01.0371	03.3473	(00)
5. Internal gas	ins (see T	able 5 and	5a)										
Metabolic gains	s (Table 5 Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gains	(calculat	ed in Appen	dix L, equa	tion L9 or		see Table 5		85.1678		85.1678	85.1678		
Appliances gain	ns (calcul	ated in App	endix L, eq	uation L13		lso see Tab		6.4128	8.6072	10.9288	12.7555	13.5979	, ,
Cooking gains	(calculate	d in Append	ix L, equat:	ion L15 or	127.3720 L15a), also	see Table	5				132.0533	141.8547	
Pumps, fans	3.0000	3.0000	3.0000	3.0000	31.5168 3.0000	31.5168 3.0000	31.5168 3.0000	31.5168 3.0000	31.5168 3.0000	31.5168 3.0000	31.5168 3.0000	31.5168 3.0000	
	-68.1342	-68.1342			-68.1342	-68.1342	-68.1342	-68.1342	-68.1342	-68.1342	-68.1342	-68.1342	(71)
Water heating			111.9331	107.0646	103.9038	99.4532	95.6703	100.5172	102.2393	107.2783	112.9682	115.5214	(72)
Total internal		328.7581	319.1019	303.6503	288.2343	273.1399	263.1769	267.9630	275.7602	291.3823	309.3275	322.5244	(73)
6. Solar gains													
[Jan]			A	rea m2	Solar flux Table 6a W/m2	Speci or '	g fic data Table 6b	Specific or Tab	FF data le 6c	Acces facto Table (or	Gains W	
[Jan] West			7.5 6.1	rea m2 000 000	Solar flux Table 6a W/m2 19.6403 19.6403	Speci or	g fic data Table 6b 0.7600 0.7600	Specific or Tab	FF data le 6c .7000	facto	or 6d 00		
[Jan] West	98.4762	192.6403	7.5 6.1 317.2511	rea m2	Solar flux Table 6a W/m2 19.6403 19.6403	Speci or '	g fic data Table 6b 0.7600 0.7600	Specific or Tab. 0 0	.7000 .7000 368.9761	factor Table (0.770 0.770	or 6d 00 00 122.7882	54.3067 44.1695 80.9820	(76)
West East Solar gains Total gains	98.4762 428.8980	192.6403 521.3983	7.5; 6.1; 317.2511 636.3529	rea m2	Solar flux Table 6a W/m2 19.6403 19.6403	Speci or 5 580.4726 853.6125	gfic data Table 6b 0.7600 0.7600 552.6336 815.8104	Specific or Tab 0 0 474.7041 742.6671	.7000 .7000 368.9761	factor Table (0.770 0.770	or 6d 00 00 122.7882	54.3067 44.1695 80.9820	(76)
West East Solar gains Total gains 7. Mean international description of the second seco	98.4762 428.8980 al tempera	192.6403 521.3983 ture (heati	7.50 6.11 317.2511 636.3529 ng season) in the livin	rea m2 000 000 462.6918 766.3421	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804	Speci or 580.4726 853.6125	gfic data Table 6b 	Specific or Tab. 0 0 474.7041 742.6671	.7000 .7000 368.9761	factor Table (0.770 0.770	or 6d 00 00 122.7882	54.3067 44.1695 80.9820	(76) (83) (84)
West East Solar gains Total gains Total gains Temperature du Utilisation factau	98.4762 428.8980 all tempera 	192.6403 521.3983 ture (heati ng periods tains for li Feb 42.6796	7.50 6.11 317.2511 636.3529 ng season) in the livin ving area, 11 Mar 42.7869	m2 000 000 462.6918 766.3421 ang area fr nil,m (see Apr 43.2985	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 may Table 9a) May 43.3956	Speci or	gfic data Table 6b	Specific or Tab. 0 0 474.7041 742.6671	.7000 .7000 368.9761 644.7363 Sep 43.6759	factor Table (0.77(0.77) 228.5839 519.9662	00 00 122.7882 432.1157 Nov 43.1997	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967	(76) (83) (84)
West East Solar gains Total gains 7. Mean international gains	98.4762 428.8980 all tempera 	192.6403 521.3983 ture (heati- ng periods ains for li Feb	7.55 6.10 317.2511 636.3529 ng season) in the living area, in Mar	rea m2	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 may Table 9a) May 43.3956	Speci or 580.4726 853.6125	gfic data Table 6b	Specific or Tab. 0 0 474.7041 742.6671	.7000 .7000 368.9761 644.7363	factor Table (0.77)	or 6d 00 00 00 122.7882 432.1157	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec	(76) (83) (84) (85)
West East Solar gains Total gains Total gains Tutal gains	98.4762 428.8980 al tempera 	192.6403 521.3983 ture (heati- ng periods ains for li Feb 42.6796 3.8453	7.50 6.11 317.2511 636.3529 in the livir ving area, 1 Mar 42.7869 3.8525	462.6918 766.3421 ang area fr nil, m (see Apr 43.2985 3.8866	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 mag Table 9a) May 43.3956 3.8930	Speci or ' 580.4726 853.6125 Th1 (C) Jun 43.8533 3.9236	gfic data Table 6b 0.7600 0.7600 552.6336 815.8104 Jul 43.8533 3.9236	Specific or Tab 0 0 474.7041 742.6671 Aug 43.9391 3.9293	.7000 .7000 368.9761 644.7363 Sep 43.6759 3.9117	factor Table (0.77(0.77) 228.5839 519.9662	Nov 43.1997 3.8800	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664	(83) (84) (85) (86) (87)
West East Solar gains Total gains 7. Mean internation fact Utilisation fact tau alpha util living are MIT Th 2 util rest of he	98.4762 428.8980 al tempera 	192.6403 521.3983 tture (heati ng periods ains for li Feb 42.6796 3.8453 0.9809 19.9113 19.6327 0.9747	7.5 6.1 317.2511 636.3529 ng season) in the livin ving area, i Mar 42.7869 3.8525 0.9514 20.2083 19.6356	m2 462.6918 766.3421 ng area froil,m (see Apr 43.2985 3.8866 0.8700 20.5568 19.6493 0.8307	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 Table 9a) May 43.3956 3.8930 0.7260 20.7902 19.6519 0.6537	Speci or	gfic data Table 6b	Specific or Tab. 0 0 474.7041 742.6671 Aug 43.9391 3.9293 0.4636 20.9172 19.6661 0.3359	.7000 .7000 .7000 .7000 .7000 .7060	factor Table (0.77(0.77) 228.5839 519.9662 Oct 43.3956 3.8930 0.9285 20.4913 19.6519 0.8971	Nov 43.1997 3.8800 0.9832 20.0436 19.6467	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664 0.9929 19.7013 19.6413 0.9906	(83) (84) (85) (86) (87) (88) (89)
West East Solar gains Total gains Total gains Total gains Temperature du Utilisation fact tau alpha util living are MIT Th 2 util rest of he MIT 2 Living area fre	98.4762 428.8980 al tempera ring heati ctor for g Jan 42.5706 3.8380 ea 0.9911 19.7296 19.6297 ouse 0.9882 17.9785 action	192.6403 521.3983 ture (heati- ng periods tains for li Feb 42.6796 3.8453 0.9809 19.9113 19.6327 0.9747 18.2430	7.56 6.11 317.2511 636.3529 in the livin ying area, 1 Mar 42.7869 3.8525 0.9514 20.2083 19.6356 0.9356 18.6668	462.6918 766.3421 ang area fr nil,m (see Apr 43.2985 3.8866 0.8700 20.5568 19.6493 0.8307 19.1478	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 m Table 9a) May 43.3956 3.8930 0.7260 20.7902 19.6519 0.6537 19.4294	580.4726 853.6125 Th1 (C) Jun 43.8533 3.9236 0.5486 20.8960 19.6639 0.4465 19.5431	Jul 43.8533 3.9236 0.2886 19.5604	Aug 43.9391 3.9293 0.4636 20.9172 19.6661 0.3359 19.5607	.7000 .7000 .7000 .7000 .7000 .7060	factor Table 6 0.77(0.7	Nov 43.1997 3.8800 0.9832 20.0436 19.6467 0.9766 18.4475 a / (4) =	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664 0.9929 19.7013 19.6413 0.9906 17.9460 0.4618	(85) (86) (87) (88) (89) (90) (91)
West East Solar gains Total gains 7. Mean internation Temperature du; Utilisation fact tau alpha util living are MIT Th 2 util rest of he MIT 2 Living area from MIT Temperature ad; Temperature ad;	98.4762 428.8980 al tempera 	192.6403 521.3983 ture (heati- ng periods tains for li- Feb 42.6796 3.8453 0.9809 19.9113 19.6327 0.9747 18.2430 19.0135	7.56 6.11 317.2511 636.3529 in the livir ving area, 1 Mar 42.7869 3.8525 0.9514 20.2083 19.6356 18.6668	462.6918 766.3421 462.6918 766.3421 ang area fr nil,m (see Apr 43.2985 3.8866 0.8700 20.5568 19.6493 0.8307 19.1478	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 567.0461 855.2804 0.7260 20.7902 19.6519 0.6537 19.4294 20.0579	Speci or ' 580.4726 853.6125 Th1 (C) Jun 43.8533 3.9236 0.5486 20.8960 19.6639 0.4465 19.5431 20.1679	Jul 43.8533 3.9236 0.4088 20.9224 19.6639 0.2886 19.5604 20.1894	Aug 43.9391 3.9293 0.4636 20.9172 19.6661 0.3359 19.5607 20.1872	.7000 .7000 .7000 .7000 .7000 .7060 .7166	Oct 43.3956 3.8930 0.9285 20.4913 19.6519 0.8971 19.0805 Living area 19.7321	Nov 43.1997 3.8800 0.9832 20.0436 19.6467 0.9766 18.4475 a / (4) = 19.1847	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664 0.9929 19.7013 19.6413 0.9906 17.9460 0.4618 18.7567 0.0000	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
West East Solar gains Total gains 7. Mean internation Temperature du; Utilisation fact tau alpha util living are MIT Th 2 util rest of he MIT 2 Living area from MIT Temperature ad; Temperature ad;	98.4762 428.8980 all tempera aring heati ctor for g Jan 42.5706 3.8380 ea 0.9911 19.7296 19.6297 ouse 0.9882 17.9785 action 18.7872	192.6403 521.3983 ture (heati- ng periods tains for li Feb 42.6796 3.8453 0.9809 19.9113 19.6327 0.9747 18.2430	7.56 6.11 317.2511 636.3529 in the livin ying area, 1 Mar 42.7869 3.8525 0.9514 20.2083 19.6356 0.9356 18.6668	462.6918 766.3421 ang area fr nil,m (see Apr 43.2985 3.8866 0.8700 20.5568 19.6493 0.8307 19.1478	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 m Table 9a) May 43.3956 3.8930 0.7260 20.7902 19.6519 0.6537 19.4294	580.4726 853.6125 Th1 (C) Jun 43.8533 3.9236 0.5486 20.8960 19.6639 0.4465 19.5431	Jul 43.8533 3.9236 0.2886 19.5604	Aug 43.9391 3.9293 0.4636 20.9172 19.6661 0.3359 19.5607	.7000 .7000 .7000 .7000 .7000 .7060	factor Table 6 0.77(0.7	Nov 43.1997 3.8800 0.9832 20.0436 19.6467 0.9766 18.4475 a / (4) =	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664 0.9929 19.7013 19.6413 0.9906 17.9460 0.4618 18.7567	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
West East Solar gains Total gains 7. Mean internation Temperature du; Utilisation fact tau alpha util living are MIT Th 2 util rest of he MIT 2 Living area from MIT Temperature ad; Temperature ad;	98.4762 428.8980 	192.6403 521.3983 ture (heati	7.56 6.11 317.2511 636.3529 ng season) in the livin ving area, 1 Mar 42.7869 3.8525 0.9514 20.2083 19.6356 18.6668 19.3787	m2 000 000 462.6918 766.3421 mg area frenil,m (see Apr 43.2985 3.8866 0.8700 20.5568 19.6493 0.8307 19.1478 19.7985	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 Table 9a) May 43.3956 3.8930 0.7260 20.7902 19.6519 0.6537 19.4294 20.0579 20.0579	Speci or	Jul 43.8533 3.9236 0.4088 20.9224 19.6639 0.2886 19.5604 20.1894	Aug 43.9391 3.9293 0.4636 20.9172 19.6661 0.3359 19.5607 20.1872 20.1872	.7000 .7000 .7000 .7000 .7000 .7060 .7166	Oct 43.3956 3.8930 0.9285 20.4913 19.6519 0.8971 19.0805 Living area 19.7321	Nov 43.1997 3.8800 0.9832 20.0436 19.6467 0.9766 18.4475 a / (4) = 19.1847	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664 0.9929 19.7013 19.6413 0.9906 17.9460 0.4618 18.7567 0.0000	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
West East Solar gains Total gains Total gains Total gains Total gains Temperature du Utilisation fact tau alpha util living are MIT Th 2 util rest of he MIT 2 Living area fr. MIT Temperature ad adjusted MIT 8. Space heatin	98.4762 428.8980 	192.6403 521.3983 ture (heati ng periods tains for li Feb 42.6796 3.8453 0.9809 19.9113 19.6327 0.9747 18.2430 19.0135 19.0135	7.56 6.11 317.2511 636.3529 in the livin ving area, 1 Mar 42.7869 3.8525 0.9514 20.2083 19.6356 0.9356 18.6668 19.3787	m2 2000 462.6918 766.3421 ang area fr. nil,m (see Apr 43.2985 3.8866 0.8700 20.5568 19.6493 0.8307 19.1478 19.7985	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 Table 9a) May 43.3956 3.8930 0.7260 20.7902 19.6519 0.6537 19.4294 20.0579 20.0579	Speci or ' 580.4726 853.6125 Th1 (C) Jun 43.8533 3.9236 0.5486 20.8960 19.6639 0.4465 19.5431 20.1679 20.1679	Jul 43.8533 3.9236 0.2886 19.5604 20.1894	Aug 43.9391 3.9293 0.4636 20.9172 19.6661 0.3359 19.5607 20.1872	.7000 .7000 .7000 .7000 .7000 .7060	Oct 43.3956 3.8930 0.9285 20.4913 19.6519 0.8971 19.0805 Living area 19.7321	Nov 43.1997 3.8800 0.9832 20.0436 19.6467 0.9766 18.4475 a / (4) = 19.1847	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664 0.9929 19.7013 19.6413 0.9906 17.9460 0.4618 18.7567	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
West East Solar gains Total gains Total gains Total gains Total gains Temperature du Utilisation fact tau alpha util living are MIT Th 2 util rest of he MIT 2 Living area fr. MIT Temperature ad adjusted MIT 8. Space heatin	98.4762 428.8980 all tempera	192.6403 521.3983 ture (heati- ng periods rains for li- Peb 42.6796 3.8453 0.9809 19.9113 19.6327 0.9747 18.2430 19.0135 19.0135	7.56 6.11 317.2511 636.3529 ing season) in the livir ving area, 12 Mar 42.7869 3.8525 0.9514 20.2083 19.6356 18.6668 19.3787 19.3787	462.6918 766.3421 462.6918 766.3421 ang area fr nil,m (see Apr 43.2985 3.8866 0.8700 20.5568 19.6493 0.8307 19.1478 19.7985	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 567.0461 855.2804 7 Table 9a) May 43.3956 3.8930 0.7260 20.7902 19.6519 0.6537 19.4294 20.0579 20.0579	Speci or ' 580.4726 853.6125 Th1 (C) Jun 43.8533 3.9236 0.5486 20.8960 19.6639 0.4465 19.5431 20.1679 20.1679	Jul 43.8533 3.9236 0.4088 20.9224 19.6639 0.2886 19.5604 20.1894 20.1894 Jul 0.3367	Aug 43.9391 3.9293 0.4636 20.9172 19.6661 0.3359 19.5607 20.1872 20.1872	.7000 .7000 .7000 .7000 .7000 .368.9761 .644.7363 .829 .7166 .20.8329 .9.6593 .0.6156 .19.4907 .1106 .20.1106 .20.1106	Oct 43.3956 3.8930 0.9285 20.4913 19.6519 19.7321 19.7321 0.893	Nov 43.1997 3.8800 0.9832 20.0436 19.6467 0.9766 18.4475 a / (4) = 19.1847	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664 0.9929 19.7013 19.6413 0.9906 17.9460 0.4618 18.7567 Dec 0.9885	(85) (86) (87) (88) (89) (90) (91) (92) (93)
West East Solar gains Total gains Total gains Total gains Total gains Temperature du Utilisation fact tau alpha util living are MIT Th 2 util rest of he MIT 2 Living area fre MIT Temperature ad adjusted MIT Temperature ad utilisation Useful gains Ext temp. Heat loss rate	98.4762 428.8980 al tempera ring heati ctor for g Jan 42.5706 3.8380 ea 0.9911 19.7296 19.6297 ouse 0.9882 17.978s action 18.7872 justment 18.7872	192.6403 521.3983 ture (heati- ng periods tains for li Feb 42.6796 3.8453 0.9809 19.9113 19.6327 0.9747 18.2430 19.0135 19.0135	7.56 6.11 317.2511 636.3529 in the living area, 19 Mar 42.7869 3.8525 0.9514 20.2083 19.6356 0.9356 18.6668 19.3787 19.3787	m2 000 000 462.6918 766.3421 ang area frenil,m (see Apr 43.2985 3.8866 0.8700 20.5568 19.6493 0.8307 19.1478 19.7985 Apr 0.8356 640.3391	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 Table 9a) May 43.3956 3.8930 0.7260 20.7902 19.6519 0.6537 19.4294 20.0579 20.0579 May 0.6770 579.0652 11.7000 652.6042	Speci or 580.4726 853.6125 Fh1 (C) Jun 43.8533 3.9236 0.5486 20.8960 19.6639 0.4465 19.5431 20.1679 20.1679 Jun 0.4844 415.1960	Jul 43.8533 3.9236 0.4088 20.9224 19.6639 0.2886 19.5604 20.1894 20.1894	Specific or Tab. 0 0 474.7041 742.6671 Aug 43.9391 3.9293 0.4636 20.9172 19.6661 0.3359 19.5607 20.1872 20.1872 Aug 0.3871 287.4811	.7000 .7000	factor Table 6 0.77(0.7	Nov 43.1997 3.8800 0.9832 20.0436 19.6467 0.9766 18.4475 a / (4) = 19.1847 19.1847	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664 0.9929 19.7013 19.6413 0.9906 17.9460 0.4618 18.7567 0.0000 18.7567	(85) (86) (87) (88) (89) (90) (91) (92) (93)
West East	98.4762 428.8980	192.6403 521.3983 tture (heati	7.56 6.11 317.2511 636.3529 in the living area, 19 42.7869 3.8525 0.9514 20.2083 19.6356 18.6668 19.3787 19.3787 Mar 0.9320 593.0861 6.5000 1019.9098 1.0000	m2 000 000 462.6918 766.3421 mg area frenil,m (see Apr 43.2985 3.8866 0.8700 20.5568 19.6493 0.8307 19.1478 19.7985 19.7985 Apr 0.8356 640.3391 8.9000 852.8936 1.0000	Solar flux Table 6a W/m2 19.6403 19.6403 567.0461 855.2804 Table 9a) May 43.3956 3.8930 0.7260 20.7902 19.6519 0.6537 19.4294 20.0579 20.0579 May 0.6770 579.0652 11.7000 652.6042	Speci or 580.4726 853.6125 Th1 (C) Jun 43.8533 3.9236 0.5486 20.8960 19.6639 0.4465 19.5431 20.1679 20.1679 Jun 0.4864 415.1960 14.6000 430.2199	Jul 43.8533 3.9236 0.4088 20.9224 19.6639 0.2886 19.5604 20.1894 20.1894 Jul 0.3367 274.6781 16.6000 277.3468	Specific or Tab. 0 0 474.7041 742.6671 Aug 43.9391 3.9293 0.4636 20.9172 19.6661 0.3359 19.5607 20.1872 20.1872 Aug 0.3871 287.4811 16.4000 292.0541	.7000 .7000 .7000 .7000 .7000 .7000 .7060 .7066 .706593 .70659	Oct 43.3956 3.8930 0.9285 20.4913 19.6519 0.8971 19.7321 0ct 0.8933 467.6228 10.6000 713.0549	Nov 43.1997 3.8800 0.9832 20.0436 19.6467 0.9766 18.4475 a / (4) = 19.1847 19.1847	W 54.3067 44.1695 80.9820 403.5064 21.0000 Dec 42.9967 3.8664 0.9929 19.7013 19.6413 0.9906 17.9460 0.4618 18.7567 0.0000 18.7567	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97a) (98)





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling													
Not applicable													
0													
9a. Energy require													
Fraction of space Fraction of space Efficiency of main Efficiency of seco Space heating requ	heat from space hondary/su	m main sy: eating sy:	stem(s) stem 1 (in %)	n (Table 11))						0.0000 1.0000 249.9000 0.0000 1040.5385	(202) (206) (208)
J Space heating requ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
543 Space heating effi	3.3629		317.5569		54.7130	0.0000	0.0000	0.0000	0.0000	182.6014	379.5641	556.7319	(98)
249 Space heating fuel	9.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
217	7.4321	165.1606		61.2402	21.8940	0.0000	0.0000	0.0000	0.0000	73.0698	151.8864	222.7819	(211)
Water heating requ	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													
	0.1983		168.3264	152.3542	150.3601	135.8724	131.9370	142.7823	141.9055	157.9110	165.1381	176.3556	
Efficiency of water (217)m 175 Fuel for water hea	5.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 175.1000	
	2.9116 l used		96.1316	87.0098	85.8710	77.5970	75.3495	81.5433	81.0426	90.1833	94.3108	100.7171 1063.6295	
Space heating fuel Space heating fuel	l - main	system										1040.5385	
Electricity for pu central heating Total electricity Electricity for li	g pump for the	above, kWl		x L)								30.0000 30.0000 233.6495	(231)
Energy saving/gene PV Unit 0 (0.80 * Total delivered en	0.30 * 9	51 * 1.00	es (Appendic) =	es M ,N and	i Q)					-228.1478		-228.1478 2139.6697	
12a. Carbon dioxid													
Space heating - ma Space heating - se Water heating (oth Space and water he	ner fuel)	em 1						Energy kWh/year 1040.5385 0.0000 1063.6295		ion factor kg CO2/kWh 0.5190 0.0000 0.5190		Emissions g CO2/year 540.0395 0.0000 552.0237 1092.0632	(261) (263) (264)
Pumps and fans Energy for lightin	-							30.0000 233.6495		0.5190 0.5190		15.5700 121.2641	(267)
Energy saving/gen PV Unit Total CO2, kg/year Dwelling Carbon Di	r							-228.1478		0.5190		-118.4087 1110.4886 22.0100	(272)
16 CO2 EMISSIONS A DER Total Floor Area Assumed number of CO2 emission factor CO2 emissions from Total CO2 emission Residual CO2 emiss Additional allowath Resulting CO2 emiss Net CO2 emissions	occupant or in Tak n applian n cooking ns sions off ole elect	es ale 12 for aces, equation aces from 1 cricity gen	electricity tion (L14) n (L16) biofuel CHP neration, kW	displaced	from grid		TY GENERATI	ON TECHNOLO	GIES		TFA N EF	22.0100 50.4500 1.7034 0.5190 17.4312 3.1691 42.6103 0.0000 0.0000 42.6103	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7





CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014 (Version 9.92, January 2014) 1. Overall dwelling dimensions Volume (m3) 153.8725 (1b) - (3b) (m) 3.0500 (2b) 50.4500 (1b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)Dwelling volume 50.4500 $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) =$ 153.8725 (5) main secondary total m3 per hour heating 0 0 Number of chimneys Number of open flues 0 * 40 = 0 * 20 = 2 * 10 = 0.0000 (6a) 0.0000 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires 20.0000 (7a) 0.0000 0 * 40 = Air changes per hour 20.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.1300 (8) Pressure test Measured/design AP50 0.3800 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] (21) = (18) x (20) Shelter factor Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 5.1000 5.0000 1.2500 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind speed Wind factor Adj infilt rate 0.4481 0.4393 0.4306 0.3866 0.3778 0.3339 0.3339 0.3251 0.3515 0.3778 0.3954 0.4130 (22b) Effective ac 3. Heat losses and heat loss parameter Openings A x U W/K 1.9100 Element Gross NetArea U-value K-value W/m2K 1.0000 1.3258 0.1300 m2 1.9100 10.7000 4.2500 (26) TER Opaque door TER Opening Type (Uw = 1.40)
Ground Floor 14.1856 0.5525 (27) (28a) Wall 1
Wall 3 - Stairwell
Flat Ceiling - To Stairwell 61.0600 12.6100 48.4500 0.1800 8.7210 (29a) Flat Roof Total net area of external elements Aum(A, m2)1.3000 1.3000 0.1300 0.1690 (30)102.9400 (31) Fabric heat loss, $W/K = Sum (A \times U)$ (26)...(30) + (32) =31.7875 (33) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 5.2488 (36) Total fabric heat loss (33) + (36) =37.0363 (37) Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ Jan 30.4877 Feb 30.2897 Mar 30.0957 Apr 29.1841 May 29.0136 Jul Nov 29.3586 Dec 29.7193 (38) 28.2197 29.0136 Heat transfer coeff 67.5240 Average = Sum(39)m / 12 = 66.7556 (39) 66.2196 (39) 67.3260 67 1320 66 2204 66 0499 65 2560 65 2560 65 1089 65 5618 66 0499 66.3949 Feb Mar Jul Aug 1.2906 1.3092 1.3384 1.3092 1.3345 1.3307 1.3126 1.2935 1.2935 1.3161 1.3232 (40) 1.3126 (40) Days in month 31 28 31 30 31 31 31 30 31 30 31 (41) 4. Water heating energy requirements (kWh/year) 1.7034 (42) 74.6547 (43) Assumed occupancy Average daily hot water use (litres/day) Aug Apr May Jul Sep Daily hot water use 82.1202 Energy conte 121.7819 82.1202 (44) 117.9392 (45) 1174.6093 (45) 79.1340 106.5112 76.1478 73.1616 109.9100 108.6061 95.8222 91.9437 79.3404 73.5206 84.3659 99.4946 Energy content (annual)
Distribution loss (46)m = 18.2673 Total = Sum(45)m = 0.15 x (45)m 15.9767 1 14.3733 13.7916 11.9011 11.0281 17.6909 (46) 12.6549 16.2909 Water storage loss: volume manufacturer declared loss factor is known (kWh/day): 180.0000 (47) 1.5520 (48)



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.12r02



CALCULAT	ION OF T	ARGET E	MISSION	IS 09.	Jan 2014								
Temperature Enter (49) or												0.5400 0.8381	
Total storage	25.9803		25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder co Primary loss	25.9803	23.4661	25.9803		25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	25.9803 23.2624			25.1422 22.5120	25.9803 23.2624	
Total heat req	uired for w 171.0245	vater heati 150.9884	ng calculate 159.1527	ed for each 143.4764	n month 141.1864	126.9946	122.7632	133.6086	133.0277	148.7373	156.2603	167.1819	(62)
Solar input Output from w/	0.0000 h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 Solar inp		0.0000 months) = S	0.0000 um(63)m =	0.0000	
	171.0245			143.4764	141.1864	126.9946	122.7632			148.7373 h/year) = S			
Heat gains fro	m water hea 79.8866	70.9968	month 75.9392	69.9842	69.9654	64.5040	63.8397	67.4458	66.5100	72.4761	74.2349	78.6089	(65)
5. Internal ga													
Metabolic gain	s (Table 5)	, Watts									-		
(66)m Lighting gains	85.1678				May 85.1678			Aug 85.1678	Sep 85.1678	Oct 85.1678	Nov 85.1678	Dec 85.1678	(66)
ppliances gai	13.2578	11.7754	9.5764	7.2500	5.4194	4.5753	4.9438	6.4261	8.6251	10.9516	12.7821	13.6262	(67)
ooking gains	148.4026	149.9426	146.0620	137.8005	127.3720	117.5706	111.0227	109.4827	113.3634	121.6248	132.0533	141.8547	(68)
umps, fans	31.5168		31.5168	31.5168	31.5168 3.0000		31.5168	31.5168 3.0000	31.5168 3.0000	31.5168 3.0000	31.5168 3.0000	31.5168 3.0000	
osses e.g. ev	aporation -68.1342	negative v -68.1342	alues) (Tab	le 5)	-68.1342	-68.1342	-68.1342	-68.1342	-68.1342	-68.1342	-68.1342	-68.1342	
Mater heating	107.3745		102.0688	97.2003	94.0395	89.5890	85.8061	90.6530	92.3751	97.4141	103.1040	105.6572	(72)
otal internal		318.9183	309.2576	293.8012	278.3813	263.2852	253.3229	258.1122	265.9139	281.5408	299.4898	312.6885	(73)
. Solar gains													
Jan]			A	rea m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	or	Gains W	
ast					19.6403 19.6403					0.77		28.8111	
est			5.9	000 	19.6403		0.6300	0	.7000	0.77	00	35.4137	(80)
olar gains otal gains	64.2248 384.8100	125.6374 444.5557	206.9069 516.1644	301.7613 595.5625	369.8198 648.2011	378.5764 641.8616	360.4202 613.7431	309.5956 567.7078	240.6412 506.5552	149.0793 430.6202	80.0808 379.5706	52.8154 365.5038	
. Mean intern													
emperature du												21.0000	(85)
Jtilisation fa	ctor for ga	ins for li		nil,m (see	Table 9a)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
au lpha til living ar	4.4590				53.0428 4.5362					53.0428 4.5362	52.7672 4.5178		
cii iiving ar	0.9945	0.9889	0.9717	0.9169	0.7967	0.6157	0.4600	0.5139	0.7710	0.9515	0.9893	0.9956	(86)
IT h 2 til rest of h	19.6593 19.8108	19.8396 19.8139	20.1496 19.8169	20.5386 19.8310		20.9593 19.8459	20.9913 19.8459	20.9859 19.8482	20.8879 19.8412	20.4985 19.8336	20.0109 19.8283	19.6328 19.8227	
III rest of n	0.9927 18.0569	0.9852 18.3206	0.9620 18.7678	0.8889 19.3161		0.5189 19.8213	0.3434 19.8431	0.3921 19.8431	0.6821 19.7593	0.9291 19.2777	0.9850 18.5812		
iving area fr			19.4060	19.8807		20.3469	20.3734	20.3709		Living are		0.4618	(91)
emperature ad djusted MIT	justment		19.4060	19.8807		20.3469	20.3734	20.3709	20.2805			0.0000	(93)
3. Space heati	ng requirem	nent											
									~			_	
Jtilisation Jseful gains Ext temp.	Jan 0.9905 381.1545 4.3000				490.2007	Jun 0.5624 361.0126 14.6000	Jul 0.3975 243.9725 16.6000	Aug 0.4486 254.6778 16.4000	Sep 0.7187 364.0365 14.1000	Oct 0.9292 400.1489 10.6000	Nov 0.9821 372.7804 7.1000	362.6973	(95)
Heat loss rate	W 978.8924	950.7855	866.4048	727.1450	561.6866	375.0200	246.2373	258.5414	405.2071	610.4017	806.1348	972.5245	(97)
Month fracti Space heating			1.0000 276.7855			0.0000	0.0000	0.0000	0.0000	1.0000	1.0000		
Space heating Space heating		J-J.JJ20	2.0.1000	171.//00	55.1000	5.0000	0.0000	0.0000	0.0000) / (4) =	2184.2118 43.2946	(98)
8c. Space cool													
ot applicable													



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.12r02



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirement	s - Individua	l heating s	ystems, inc	luding micr	o-CHP							
Fraction of space heat Fraction of space heat Efficiency of main spa Efficiency of secondar Space heating requirem	from seconda from main sy ce heating sy y/supplementa	ry/suppleme stem(s) stem 1 (in	ntary system)						0.0000 1.0000 93.5000 0.0000 2336.0554	(202) (206) (208)
Jan Space heating requirem	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
444.717	0 345.5926	276.7855	141.7766	53.1855	0.0000	0.0000	0.0000	0.0000	156.4281	312.0151	453.7114	(98)
Space heating efficien 93.500	0 93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (ma 475.633		stem) 296.0273	151.6327	56.8829	0.0000	0.0000	0.0000	0.0000	167.3028	333.7060	485.2528	(211)
Water heating requirem 0.000		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 requirem 171.024		159.1527	143.4764	141.1864	126.9946	122.7632	133.6086	133.0277	148.7373	156.2603	167.1819	(64)
Efficiency of water he (217)m 87.250	ater	86.2766	84.7821	82.4680	79.8000	79.8000	79.8000	79.8000	84.9484	86.6241	79.8000 87.3465	(216)
Fuel for water heating	, kWh/month	184.4680	169.2296	171.2015	159.1411	153.8386	167.4293	166.7014	175.0914	180.3889	191.4009	
Water heating fuel use Annual totals kWh/year		104.4000	103.2230	171.2013	133.1411	133.0300	107.4233	100.7014	173.0314	100.3003	2088.5459	
Space heating fuel - m Space heating fuel - s											2336.0554	
Electricity for pumps central heating pum main heating flue f Total electricity for Electricity for lighti Total delivered energy	p an the above, kW ng (calculate	d in Append	ix L)								30.0000 45.0000 75.0000 234.1364 4733.7377	(230e) (231) (232)
12a. Carbon dioxide em												
Space heating - main s Space heating - second Water heating (other f Space and water heatin	ary uel)						Energy kWh/year 2336.0554 0.0000 2088.5459		ion factor kg CO2/kWh 0.2160 0.0000 0.2160	k	Emissions g CO2/year 504.5880 0.0000 451.1259 955.7139	(263) (264)
Pumps and fans Energy for lighting Total CO2, kg/m2/year Emissions per m2 for s Fuel factor (electrici Emissions per m2 for l Emissions per m2 for p Target Carbon Dioxide	pace and wate ty) ighting umps and fans		8.9438 * 1.	55) + 2.408	7 + 0.7716,	rounded to	75.0000 234.1364 2 d.p.		0.5190 0.5190		38.9250 121.5168 1116.1557 18.9438 1.5500 2.4087 0.7716 32.5400	(267) (268) (272) (272a) (272b) (272c)





Property Reference	0007-Godsmark-Royal-Co	llege-F3			Issued on Date	13/08/2020
Assessment	AD			Prop Type Ref	Flat 3	
Reference Property	Flat 3, 154, Royal College	Street, Londo	n, NW1 0TA			
SAP Rating		83 B	DER	23.34	TER	34.83
Environmental		85 B	% DER <ter< th=""><th></th><th>32.99</th><th></th></ter<>		32.99	
CO ₂ Emissions (t/y	ear)	0.98	DFEE	67.08	TFEE	68.49
General Requirem	ents Compliance	Pass	% DFEE <tfe< th=""><th>Ε</th><th>2.05</th><th></th></tfe<>	Ε	2.05	
Assessor Details	Mr. Andrew Gwynne, Andrew andrew.gwynne@mesenergy			5,	Assessor ID	P741-0001
Client						





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

	REFORT - APPLOV	red Document L1A, 2013 Edition, England	
DWELLING AS DES	IGNED		
Ground-floor fl	at, total floor area 51	. m²	
It is not a com	ers items included with plete report of regulat	in the SAP calculations.	
la TER and DER Fuel for main h Fuel factor:1.5 Target Carbon D Dwelling Carbon	eating:Electricity	(DER) 23.34 kgCO□/m²OK	
1b TFEE and DFE Target Fabric E Dwelling Fabric	E nergy Efficiency (TFEE) Energy Efficiency (DFE	68.5 kWh/m²/yr	
2 Fabric U-valu	es		
Element External wall	Average 0.23 (max. 0.30)	Highest 0.44 (max. 0.70) OK	
Party wall	0.23 (max. 0.30) 0.00 (max. 0.20)	- OK	
Floor	0.00 (max. 0.20) 0.21 (max. 0.25) 0.16 (max. 0.20)	0.21 (max. 0.70) OK	
Roof	0.16 (max. 0.20) 1.40 (max. 2.00)	0.21 (max. 0.35) OK	
Openings	1.40 (max. 2.00)	1.40 (max. 3.30) OK	
2a Thermal brid	ging	-specified y-value of 0.067	
3 Air permeabil			
Air permeabilit Maximum	y at 50 pascals:	5.10 (design value) 10.0	ОК
4 Heating effic Main heating sy Air-to-water he	iency stem:	Heat pump with radiators or underflo	or - Electric
Secondary heati	na custom.	None	
	ing system.	None	
E Couldedow dear			
	lation ge	Measured cylinder loss: 2.10 kWh/day	
Hot water stora Permitted by DB	ge SCG 2.10	Measured cylinder loss: 2.10 kWh/day OK	
Hot water stora Permitted by DB Primary pipewor	ge SCG 2.10 k insulated:		ок
Hot water stora Permitted by DB Primary pipewor	ge SCG 2.10 k insulated:	OK	
Hot water stora Permitted by DB Primary pipewor	ge SCG 2.10 k insulated:	OK	
Hot water stora Permitted by DB Primary pipewor 6 Controls	ge SCG 2.10 k insulated:	OK Yes	OK
Hot water stora Permitted by DB Primary pipewor 6 Controls	ge SCG 2.10 k insulated:ontrols:	OK Yes Time and temperature zone control Cylinderstat	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c	ge SCG 2.10 k insulated:ontrols:	OK Yes Time and temperature zone control	ок
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c	ge SCG 2.10 k insulated: ontrols:	OK Yes Time and temperature zone control Cylinderstat	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr	ge SCG 2.10 k insulated: ontrols: ols: ghts	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr	ge SCG 2.10 k insulated: ontrols: ols: ghts ixed lights with low-en	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum	ge SCG 2.10 k insulated: ontrols: ols: ghts ixed lights with low-en	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100%	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable	ge SCG 2.10 k insulated: ontrols: ols: ghts ixed lights with low-en ntilation	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100%	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable 9 Summertime te	ge SCG 2.10 k insulated: ontrols: ols: ghts ixed lights with low-en ntilation	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100%	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable 9 Summertime te Overheating ris Based on: Overshading:	ge SCG 2.10 k insulated:	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100% 75% Slight Average	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water controls 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable Overheating ris Based on: Overshading: Windows facing	ge SCG 2.10 k insulated:	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100% 75% Slight Average 6.10 m², No overhang	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable	ge SCG 2.10 k insulated:	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100% 75% Slight Average 6.10 m², No overhang 3.83 m², No overhang	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable Overheating ris Based on: Overshading: Windows facing Windows facing Windows facing Air change rate Blinds/curtains	ge SCG 2.10 k insulated:	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100% 75% Slight Average 6.10 m², No overhang	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable 9 Summertime te Overshading: Windows facing Windows facing Windows facing Air change rate Blinds/curtains	ge SCG 2.10 k insulated:	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100% 75% Slight Average 6.10 m², No overhang 3.83 m², No overhang 3.83 m², No overhang 6.00 ach	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable Overheating ris Based on: Overshading: Windows facing Windows facing Windows facing Air change rate Blinds/curtains	ge SCG 2.10 k insulated:	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100% 75% Slight Average 6.10 m², No overhang 3.83 m², No overhang 3.83 m², No overhang 6.00 ach	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water controls The controls	ge SCG 2.10 k insulated:	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW ergy fittings:100% 75% Slight Average 6.10 m², No overhang 3.83 m², No overhang 6.00 ach None 0.13 W/m²K 0.00 W/m²K	OK OK
Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable	ge SCG 2.10 k insulated:	OK Yes Time and temperature zone control Cylinderstat Independent timer for DHW dergy fittings:100% 75% Slight Average 6.10 m², No overhang 3.83 m², No overhang 6.00 ach None 0.13 W/m²K	OK OK





CALCULATION	ON OF D	WELLIN	G EMISSI	ONS FOR	REGULAT	IONS CC	JIVIPLIAN	CE 05	Jan 2014				
SAP 2012 WORKSH CALCULATION OF	EET FOR Nev	w Build (A	s Designed)	(Version	9.92, Januar								
1. Overall dwel	ling dimen:	sions											
Ground floor Total floor are Dwelling volume		a) + (1b) + (1	c)+(1d)+(1e))(1n)	5	31.3900		Area (m2) 51.3900		y height (m) 3.0500 (3d)+(3e)		Volume (m3) 156.7395 156.7395	(1b) - (3 (4) (5)
2. Ventilation													
Number of chimn Number of open Number of inter Number of passi Number of fluel	flues mittent far ve vents				main heating 0 0		econdary heating 0 0	+ +	other 0 = 0 =	tot	0 * 40 = 0 * 20 = 2 * 10 = 0 * 40 = 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	eys, flues	and fans	= (6a)+(6b)	+(7a)+(7b)+	(7c) =				20.0000	Air change / (5) =	0.1276 Yes 5.1000 0.3826	
Shelter factor Infiltration ra	ite adjusted	d to inclu	de shelter :	Factor					(20) = 1 - (21		(19)] = x (20) =	0.9250 0.3539	
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	0.4512 0.6018	0.4424 0.5979	0.4335 0.5940	0.3893 0.5758	0.3804 0.5724	0.3362 0.5565	0.3362 0.5565	0.3274 0.5536	0.3539 0.5626	0.3804 0.5724	0.3981 0.5793	0.4158 0.5865	
Element Window (Uw = 1. Door Glazed Door (Uw Floor 2 - To St Wall 1 Wall 3 - Stairw Flat Ceiling - Flat Roof Total net area Fabrich eat los	40) 7 = 1.40) airwell rell To Stairwell of external	oss parame	ter Aum(A, m2)			Net 3. 1. 6. 8. 63. 28. 5.	Marea m2 8300 9100 1000 4600 1900 8300 8000 7700 8900	U-value W/m2K 1.3258 1.4000 1.3258 0.2143 0.1300 0.4400 0.2143 0.1400	A x U W/K 5.0777 2.6740 8.0871 1.8131 8.2147 12.6852 1.2430 1.7878	2 6	-value kJ/m2K 0.0000 0.0000 9.0000 9.0000 9.0000	A x K kJ/K 169.2000 3791.4000 259.4700 52.2000 114.9300	(27) (26) (27) (28b) (29a) (29a) (30)
Party Wall 1 Party Floor 1 Party Ceilings Stud Wall		um (P X 0)				42. 38.	6800 9300 6200 9400	0.0000	0.0000	4 8 8	5.0000 0.0000 0.0000 9.0000	930.6000 3434.4000 3089.6000 458.4600	(32) (32d) (32b)
Heat capacity C Thermal mass pa Thermal bridges Total fabric he	rameter (The (The (User def:	MP = Cm /			area)			(28)	(30) + (32)		(32e) = + (36) =	12300.2600 239.3512 8.7696 50.3522	(35) (36)
Ventilation hea (38)m Heat transfer c	Jan 31.1277	Feb 30.9233	Mar 30.7228	= 0.33 x (2 Apr 29.7814	25)m x (5) May 29.6053	Jun 28.7854	Jul 28.7854	Aug 28.6335	Sep 29.1012	Oct 29.6053	Nov 29.9616	Dec 30.3341	(38)
Average = Sum(3	81.4799	81.2754	81.0750	80.1336	79.9575	79.1375	79.1375	78.9857	79.4534	79.9575	80.3138	80.6863 80.1327	
HLP HLP (average) Days in month	Jan 1.5855	Feb 1.5815	Mar 1.5776	Apr 1.5593	May 1.5559	Jun 1.5399	Jul 1.5399	Aug 1.5370	Sep 1.5461	Oct 1.5559	Nov 1.5628	Dec 1.5701 1.5593	
	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heatin	g energy re	equirement:	s (kWh/year))								1.7311	(42)
													/
Assumed occupan Average daily h		se (litres	/day) Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	75.3130 Dec	(43)



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.12r02



March Marc	CALCULATION OF	DWELLIN	G EMISSI	ONS FOR	R REGULA	TIONS CO	OMPLIAN	ICE 09	Jan 2014				
Part											(45)		(45)
Section	Distribution loss (46)m			14.5001	13.9132	12.0060	11.1253	12.7665	12.9190				
Total political politica	Store volume a) If manufacturer decl Temperature factor fro	m Table 2b	actor is kno	own (kWh/d	lay):							2.1000 0.5400	(48) (49)
Part	Total storage loss		35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200		
The last register for water least to graph plants for each 1900 plant legist of 1900 000 000 000 000 000 000 000 000 00	35.1540	31.7520	35.1540										
Sealer March Color Col	Total heat required for	water heati	ng calculate	ed for each	month								
Tell paties	Solar input 0.0000							0.0000	0.0000	0.0000	0.0000	0.0000	(63)
S. Teternal put not See Table See Se	181.2721			153.1992	151.1709	136.5720	132.5853						
Note				77.3674	77.5740	71.8389	71.3943	75.0321	73.8626	80.1068	81.6556	86.2937	(65)
Marting palms Palmis Pal	5. Internal gains (see T	able 5 and 5	5a)										
Column C	Metabolic gains (Table 5), Watts							Sen	Oct	Nov	Dec	
No. 1.506	(66)m 86.5537	86.5537	86.5537	86.5537	86.5537	86.5537							(66)
The conting pairs 150.6433 150.6452 150.6452 140.6557 121.6457 119.5064 112.8455 111.2815 119.2277 121.2525 134.2525 134.1285 141.2816 181.2815 150.2615 13.6554 13.6554 13.6554 13.6554 13.6554 13.6555	13.5962	12.0760	9.8209	7.4350	5.5578	4.6921		6.5902	8.8453	11.2312	13.1084	13.9741	(67)
March	150.8432	152.4085	148.4640	140.0667	129.4667	119.5041	112.8485	111.2832	115.2277	123.6250	134.2250	144.1876	(68)
March	31.6554 Pumps, fans 3.0000	31.6554 3.0000	31.6554 3.0000	31.6554 3.0000	31.6554	31.6554	31.6554						
Trans					-69.2430	-69.2430	-69.2430	-69.2430	-69.2430	-69.2430	-69.2430	-69.2430	(71)
Second Part	117.7186		112.3662	107.4548	104.2661	99.7763	95.9600	100.8497	102.5870	107.6704	113.4105	115.9862	(72)
Calcing Table Calcing Tabl		332.4295	322.6172	306.9227	291.2567	275.9386	265.8447	270.6892	278.6261	294.4927	312.7101	326.1140	(73)
Seat 1.8	6. Solar gains												
Total gains 406.0262 473.0852 554.2572 644.7557 705.2837 699.7690 669.3485 617.2930 548.0329 461.3925 402.3635 385.2427 (84) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature adjustment Temperature adjustment Jan 2	[Jan]		A	rea m2	Solar flux Table 6a W/m2	Speci:	g fic data Table 6b	Specific or Tabl		facto	or		
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (C) Temperature during heating periods in the living area from Table 9, Th1 (C) Utilisation factor for gains for living area, ml,m (see Table 9a) Table 9, Th1 (C) Table 9, Th1 ([Jan] West		A: 3.8: 6.10	rea m2 300 000	Solar flux Table 6a W/m2 19.6403 19.6403	Speci: or !	g fic data Table 6b 0.7600 0.7600	Specific or Tabl	data le 6c	facto Table 6	or 5d	W 27.7326	
Temperature during heating periods in the living area from Table 9, Thi (C) Utilisation factor for gains for living area, ni,m (see Table 9) Utilisation factor for gains for living area, ni,m (see Table 9) Utilisation factor for gains for living area, ni,m (see Table 9a) Utilisation factor for gains for living area Name Apr May	[Jan] West East Solar gains 71.9021	140.6557	3.83 6.10 231.6399	rea m2 300 000 337.8330	Solar flux Table 6a W/m2 19.6403 19.6403	Speci: or '	g fic data Table 6b 0.7600 0.7600	Specific or Table 0.00000000000000000000000000000000000	data le 6c .7000 .7000	facto Table 6 0.770 0.770	900 000 89.6534	W 27.7326 44.1695 59.1288	(76)
Mar	West East Solar gains 71.9021 Total gains 406.0262	140.6557 473.0852	3.8: 6.1(231.6399 554.2572	300 300 337.8330 644.7557	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837	Speci: or:	gfic data Table 6b 0.7600 0.7600 403.5038 669.3485	Specific or Tabi	data le 6c .7000 .7000	facto Table 6 0.770 0.770	900 000 89.6534	W 27.7326 44.1695 59.1288	(76)
will living area 0.9929 0.9866 0.9690 0.9189 0.8142 0.6519 0.4996 0.5552 0.7947 0.9511 0.9872 0.9942 (86) MIT 19.6736 19.6247 20.0910 20.4330 20.7066 20.8638 20.9120 20.9031 20.7813 20.4123 19.9831 19.6511 (87) Th 2 19.6240 19.6269 19.6298 19.6433 19.6458 19.6577 19.6577 19.6599 19.6531 19.6468 19.6407 19.6354 (88) will rest of house 0.9905 0.9821 0.9583 0.8903 0.7504 0.5420 0.3570 0.4089 0.7010 0.9276 0.9820 0.9922 (89) MIT 2 17.8946 18.1159 18.9870 19.3383 19.5149 19.5498 19.5490 19.4404 18.9731 18.3578 17.8701 (90) Living area fraction 18.9352 19.1154 19.4308 19.8328 20.1387 20.3039 20.3466 20.3407 20.2248 19.8150 19.3085 18.	West East Solar gains 71.9021 Total gains 406.0262 7. Mean internal tempera	140.6557 473.0852 ture (heating	3.8: 6.1(231.6399 554.2572 ng season)	m2 300 000 337.8330 644.7557	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837	Speci: or '	gfic data Table 6b 0.7600 0.7600 403.5038 669.3485	Specific or Tabi	data le 6c .7000 .7000	facto Table 6 0.770 0.770	900 000 89.6534	W 27.7326 44.1695 59.1288 385.2427	(76) (83) (84)
Th 2	West East Solar gains 71.9021 Total gains 406.0262 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 41.9335	140.6557 473.0852 ture (heating periods : lains for ling Feb 42.0390	3.8: 6.1(231.6399 554.2572 g season) in the living area, 1 Mar 42.1430	337.8330 644.7557 g area froil,m (see Apr 42.6380	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 mm Table 9, T Table 9a) May 42.7320	Speci: or / 423.8304 699.7690	gfic data Table 6b 0.7600 0.7600 403.5038 669.3485	Specific or Table	data le 6c .7000 .7000 .269.4068 .548.0329	factor Table 6 0.77(0.770 166.8999 461.3925	89.6534 402.3635	W 27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460	(76) (83) (84)
0.9905 0.9821 0.9583 0.8903 0.7504 0.5420 0.3570 0.4089 0.7010 0.9276 0.9820 0.9922 (89)	West East Solar gains 71.9021 Total gains 406.0262 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 41.9335 alpha 3.7956 util living area	140.6557 473.0852 ture (heating periods : ains for lings	3.83 6.10 231.6399 554.2572 ing season) in the livir ving area, 1 Mar 42.1430 3.8095	337.8330 644.7557 area frc ii, m (see Apr 42.6380 3.8425	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 m Table 9a, T Table 9a) May 42.7320 3.8488	Speci: or / 423.8304 699.7690 th1 (C) Jun 43.1747 3.8783	gfic data rable 6b 0.7600 0.7600 403.5038 669.3485 Jul 43.1747 3.8783	Specific or Tab: 0.0. 346.6038 617.2930 Aug 43.2577 3.8838	data Le 6c .7000 .7000 .269.4068 548.0329 	factor Table 6 0.770 0.770 166.8999 461.3925	89.6534 402.3635 Nov 42.5424 3.8362	27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460 3.8231	(76) (83) (84) (85)
MIT 18.9352 19.1154 19.4308 19.8328 20.1387 20.3039 20.3466 20.3407 20.2248 19.8150 19.3085 18.9119 (92) Temperature adjustment adjustment 18.9352 19.1154 19.4308 19.8328 20.1387 20.3039 20.3466 20.3407 20.2248 19.8150 19.3085 18.9119 (93) 8. Space heating requirement Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation 0.9889 0.9799 0.9564 0.8949 0.7758 0.5977 0.4323 0.4861 0.7449 0.9312 0.9804 0.9908 (94) Useful gains 401.5146 463.5876 530.0871 576.9881 547.1811 418.2268 289.3412 300.0614 408.2185 429.6464 394.4724 381.7045 (95) Ext temp. 4.3000 4.9000 6.5000 8.9000 11.7000 14.6000 16.6000 16.4000 14.1000 10.6000 7.1000 4.2000 (96) Heat loss rate W 1192.4760 1155.3657 1048.3665 876.0860 674.7348 451.3951 296.4972 311.2573 486.6332 736.8045 980.5103 1187.0461 (97) Month fracti 1.0000 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 kWh 588.4752 464.8748 385.5998 215.3505 94.8999 0.0000 0.0000 0.0000 0.0000 0.0000 228.5256 421.9473 599.1742 (98) Space heating	West East	140.6557 473.0852 ture (heatir- ng periods: ains for liv Feb 42.0390 3.8026 0.9866 19.8247	3.83 6.10 231.6399 554.2572 231.6399 554.2572 in the living area, 19 Mar 42.1430 3.8095 0.9690 20.0910	337.8330 644.7557 g area froil,m (see Apr 42.6380 3.8425 0.9189 20.4330	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 m Table 9, T Table 9a) May 42.7320 3.8488 0.8142 20.7066	423.8304 699.7690 Th1 (C) Jun 43.1747 3.8783 0.6519 20.8638	Jul 43.1747 3.8783 0.4996 20.9120	Specific or Table of	data le 6c .7000 .7000 269.4068 548.0329 Sep 43.0031 3.8669 0.7947 20.7813	factor Table 6 0.770 0.770 166.8999 461.3925 Oct 42.7320 3.8488 0.9511 20.4123	Nov 42.5424 3.8362 0.9872	27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460 3.8231 0.9942 19.6511	(83) (84) (85) (86) (87)
8. Space heating requirement 3	West East	140.6557 473.0852 tture (heating periods sains for live Feb 42.0390 3.8026 0.9866 19.8247 19.6269	3.83 6.1(231.6399 554.2572 ang season) in the living area, in Mar 42.1430 3.8095 0.9690 20.0910 19.6298 0.9583	337.8330 644.7557 og area frc iil,m (see Apr 42.6380 3.8425 0.9189 20.4330 19.6433	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 mm Table 9, 1 Table 9a) May 42.7320 3.8488 0.8142 20.7066 19.6458 0.7504	Speci:	Jul 43.1747 3.8783 0.4996 20.9120 19.6577 0.3570	Specific or Tabi 0.0 346.6038 617.2930 Aug 43.2577 3.8838 0.5552 20.9031 19.6599 0.4089	data le 6c .7000 .7000 269.4068 548.0329 Sep 43.0031 3.8669 0.7947 20.7813 19.6531 0.7010 19.4404	factor Table 6 0.770 0.770 166.8999 461.3925 Oct 42.7320 3.8488 0.9511 20.4123 19.6458 0.9276 18.9731	Nov 42.5424 3.8362 0.9872 19.9831 19.6407 0.9820 18.3578	27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460 3.8231 0.9942 19.6511 19.6554 0.9922 17.8701	(83) (84) (85) (86) (87) (88) (89) (90)
8. Space heating requirement Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation 0.9889 0.9799 0.9564 0.8949 0.7758 0.5977 0.4323 0.4861 0.7449 0.9312 0.9804 0.9908 (94) Useful gains 401.5146 463.5876 530.0871 576.9881 547.1811 418.2268 289.3412 300.0614 408.2185 429.6464 394.4724 381.7045 (95) Ext temp. 4.3000 4.9000 6.5000 8.9000 11.7000 14.6000 16.6000 16.4000 14.1000 10.6000 7.1000 4.2000 (96) Heat loss rate W North fracti 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 0.0000 0.0000 0.0000 1.0000 1.0000 1.0000 (97a) Space heating kWh 588.4752 464.8748 385.5998 215.3505 94.8999 0.0000 0.0000 0.0000 0.0000 228.5256 421.947 5991.874 (98) Space heating	West East Total gains 71.9021 Total gains 406.0262 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 41.9335 alpha 3.7956 util living area 0.9929 MIT 19.6736 Th 2 19.6240 util rest of house 0.9905 MIT 2 17.8946 Living area fraction MIT 18.9352	140.6557 473.0852 ture (heatir- ng periods: ains for liv Feb 42.0390 3.8026 0.9866 19.8247 19.6269 0.9821 18.1159	3.83 6.10 231.6399 554.2572 231.6399 554.2572 in the living area, 1 Mar 42.1430 3.8095 0.9690 20.0910 19.6298 0.9583 18.5005	337.8330 644.7557 ag area frc ii,m (see Apr 42.6380 3.8425 0.9189 20.4330 19.6433 0.8903 18.9870	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 m Table 9a) May 42.7320 3.8488 0.8142 20.7066 19.6458 0.7504 19.3383	423.8304 699.7690 Th1 (C) Jun 43.1747 3.8783 0.6519 20.8638 19.6577 0.5420 19.5149	Jul 43.1747 3.8783 0.4996 20.9120 19.5498	Aug 43.2577 3.8838 0.5552 20.9031 19.6599 0.4089 19.5480	data Le 6c .7000 .7000 269.4068 548.0329 Sep 43.0031 3.8669 0.7947 20.7813 19.6531 0.7010 19.4404 fLA =	factor Table 6 0.776 0.776 166.8999 461.3925 Oct 42.7320 3.8488 0.9511 20.4123 19.6458 0.9276 618.9731 Living area	Nov 42.5424 3.8362 0.9872 19.9831 19.6407 0.9820 18.3578	27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460 3.8231 0.9942 19.6511 19.6354 0.9922 17.8701 0.5849 18.9119	(85) (86) (87) (88) (89) (90) (91)
Space heating With Space	West East Solar gains 71.9021 Total gains 406.0262 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 41.9335 alpha 3.7956 util living area 0.9929 MIT 19.6736 Th 2 19.6240 util rest of house 0.9905 MIT 2 17.8946 Living area fraction MIT 18.9352 Temperature adjustment	140.6557 473.0852 ture (heating periods rains for livel Feb 42.0390 3.8026 0.9866 19.8247 19.6269 0.9821 18.1159	3.8: 6.1(231.6399 554.2572 ing season) in the livir ving area, 1 Mar 42.1430 3.8095 0.9690 20.0910 19.6298 0.9583 18.5005 19.4308	337.8330 644.7557 ag area frc nil,m (see Apr 42.6380 3.8425 0.9189 20.4330 19.6433 0.8903 18.9870 19.8328	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 m Table 9a, T Table 9a) May 42.7320 3.8488 0.8142 20.7066 19.6458 0.7504 19.3383 20.1387	423.8304 699.7690 **h1 (C) Jun 43.1747 3.8783 0.6519 20.8638 19.6577 0.5420 19.5149 20.3039	Jul 43.1747 3.8783 0.4996 20.9120 19.5498 20.3466	Aug 43.2577 3.8838 0.5552 20.9031 19.6599 0.4089 19.5480 20.3407	data le 6c .7000 .7000 .7000 .7000 269.4068 548.0329 Sep 43.0031 3.8669 0.7947 20.7813 19.6531 0.7010 19.4404 fla = 20.2248	factor Table 6 0.770 0.770 166.8999 461.3925 Oct 42.7320 3.8488 0.9511 20.4123 19.6458 0.9276 18.9731 Living area 19.8150	Nov 42.5424 3.8362 0.9872 19.9831 19.6407 0.9820 18.3578 a / (4) = 19.3085	27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460 3.8231 0.9942 19.6551 19.6354 0.9922 27.8701 0.5849 18.9119 0.0000	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Utilisation 0.9889 0.9799 0.9564 0.8949 0.7758 0.5977 0.4223 0.4661 0.7449 0.9312 0.9804 0.9908 (94) Useful gains 401.5146 463.5876 530.0871 576.9881 547.1811 418.2268 289.3412 300.0614 408.2185 429.6464 394.4724 381.7045 (95) Ext temp. 4.3000 4.9000 6.5000 8.9000 11.7000 14.6000 16.6000 16.4000 14.1000 10.6000 7.1000 4.2000 (96) Heat loss rate W Month fracti 1.0000 1.55.3657 1048.3665 876.0860 674.7348 451.3951 296.4972 311.2573 486.6332 736.8045 980.5103 1187.0461 (97) Month fracti 1.0000 1.0000 1.0000 1.0000 1.0000 0.0000 0.0000 0.0000 0.0000 1.0000 1.0000 (97a) Space heating kWh Space heating Space Space heating Space Space heating Space Space heating Space	West East Total gains 71.9021 Total gains 406.0262 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 41.935 alpha 3.7956 util living area 0.9929 MIT 19.6736 Th 2 19.6240 util rest of house 0.9905 MIT 2 17.8946 Living area fraction MIT 18.9352 Temperature adjustment adjusted MIT 18.9352	140.6557 473.0852 ture (heating periods and for live response of the response	3.83 6.10 231.6399 554.2572 ang season) in the living area, 11 Mar 42.1430 3.8095 0.9690 20.0910 19.6298 0.9583 18.5005 19.4308 19.4308	337.8330 644.7557 ag area frc iil,m (see Apr 42.6380 3.8425 0.9189 20.4330 19.6433 0.8903 18.9870 19.8328	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 mm Table 9, T Table 9a) May 42.7320 3.8488 0.8142 20.7066 19.6458 0.7504 19.3383 20.1387 20.1387	Speci:	Jul 43.1747 3.8783 0.4996 20.9120 19.5498 20.3466 20.3466	Aug 43.2577 3.8838 0.5552 20.9031 19.6599 0.4089 19.5480 20.3407 20.3407	data le 6c .7000 .7000 .7000 .7000 269.4068 548.0329 Sep 43.0031 3.8669 0.7947 20.7813 19.6531 0.7010 19.4404 fla = 20.2248	factor Table 6 0.770 0.770 166.8999 461.3925 Oct 42.7320 3.8488 0.9511 20.4123 19.6458 0.9276 18.9731 Living area 19.8150	Nov 42.5424 3.8362 0.9872 19.9831 19.6407 0.9820 18.3578 a / (4) = 19.3085	27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460 3.8231 0.9942 19.6551 19.6354 0.9922 27.8701 0.5849 18.9119 0.0000	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
1192.4760 1155.3657 1048.3665 876.0860 674.7348 451.3951 296.4972 311.2573 486.6332 736.8045 980.5103 1187.0461 (97) Month fracti	West East Solar gains 71.9021 Total gains 406.0262 7. Mean internal tempera Temperature during heati Utilisation factor for gains alpha 3.7956 util living area 0.9929 MIT 19.6736 Th 2 19.6240 util rest of house 0.9905 MIT 2 17.8946 Living area fraction MIT 18.9352 Temperature adjustment adjusted MIT 18.9352	140.6557 473.0852 ture (heating periods: ains for live periods: ain	3.83 6.10 231.6399 554.2572 Ing season) in the livir ving area, 1 Mar 42.1430 3.8095 0.9690 20.0910 19.6298 0.9583 18.5005 19.4308 19.4308	337.8330 644.7557 337.8330 644.7557 ag area froil,m (see Apr 42.6380 3.8425 0.9189 20.4330 19.6433 0.8903 18.9870 19.8328 19.8328	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 m Table 9a, T Table 9a) May 42.7320 3.8488 0.8142 20.7066 19.6458 0.7504 19.3383 20.1387 20.1387	Speci: or / 423.8304 699.7690 423.8747 3.8783 0.6519 20.8638 19.6577 0.5420 19.5149 20.3039 20.3039	Jul 43.1747 3.8783 0.4996 20.9120 19.5498 20.3466 20.3466	Aug 43.2577 3.8838 0.5552 20.9031 19.6599 0.4089 19.5480 20.3407	Sep 43.0031 3.8669 0.7947 20.7813 19.6531 0.7010 19.4404 fLA = 20.2248 20.2248	factor Table 6 0.77(0.77(0.77(166.8999 461.3925 Oct 42.7320 3.8488 0.9511 20.4123 19.6458 0.9276 618.9731 Living area 19.8150 19.8150	Nov 42.5424 3.8362 0.9872 19.9831 19.6407 0.9878 19.3085	27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460 3.8231 0.9942 19.6511 19.6354 0.9922 17.8701 0.5849 18.9119 0.0000 18.9119	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
588.4752 464.8748 385.5998 215.3505 94.8999 0.0000 0.0000 0.0000 0.0000 228.5256 421.9473 599.1742 (98) Space heating 2998.8474 (98)	West East	140.6557 473.0852 ture (heating periods: ains for liver periods: ains for liv	3.83 6.1(231.6399 554.2572 231.6399 554.2572 in the living area, 1 Mar 42.1430 3.8095 0.9690 20.0910 19.6298 0.9583 18.5005 19.4308 19.4308 19.4308	337.8330 644.7557 337.8330 644.7557 ag area froil, m (see Apr 42.6380 3.8425 0.9189 20.4330 19.6433 0.8903 18.9870 19.8328 42.6380 19.6433 0.8903 19.8328	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 mm Table 9a) May 42.7320 3.8488 0.8142 20.7066 19.6458 0.7504 19.3383 20.1387 20.1387	Speci:	Jul 43.1747 3.8783 0.4996 20.9120 19.6577 0.3570 19.5498 20.3466 20.3466	Aug 43.2577 3.8838 0.5552 20.9031 19.6599 0.4089 19.5480 20.3407 20.3407	Sep 43.0031 3.8669 0.7947 20.7813 19.6531 0.7010 19.4404 £20.2248 20.2248	factor Table 6 0.776 0.776 0.776 166.8999 461.3925 Oct 42.7320 3.8488 0.9511 20.4123 19.6458 0.9276 18.9731 Living area 19.8150 19.8150 Oct 0.9312 429.6464	Nov 42.5424 3.8362 0.9872 19.9831 19.6407 0.9820 18.3578 a/(4) = 19.3085 19.3085	27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460 3.8231 0.9942 19.6511 19.6354 0.9922 17.8701 0.5849 18.9119 0.0000 18.9119	(85) (86) (87) (88) (89) (90) (91) (92) (93)
Space heating per m2 $(98) / (4) = 58.3547 (99)$	West East Total gains 71.9021 Total gains 406.0262 7. Mean internal tempera Temperature during heati Utilisation factor for g Jan tau 41.9335 alpha 3.7956 util living area 0.9929 MIT 19.6736 Th 2 19.6240 util rest of house 0.9905 MIT 2 17.8946 Living area fraction MIT 18.9352 Temperature adjustment adjusted MIT 18.9352 8. Space heating require 2. Jan Utilisation 0.9889 Useful gains 401.5146 Ext temp 4.3000 Heat loss rate W 1192.4760 Month fracti 1.0000	140.6557 473.0852 tture (heating periods realistics) ains for livers of the second se	3.83 6.1(231.6399 554.2572 ang season) in the living area, is Mar 42.1430 3.8095 0.9690 20.0910 19.6298 0.9583 18.5005 19.4308 19.4308 Mar 0.9564 530.0871 6.5000 1048.3665	m2 337.8330 644.7557 ag area frc iii,m (see Apr 42.6380 3.8425 0.9189 20.4330 19.6433 0.8903 18.9870 19.8328 Apr 0.8949 576.9881 8.9000 876.0860	Solar flux Table 6a W/m2 19.6403 19.6403 414.0271 705.2837 mm Table 9, 1 Table 9a) May 42.7320 3.8488 0.8142 20.7066 19.6458 0.7504 19.3383 20.1387 20.1387	Speci:	Jul 43.1747 3.8783 0.4996 20.9120 19.6577 0.3570 19.5498 20.3466 20.3466 20.3466	Aug (0.3407) 20.3407 20.3407 20.3407 311.2573	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 .7010 .70	Oct 42.7320 3.8488 0.9511 20.4123 19.6458 0.9276 18.9731 Living area 19.8150 Oct 0.9312 429.6464 10.6000 736.8045	Nov 42.5424 3.8362 0.9872 19.9831 19.6407 0.9820 18.3578 a/(4) = 19.3085 Nov 0.9804 394.4724 7.1000 980.5103	27.7326 44.1695 59.1288 385.2427 21.0000 Dec 42.3460 3.8231 0.9942 19.6511 19.6354 0.9922 17.8701 0.5849 18.9119 0.0000 18.9119	(83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)





CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cool													
Not applicable													
0													
9a. Energy red													
Fraction of sp Fraction of sp Efficiency of Efficiency of Space heating	pace heat fr main space secondary/s	om main sy heating sy upplementa	stem(s) stem 1 (in %	s)	m (Table 11))						0.0000 1.0000 249.9000 0.0000 1200.0190	(202) (206) (208)
Space heating	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	588.4752	464.8748	385.5998		94.8999	0.0000	0.0000	0.0000	0.0000	228.5256	421.9473	599.1742	(98)
Space heating	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Water heating	235.4843	186.0243		86.1747	37.9752	0.0000	0.0000	0.0000	0.0000	91.4468	168.8465	239.7656	(211)
water neating	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	181.2721	160.2136	169.2956	153.1992	151.1709	136.5720	132.5853	143.5263	142.6583	158.7883	166.0958	177.3956	
Efficiency of (217)m Fuel for water	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 175.1000	
Water heating Annual totals	103.5249 fuel used		96.6851	87.4924	86.3340	77.9966	75.7197	81.9682	81.4725	90.6844	94.8577	101.3110 1069.5449	
Space heating Space heating	fuel - main	system										1200.0190	
Electricity for central heat Total electric Electricity for	ating pump city for the	above, kW		ж L)								30.0000 30.0000 240.1133	(231)
Energy saving, PV Unit 0 (0.8 Total delivere	30 * 0.30 *	951 * 1.00) =	ces M ,N and	d Q)					-228.1478		-228.1478 2311.5293	
12a. Carbon d			ividual heat										
Space heating Space heating Water heating	- main syst - secondary (other fuel	em 1						Energy kWh/year 1200.0190 0.0000 1069.5449		ion factor kg CO2/kWh 0.5190 0.0000 0.5190	k	Emissions G CO2/year 622.8098 0.0000 555.0938	(261) (263) (264)
Space and water Pumps and fans								30.0000		0.5190		1177.9036 15.5700	
Energy for lie	ghting							240.1133		0.5190		124.6188	(268)
Energy saving PV Unit Total CO2, kg, Dwelling Carbo	/year							-228.1478		0.5190		-118.4087 1199.6837 23.3400	(272)
16 CO2 EMISSIC DER Total Floor An Assumed number CO2 emissions CO2 emissions CO2 emissions Total CO2 emis Residual CO2 ed Additional all Resulting CO2 Net CO2 emiss:	rea c of occupan factor in Ta from applia from cookin ssions emissions of Lowable elec emissions o	ble 12 for nces, equa g, equatio	electricity tion (L14) in (L16) biofuel CHP	/ displaced Wh/m²/year	from grid		TY GENERATI	ON TECHNOLO	GIES		TFA N EF	23.3400 51.3900 1.7311 0.5190 17.3938 3.1241 43.8578 0.0000 0.0000 0.0000 43.8578	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7





CALCULATION OF TARGET EMISSIONS 09	Jan 2014
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SAP 2012 WORKSHEET FOR New Build (As Designed)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014 (Version 9.92, January 2014) 1. Overall dwelling dimensions Volume (m3) 156.7395 (1b) - (3b) (m) 3.0500 (2b) 51.3900 (1b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)Dwelling volume 51.3900 $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) =$ 156.7395 (5) main secondary total m3 per hour heating 0 0 Number of chimneys Number of open flues 0 * 40 = 0 * 20 = 2 * 10 = 0.0000 (6a) 0.0000 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires 20.0000 (7a) 0.0000 0 * 40 = Air changes per hour 20.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.1276 (8) Pressure test Measured/design AP50 0.3776 (18) 1 (19) Infiltration rate Number of sides sheltered - [0.075 x (19)] (21) = (18) x (20) Shelter factor Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 5.1000 1.2750 5.0000 1.2500 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind speed Wind factor Adj infilt rate 0.4453 0.4366 0.4279 0.3842 0.3755 0.3318 0.3318 0.3231 0.3493 0.3755 0.3929 0.4104 (22b) Effective ac 3. Heat losses and heat loss parameter A x U W/K 1.9100 13.1648 1.0998 Openings Element Gross NetArea U-value K-value W/m2K 1.0000 1.3258 0.1300 1.9100 (26) TER Opaque door TER Opening Type (Uw = 1.40) Floor 2 - To Stairwell 9.9300 (27) (28b) Wall 1
Wall 3 - Stairwell
Flat Ceiling - To Stairwell 63.1900 28.8300 5.8000 12.7700 11.3742 5.1894 0.7540 75.0300 11.8400 0.1800 (29a) Flat Roof Total net area of external elements $\operatorname{Aum}\left(\mathsf{A},\ \mathsf{m2}\right)$ 0.1300 1.6601 (30)130.8900 (31) Fabric heat loss, $W/K = Sum (A \times U)$ (26)...(30) + (32) =35.1523 (33) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 6.8558 (36) Total fabric heat loss (33) + (36) =42.0081 (37) Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ Jan 30.9910 Feb 30.7918 Mar 30.5966 Apr 29.6797 May 29.5081 Jun 28.7095 Jul Aug 28.5616 Oct 29.5081 Nov 29.8552 Dec 30.2180 (38) 28.7095 Heat transfer coeff 72.9991 Average = Sum(39)m / 12 = 72.2261 (39) 71.6869 (39) 72 7999 72 6047 71 6877 71 5162 70 7176 70 5697 71 0252 71 5162 71.8632 Feb Mar May 1.3916 Jul Aug 1.3732 1.4205 1.4128 1.3916 1.4166 1.3950 1.3761 1.3761 1.3984 1.4054 (40) 1.3950 (40) Days in month 31 (41) 31 28 31 30 31 30 31 31 30 31 30 4. Water heating energy requirements (kWh/year) 1.7311 (42) 75.3130 (43) Assumed occupancy Average daily hot water use (litres/day) Aug Apr May Jul Sep Daily hot water use 82.8443
Energy conte 122.8557 82.8443 (44) 118.9792 (45) 1184.9671 (45) 79.8318 107.4504 76.8193 70.7942 92.7545 67.7817 73.8068 73.8068 76.8193 100.3719 79.8318 110.8792 109.5638 96.6672 80.0400 74.1689 85.1099 86.1263 Energy content (annual)
Distribution loss (46)m =
18.4284 0.15 x (45)m 16.1176 1 13.9132 12.0060 11.1253 12.7665 17.8469 (46) 14.5001 16.4346 Water storage loss: volume manufacturer declared loss factor is known (kWh/day): 180.0000 (47) 1.5520 (48)





	N OF TA	ARGET E	MISSION	S 09 J	an 2014								
Temperature fact iter (49) or (54)												0.5400 0.8381	
	5.9803		25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
E cylinder contai 25 cimary loss 23	5.9803	23.4661			25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	25.9803 23.2624	25.1422 22.5120		25.1422 22.5120	25.9803 23.2624	
	2.0984				141.9971 0.0000	127.6942	123.4115	134.3525	133.7805			168.2219	
itput from w/h									ut (sum of i	months) = Si	um (63) m =	0.0000	(63)
eat gains from wa	ater heat	ing, kWh/m					123.4115			h/year) = Si	um (64) m =		
80	0.2437	71.3091	76.2615	70.2652	70.2350	64.7367	64.0553	67.6932	66.7604	72.7678	74.5533	78.9547	(65)
Internal gains	(see Tak	le 5 and 5	āa)										
tabolic gains (T	Table 5),		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
56)m 86 ghting gains (ca	5.5537	86.5537	86.5537	86.5537	86.5537	86.5537	86.5537	86.5537	86.5537	86.5537	86.5537	86.5537	(66)
	3.5962	12.0760	9.8209	7.4350	5.5578	4.6921	5.0700	6.5902	8.8453	11.2312	13.1084	13.9741	(67)
	0.8432	152.4085	148.4640	140.0667	129.4667	119.5041	112.8485	111.2832	115.2277	123.6250	134.2250	144.1876	(68)
31	1.6554			31.6554	31.6554		31.6554	31.6554 3.0000	31.6554 3.0000	31.6554 3.0000	31.6554 3.0000	31.6554 3.0000	
sses e.g. evapor	ration (r	egative va	alues) (Tabl	Le 5)	-69.2430			-69.2430	-69.2430		-69.2430	-69.2430	
ter heating gain 107			102.5020	97.5905	94.4019	89.9120	86.0958	90.9854	92.7227	97.8062	103.5463	106.1219	
tal internal gai 324		322.5653	312.7530	297.0584	281.3925	266.0744	255.9804	260.8250	268.7619	284.6284	302.8459	316.2497	(73)
0.1													
Solar gains													
Jan]				m2	Solar flux Table 6a W/m2	Speci: or '	g Fic data Fable 6b	Specific or Tabl	FF data le 6c	Acces facto Table (or	Gains W	
ıst st					19.6403 19.6403					0.770		36.6142 22.9889	
					19.0403				. 7000	0.77	50	22.9009	(00)
plar gains 59 otal gains 383	9.6030 3.8630	116.5962 439.1615	192.0173 504.7703	280.0458 577.1042	343.2066 624.5991	351.3331 617.4075	334.4834 590.4638	287.3163 548.1413	223.3241 492.0859	138.3512 422.9796	74.3180 377.1638	49.0146 365.2644	
Mean internal t													
emperature during												21.0000	(85)
ilisation factor	r for gai	ns for liv		nil,m (see	Table 9a)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(00)
u 48 .pha 4	3.8876 1.2592	49.0214	49.1532	49.7819	49.9013 4.3268	50.4648	50.4648	50.5706	50.2463	49.9013	49.6603 4.3107	49.4108	
il living area 0	0.9950	0.9905	0.9771	0.9350	0.8369	0.6708	0.5112	0.5662	0.8114	0.9605	0.9906	0.9960	(86)
	9.5419 9.7477	19.7153 19.7506	20.0241 19.7535	20.4264 19.7672	20.7507 19.7698	20.9326 19.7817	20.9837 19.7817	20.9750 19.7839	20.8408 19.7771		19.9068 19.7646	19.5164 19.7592	
0	90.9933 7.8437	0.9872 18.0975	0.9689 18.5447	0.9110 19.1182	0.7788 19.5373	0.5672 19.7399	0.3775 19.7764	0.4291 19.7746	0.7245 19.6571	0.9411 19.1090	0.9867 18.3870	0.9946 17.8141	
ving area fracti	Lon	19.0438	19.4101	19.8834	20.2471	20.4375	20.4826	20.4768		Living area			(91)
emperature adjust	tment	19.0438	19.4101	19.8834	20.2471	20.4375	20.4826	20.4768	20.3495		19.2759	0.0000	
одиосем мит. — 18													
-													
Space heating r	requireme	ent											
Space heating r	requireme Jan 0.9916	Feb 0.9847	Mar 0.9660	Apr 0.9137	May 0.8034	Jun 0.6254	Jul 0.4561	Aug 0.5095	Sep 0.7689	Oct 0.9430	Nov 0.9847		
Space heating r J cilisation 0 seful gains 380	Jan 0.9916 0.6246 1.3000	Feb 0.9847	Mar 0.9660	Apr 0.9137	May 0.8034	Jun	Jul 0.4561 269.2839	Aug	0.7689	0.9430 398.8688		0.9931 362.7452	(95)
Space heating r Silisation 0 Sieful gains 380 St temp. 4 Sat loss rate W South fracti 1	Jan).9916).6246 4.3000	Feb 0.9847 432.4542 4.9000 029.6699	Mar 0.9660 487.6102 6.5000	Apr 0.9137 527.2747 8.9000	May 0.8034 501.7993 11.7000	Jun 0.6254 386.1238 14.6000	Jul 0.4561 269.2839 16.6000	Aug 0.5095 279.2662	0.7689 378.3746 14.1000	0.9430 398.8688 10.6000 662.9226	0.9847 371.3942 7.1000	0.9931 362.7452	(95) (96) (97)
Space heating r Silisation 0 seful gains 380 tt temp. 4 sat loss rate W onth fracti 1 bace heating kWh bace heating	Jan 0.9916 0.6246 4.3000 1.1910 1	Feb 0.9847 432.4542 4.9000 029.6699 1.0000	Mar 0.9660 487.6102 6.5000 937.3319	Apr 0.9137 527.2747 8.9000 787.3775 1.0000	May 0.8034 501.7993 11.7000	Jun 0.6254 386.1238 14.6000	Jul 0.4561 269.2839 16.6000	Aug 0.5095 279.2662 16.4000 287.6953	0.7689 378.3746 14.1000 443.8724 0.0000	0.9430 398.8688 10.6000 662.9226 1.0000	0.9847 371.3942 7.1000 875.0031 1.0000 362.5984	0.9931 362.7452 4.2000 1055.2087 1.0000 515.1928 2585.2198	(95) (96) (97) (97a) (98) (98)
Space heating r cilisation 0 eeful gains 380 et temp. 4 eat loss rate W 1061 onth fracti 1 ace heating kWh 506	Jan 0.9916 0.6246 4.3000 1.1910 1	Feb 0.9847 432.4542 4.9000 029.6699 1.0000	Mar 0.9660 487.6102 6.5000 937.3319 1.0000	Apr 0.9137 527.2747 8.9000 787.3775 1.0000	May 0.8034 501.7993 11.7000 611.2553 1.0000	Jun 0.6254 386.1238 14.6000 412.8154 0.0000	Jul 0.4561 269.2839 16.6000 274.5667 0.0000	Aug 0.5095 279.2662 16.4000 287.6953 0.0000	0.7689 378.3746 14.1000 443.8724 0.0000	0.9430 398.8688 10.6000 662.9226 1.0000	0.9847 371.3942 7.1000 875.0031 1.0000	0.9931 362.7452 4.2000 1055.2087 1.0000 515.1928	(95) (96) (97) (97a) (98) (98)
Space heating r Silisation 0 seful gains 380 tt temp. 4 sat loss rate W onth fracti 1 bace heating kWh bace heating	Jan 0.9916 0.6246 4.3000 1.1910 1.0000 5.3414 m2	Feb 0.9847 432.4542 4.9000 0.029.6699 1.0000 401.3290	Mar 0.9660 487.6102 6.5000 937.3319 1.0000 334.5930	Apr 0.9137 527.2747 8.9000 787.3775 1.0000	May 0.8034 501.7993 11.7000 611.2553 1.0000 81.4352	Jun 0.6254 386.1238 14.6000 412.8154 0.0000	Jul 0.4561 269.2839 16.6000 274.5667 0.0000	Aug 0.5095 279.2662 16.4000 287.6953 0.0000	0.7689 378.3746 14.1000 443.8724 0.0000	0.9430 398.8688 10.6000 662.9226 1.0000	0.9847 371.3942 7.1000 875.0031 1.0000 362.5984	0.9931 362.7452 4.2000 1055.2087 1.0000 515.1928 2585.2198	(95) (96) (97) (97a) (98) (98)



Regs Region: England Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.12r02



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements	- Individua	l heating s	ystems, inc	luding micr	o-CHP							
Fraction of space heat f Fraction of space heat f Efficiency of main space Efficiency of secondary/ Space heating requiremen	rom seconda: rom main sy: heating sy: supplementa:	ry/suppleme stem(s) stem 1 (in	ntary system)						0.0000 1.0000 93.5000 0.0000 2764.9410	(202) (206) (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requiremen 506.3414	401.3290	334.5930	187.2741	81.4352	0.0000	0.0000	0.0000	0.0000	196.4560	362.5984	515.1928	(98)
Space heating efficiency 93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main 541.5416		stem) 357.8535	200.2931	87.0965	0.0000	0.0000	0.0000	0.0000	210.1134	387.8058	551.0084	(211)
Water heating requiremen 0.0000	t 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 172.0984	t 151.9277	160.1219	144.3214	141.9971	127.6942	123.4115	134.3525	133.7805	149.6146	157.2180	168.2219	(64)
Efficiency of water heat	er	86.7358		83.3936		79.8000			85.5413		79.8000	(216)
Fuel for water heating,			85.5098		79.8000		79.8000	79.8000		86.9729	87.6085	
196.6321 Water heating fuel used	174.0572	184.6088	168.7776	170.2733	160.0178	154.6510	168.3616	167.6448	174.9033	180.7667	192.0155 2092.7097	
Annual totals kWh/year Space heating fuel - mai Space heating fuel - sec											2764.9410 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, kWi		ix L)								30.0000 45.0000 75.0000 240.1133 5172.7640	(230e) (231) (232)
12a. Carbon dioxide emis												
Space heating - main sys Space heating - secondar Water heating (other fue Space and water heating	У						Energy kWh/year 2764.9410 0.0000 2092.7097		ion factor kg CO2/kWh 0.2160 0.0000 0.2160	k	Emissions g CO2/year 597.2273 0.0000 452.0253 1049.2526	(263) (264)
Pumps and fans Energy for lighting Total CO2, kg/m2/year Emissions per m2 for spa Fuel factor (electricity Emissions per m2 for lig Emissions per m2 for pum Target Carbon Dioxide Em) hting ps and fans	-	0.4174 * 1.	55) + 2.425	0 + 0.7574,	rounded to	75.0000 240.1133 2 d.p.		0.5190 0.5190		38.9250 124.6188 1212.7964 20.4174 1.5500 2.4250 0.7574 34.8300	(267) (268) (272) (272a) (272b) (272c)





Property Reference	0007-Godsmark-Royal-Co	llege-F4			Issued on Date	13/08/2020
Assessment Reference	AD		Pro	op Type Ref	Flat 4	
Property	Flat 4, 154, Royal College	Street, Londo	n, NW1 0TA			
SAP Rating		83 B	DER	19.56	TER	30.93
Environmental		85 B	% DER <ter< th=""><th></th><th>36.75</th><th></th></ter<>		36.75	
CO ₂ Emissions (t/ye	ear)	1.20	DFEE	58.44	TFEE	65.77
General Requireme	ents Compliance	Pass	% DFEE <tfee< th=""><th></th><th>11.15</th><th></th></tfee<>		11.15	
Assessor Details	Mr. Andrew Gwynne, Andrew andrew.gwynne@mesenergy	, ,	,		Assessor ID	P741-0001
Client						





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

REGULATIONS COM		red Document L1A, 2013 Editi	on, England	
DWELLING AS DES	IGNED			
Top-floor flat,	total floor area 74 m²			
It is not a com	ers items included with	in the SAP calculations.		
la TER and DER Fuel for main h Fuel factor:1.5 Target Carbon D Dwelling Carbon	eating:Electricity	(DER) 19.56 kgCOU/m2OK		
1b TFEE and DFE Target Fabric E Dwelling Fabric	nergy Efficiency (TFEE) Energy Efficiency (DFE	65.8 kWh/m²/yr		
2 Fabric U-valu	es			
	Average 0.19 (max. 0.30)	Highest 0.44 (max. 0.70)	OK	
Party wall	0.00 (max. 0.20)	-	OK	
Floor Roof	0.21 (max. 0.25) 0.14 (max. 0.20)	0.21 (max. 0.70)	OK	
Root Openings	0.14 (max. 0.20) 1.42 (max. 2.00)	0.16 (max. 0.35)	OK OK	
2a Thermal brid Thermal bridgin		-specified y-value of 0.068		
3 Air permeabil				
Air permeabilit Maximum	y at 50 pascals:	5.10 (design value) 10.0		OK
4 Heating effic Main heating sy Air-to-water he	iency stem:	Heat pump with radiators	or underfloor - Electric	
Secondary heati		None		
Secondary heati 5 Cylinder insu Hot water stora	lation	None Measured cylinder loss: 2	.10 kWh/day	
5 Cylinder insu Hot water stora Permitted by DB	lation ge SCG 2.10	Measured cylinder loss: 2		
5 Cylinder insu Hot water stora	llation ge SCG 2.10 k insulated:	Measured cylinder loss: 2		OK
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls	lation ge SCG 2.10 k insulated:	Measured cylinder loss: 2 OK Yes		
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor	lation ge SCG 2.10 k insulated:	Measured cylinder loss: 2		ок ок
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c	lation ge SCG 2.10 k insulated:	Measured cylinder loss: 2 OK Yes Time and temperature zone	control	ok
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls	lation ge SCG 2.10 k insulated:	Measured cylinder loss: 2 OK Yes	control	
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c	lation ge SCG 2.10 k insulated:	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW	control	ок
5 Cylinder insu Hot water stora Permitted by De Frimary pipewor 6 Controls Space heating c Hot water contr	lation ge SCG 2.10 k insulated: controls:	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW	control	ок
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water contr	lation ge SCG 2.10 k insulated: controls: cols: ghts ixed lights with low-en	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW ergy fittings:100%	control	ок
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating of Hot water contr	lation ge SCG 2.10 k insulated: controls: ols: ghts ixed lights with low-en	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW	control	OK OK
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable 9 Summertime te Overheating ris	lation ge SCG 2.10 k insulated: controls: cols: ghts ixed lights with low-en intilation	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW ergy fittings:100%	control	OK OK
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable 9 Summertime te Overheating ris Based on:	lation ge scc 2.10 k insulated: controls: cols: ghts ixed lights with low-en intilation mperature	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW tergy fittings:100% 75%	control	OK OK
S Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable 9 Summertime to Cverheating ris Based on: Overshading: Windows facing	lation ge SCG 2.10 k insulated: controls: cols: ghts ixed lights with low-en intilation comperature k (Thames Valley):	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW rergy fittings:100% 75% Slight Average 15.10 m², No overhang	control	OK OK
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable 9 Summertime te Overheating ris Based on: Overshading: Windows facing Windows facing	lation ge SCG 2.10 k insulated: controls: controls: ghts ixed lights with low-en intilation mperature k (Thames Valley): East: West:	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW dergy fittings:100% 75% Slight Average 15.10 m², No overhang 4.60 m², No overhang	control	OK OK
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable 9 Summertime te Overheating ris Based on: Overshading: Windows facing Windows facing Windows facing Air change rate Blinds/curtains	lation ge SCG 2.10 k insulated: controls: cols: ghts ixed lights with low-en intilation mperature k (Thames Valley): East: West: :	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW rergy fittings:100% 75% Slight Average 15.10 m², No overhang	control	OK OK
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical v Not applicable 9 Summertime te Overheating ris Based on: Overshading: Windows facing Windows facing Windows facing Air change rate Blinds/curtains	lation ge SCG 2.10 k insulated: controls: cols: ghts ixed lights with low-en controlation controls: cols: co	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW dergy fittings:100% 75% Slight Average 15.10 m², No overhang 4.60 m², No overhang 6.00 ach	control	OK OK
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable	lation ge SCG 2.10 k insulated: controls: cols: ghts ixed lights with low-en contilation comperature k (Thames Valley): East: West: ::value	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW dergy fittings:100% 75% Slight Average 15.10 m², No overhang 4.60 m², No overhang 6.00 ach None 0.13 W/m²K	control	OK OK
S Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable 9 Summertime te Overshading: Windows facing Windows facing Windows facing Windows facing Figure 10 Key features External wall U-varty	lation ge SCG 2.10 k insulated: controls: cols: ghts ixed lights with low-en intilation mperature k (Thames Valley): East: West: : :value lue	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW Lergy fittings:100% 75% Slight Average 15.10 m², No overhang 4.60 m², No overhang 6.00 ach None 0.13 W/m²K 0.00 W/m²K	control	OK OK
5 Cylinder insu Hot water stora Permitted by DB Primary pipewor 6 Controls Space heating c Hot water contr 7 Low energy li Percentage of f Minimum 8 Mechanical ve Not applicable	lation ge SCG 2.10 k insulated: controls: cols: ghts ixed lights with low-en intilation mperature k (Thames Valley): East: West: : :value lue	Measured cylinder loss: 2 OK Yes Time and temperature zone Cylinderstat Independent timer for DHW dergy fittings:100% 75% Slight Average 15.10 m², No overhang 4.60 m², No overhang 6.00 ach None 0.13 W/m²K	control	OK OK





CALCULATIO									9 Jan 2014				
SAP 2012 WORKSHE CALCULATION OF I	EET FOR New OWELLING EN	w Build (A: MISSIONS FO	s Designed) OR REGULATIO	(Version	9.92, Janua NCE 09	ry 2014) Jan 2014							
1. Overall dwell	ling dimen:	sions											
								Area (m2)	Stor	ey height		Volume (m3)	
Ground floor First floor Total floor area Dwelling volume	a TFA = (1a	a)+(1b)+(1c	c)+(1d)+(1e)(1n)		73.8400		39.8300 34.0100		3.0500 2.7600	(2c) =	121.4815	(1b) - (3 (1c) - (3 (4) (5)
2. Ventilation r	rate												
					main heating		econdary heating		other	tot		3 per hour	
Number of chimne Number of open f Number of intern Number of passiv Number of fluele	Flues mittent far ve vents				0	+ +	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	eys, flues	and fans	= (6a)+(6b)+(7a)+(7b)+	(7c) =				30.0000	Air change / (5) =	s per hour 0.1393 Yes 5.1000 0.3943	
Shelter factor Infiltration rat		d to inclu	de shelter :	factor					(20) = 1 - (2	[0.075 x 1) = (18)		0.9250 0.3647	(20)
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		Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Effective ac	0.4650 0.6081	0.4559 0.6039	0.4468 0.5998	0.4012 0.5805	0.3921 0.5769	0.3465 0.5600	0.3465 0.5600	0.3374 0.5569		0.3921 0.5769	0.4103 0.5842	0.4286 0.5918	
3. Heat losses a													
Element Window (Uw = 1.4 Door Glazed Door (Uw				Gross m2	Openings m2	7	tArea m2 .5000 .9100 .2000	U-value W/m2K 1.3258 1.4000 1.3258	A x W/ 9.943 2.674 16.174	K 2 0	-value kJ/m2K	A x K kJ/K	
Roof Light (Uw = Floor 2 - To Stawall 1 Wall 3 - Stairwe Wall 4 - Dormer Wall 5 - Mansarc Flat Roof - Dorm Total net area c	airwell ell Cheeks d	l elemente		105.8900 18.9400 2.7600 4.6800 38.9400 0.6800	19.3100 2.3000 2.7400	1 86 18 0 4 36	.7400 .2900 .5800 .9400 .4600 .6800 .2000 .6800	1.5038 0.2143 0.1300 0.4400 0.1600 0.2300 0.1400 0.1600	4.120 0.276 11.255 8.333 0.073 1.076 5.068 0.108	5 2 4 6 6 6 4 0	0.0000 0.0000 9.0000 9.0000 9.0000 9.0000 9.0000	25.8000 5194.8000 170.4600 4.1400 42.1200 325.8000 6.1200	(29a) (29a) (29a) (29a) (30)
Fabric heat loss Party Wall 1 Party Floor 1 Stud Wall Internal Floor 1 Internal Ceiling	s, W/K = Si		Aum(A, m2)			16 38 82 32		30) + (32) 0.0000	= 59.104 0.000	0 4 8	5.0000 0.0000 9.0000 8.0000	747.4500 3083.2000 746.6400 582.4800 580.6800	(33) (32) (32d) (32c) (32d)
Heat capacity Cm Thermal mass par Thermal bridges Total fabric hea	rameter (The (User def:	MP = Cm / r			area)			(28)	(30) + (32		(32e) = + (36) =	11509.6900 155.8734 11.7762 70.8802	(35) (36)
Ventilation heat	Jan	culated mon	nthly (38)m Mar	= 0.33 x (25)m x (5) May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer co 1 Average = Sum(39	114.0971	42.9185 113.7987	42.6260 113.5062	41.2522	40.9952 111.8754	39.7987 110.6789	39.7987 110.6789	39.5771 110.4573		40.9952 111.8754	41.5152 112.3954	42.0588 112.9390 112.1312	(39)
HLP HLP (average)	Jan 1.5452	Feb 1.5412	Mar 1.5372	Apr 1.5186	May 1.5151	Jun 1.4989	Jul 1.4989	Aug 1.4959	Sep 1.5051	Oct 1.5151	Nov 1.5221	Dec 1.5295 1.5186	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heating													
Assumed occupance	 Эу											2.3356 89.6712	





CALCULAT	ION OF I	DWELLIN	G EMISSI	ONS FOR	R REGULA	TIONS C	OMPLIAN	ICE 09	Jan 2014	ļ			
Daily hot wate		Feb 95.0515	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	(44)
Energy conte Energy content			91.4646 132.0180	87.8778 115.0965	84.2910 110.4378	80.7041 95.2994	80.7041 88.3089	84.2910 101.3358	87.8778 102.5461		95.0515 130.4518 um(45)m =		(45)
Distribution 1	oss (46)m	= 0.15 x (17.2645	16.5657	14.2949	13.2463	15.2004	15.3819	17.9261	19.5678	21.2493	
Water storage Store volume												180.0000	
a) If manufac Temperature Enter (49) or	factor fro	m Table 2b	actor is kn	own (kWh/c	iay):							2.1000 0.5400 1.1340	(49)
Total storage	loss	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	
If cylinder co	ntains ded 35.1540	icated sola 31.7520	r storage 35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss Total heat req		21.0112 water heati 180.6987		ed for each		22.5120 151.8314	23.2624	23.2624	22.5120 159.0781	23.2624	22.5120 186.9838	23.2624	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 ut (sum of 1	0.0000	0.0000	0.0000	(63)
Output from w/		180.6987	190.4344	171.6285	168.8542	151.8314	146.7253	159.7522	159.0781	177.9240	186.9838	200.0787	(64)
Heat gains fro	om water he	ating, kWh/: 84.7491	month 90.6291	83.4952	83.4537	76.9127	76.0958	Total p	er year (kWl 79.3222	h/year) = Si 86.4694	um(64)m = 88.6008	2098.6835 93.8358	
	33.3703	04.7451	30.0231	00.4552	03.4007	70.3127	70.0330	00.4275	73.3222	00.4034	00.0000	33.0330	(03)
5. Internal ga Metabolic gain													
(66) m	116.7815				May 116.7815			Aug 116.7815	Sep 116.7815	Oct 116.7815	Nov 116.7815	Dec 116.7815	(66)
Lighting gains Appliances gai	18.3729	16.3187	13.2712	10.0472	7.5104	6.3406	6.8512	8.9055	11.9529	15.1770	17.7138	18.8836	(67)
Cooking gains	206.0886	208.2271	202.8380	191.3653	176.8830	163.2718	154.1786	152.0400	157.4291	168.9018	183.3841	196.9954	(68)
Pumps, fans	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000		34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	
Losses e.g. ev Water heating	-93.4252	-93.4252			-93.4252	-93.4252	-93.4252	-93.4252	-93.4252	-93.4252	-93.4252	-93.4252	(71)
Total internal	128.1861	126.1148	121.8133	115.9655	112.1689	106.8231	102.2794	108.1012	110.1697	116.2223	123.0567	126.1234	(72)
	413 6821	411.6950	398.9570	378.4125	357.5968	337.4699	324.3436	330.0811	340.5862	361.3356	385.1891	403.0368	(73)
	415.0021												
6. Solar gains													
6. Solar gains			A						FF data	Acce: fact:		Gains W	
6. Solar gains	 3 		A	rea m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	data le 6c	facto Table	or 6d	W	
6. Solar gains [Jan] East West	 3 		A 2.9 4.6	rea m2 	Solar flux Table 6a W/m2 19.6403 19.6403	Speci or	g fic data Table 6b 0.7600 0.7600	Specific or Tab	data le 6c .7000 .7000	facte Table 0.77 0.77	or 6d 00	W 20.9986 33.3081	(80)
6. Solar gains			2.9 4.6 12.2 2.7	rea m2	Solar flux Table 6a W/m2 19.6403 19.6403 19.6403 26.0000	Speci or	g fic data Table 6b 0.7600 0.7600 0.7600 0.7600	Specific or Tab	data le 6c .7000	factorable	or 6d 00 00	W 20.9986	(80) (76)
6. Solar gains	176.7553	349.8883	2.9 4.6 12.2 2.7	rea m2 000 000 000 400	Solar flux Table 6a W/m2 19.6403 19.6403 20.0000	Speci or 1103.2140	g fic data Table 6b 0.7600 0.7600 0.7600 0.7600	Specific or Tab 0 0 0 0	data le 6c .7000 .7000 .7000 .7000	factor Table (0.77) 0.77) 0.770 1.000 417.6967	or 6d 00 00 00 00 00 00	20.9986 33.3081 88.3389 34.1097	(80) (76) (82)
6. Solar gains [Jan] East West East Horizontal	176.7553	349.8883	2.9 4.6 12.2 2.7	rea m2 000 000 000 400	Solar flux Table 6a W/m2 19.6403 19.6403 19.6403 26.0000	Speci or 1103.2140	g fic data Table 6b 0.7600 0.7600 0.7600 0.7600	Specific or Tab 0 0 0 0	data le 6c .7000 .7000 .7000 .7000	factor Table (0.77) 0.77) 0.770 1.000 417.6967	or 6d 00 00 00 00 00 00	20.9986 33.3081 88.3389 34.1097	(80) (76) (82)
6. Solar gains [Jan] East West East Horizontal Solar gains Total gains	176.7553 590.4374	349.8883 761.5833	2.9 4.6 12.2 2.7 585.4910 984.4481	rea m2 000 000 000 400 867.0094 1245.4219	Solar flux Table 6a W/m2 19.6403 19.6403 20.0000	Speci or 1103.2140 1440.6840	gfic data Table 6b	Specific or Tab	data le 6c .7000 .7000 .7000 .7000	factor Table (0.77) 0.77) 0.770 1.000 417.6967	or 6d 00 00 00 00 00 00	20.9986 33.3081 88.3389 34.1097	(80) (76) (82)
East West East Horizontal Solar gains Total gains	176.7553 590.4374	349.8883 761.5833 ture (heati	2.9 4.6 12.2 2.7 585.4910 984.4481	rea m2 000 000 000 000 400 867.0094 1245.4219	Solar flux Table 6a W/m2 19.6403 19.6403 26.0000 1073.2701 1430.8669	Speci or 	gfic data Table 6b 0.7600 0.7600 0.7600 0.7600 1048.4574 1372.8010	Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000	factor Table (0.77) 0.77) 0.770 1.000 417.6967	or 6d 00 00 00 00 00 00	W 20.9986 33.3081 88.3389 34.1097 144.8550 547.8918	(80) (76) (82) (83) (84)
East West East Horizontal Solar gains Total gains	176.7553 590.4374	349.8883 761.5833 ture (heati	2.9 4.6 12.2 2.7 585.4910 984.4481	rea m2 000 000 000 400 867.0094 1245.4219	Solar flux Table 6a W/m2 19.6403 19.6403 26.0000 1073.2701 1430.8669 om Table 9, Table 9a)	Speci or 	gfic data Table 6b 0.7600 0.7600 0.7600 0.7600 1048.4574 1372.8010	Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000	factor Table (0.77) 0.77) 0.770 1.000 417.6967	or 6d 00 00 00 00 00 00	20.9986 33.3081 88.3389 34.1097	(80) (76) (82) (83) (84)
East West East Horizontal Temperature du Utilisation fa	176.7553 590.4374 mal tempera rining heati gctor for g Jan 28.0212 2.8681	349.8883 761.5833 ture (heati- ng periods ains for li Feb 28.0947	2.9 4.6 12.2 2.7 585.4910 984.4481 ng season) in the livi ving area, Mar 28.1671	rea m2 000 000 000 000 400 867.0094 1245.4219 ong area fronil,m (see Apr 28.5121	Solar flux Table 6a W/m2 19.6403 19.6403 26.0000 1073.2701 1430.8669 om Table 9, Table 9a)	Speci or	gfic data Table 6b 0.7600 0.7600 0.7600 0.7600 1048.4574 1372.8010	Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 685.3426 1025.9288	factor Table 0.771 0.771 0.771 1.001 417.6967 779.0323	or 6d 00 00 00 00 00 221.1554 606.3445	W 20.9986 33.3081 88.3389 34.1097 144.8550 547.8918	(80) (76) (82) (83) (84)
East West East Horizontal Solar gains Total gains Total gains Temperature du Utilisation fa	176.7553 590.4374 aal tempera arring heati actor for g Jan 28.0212 2.8681	349.8883 761.5833 ture (heati- ng periods ains for li Feb 28.0947	2.9 4.6 12.2 2.7 585.4910 984.4481 ng season) in the livi ving area, Mar 28.1671	rea m2 000 000 000 000 400 867.0094 1245.4219 ng area fronii,m (see Apr 28.5121 2.9008	Solar flux Table 6a W/m2 19.6403 19.6403 26.0000 1073.2701 1430.8669 mrable 9a) May 28.5776	Speci or	gfic data Table 6b	Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 685.3426 1025.9288	factor Table 0.777 0.771 0.771 0.771 1.000 417.6967 779.0323	Nov 28.4454 2.8964	20.9986 33.3081 88.3389 34.1097 144.8550 547.8918 21.0000 Dec 28.3085	(80) (76) (82) (83) (84)
6. Solar gains [Jan] East West East Horizontal Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar	176.7553 590.4374 Lal tempera ring heati ctor for g Jan 28.0212 2.8681 rea 0.9758 19.2687 19.2687	349.8883 761.5833 ture (heati- ng periods ains for li Feb 28.0947 2.8730 0.9515	2.9 4.6 12.2 2.7 585.4910 984.4481 mg season) in the livi ving area, Mar 28.1671 2.8778 0.8940	rea m2 000 000 000 000 400 867.0094 1245.4219 ng area fronii,m (see Apr 28.5121 2.9008	Solar flux Table 6a W/mz 19.6403 19.6403 26.0000 1073.2701 1430.8669 m Table 9a May 28.5776 2.9052 0.6167	Speci or or 1103.2140 1440.6840 1440.6840 1440.6840 1440.6840 1450 1450 1450 1450 1450 1450 1450 14	gfic data Table 6b	Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 685.3426 1025.9288 Sep 28.7668 2.9178 0.6288 20.7564	fact Table 0.777 0.777 0.771 1.000 417.6967 779.0323	Nov 28.4454 2.8964 0.9595	20.9986 33.3081 88.3389 34.1097 144.8550 547.8918 21.0000 Dec 28.3085 2.8872	(80) (76) (82) (83) (84) (85)
6. Solar gains [Jan] East West East Horizontal 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h	176.7553 590.4374 aal tempera arring heati actor for g Jan 28.0212 2.8681 rea 0.9758 19.6538 19.6538	349.8883 761.5833 ture (heati 	2.9 4.6 12.2 2.7 585.4910 984.4481 ng season) in the livi ving area, Mar 28.1671 2.8778 0.8940 19.9615 19.6597 0.8719	rea m2 000 000 000 400 867.0094 1245.4219 mg area frc nil,m (see Apr 28.5121 2.9008 0.7746 20.4212 19.6736 0.7322	Solar flux Table 6a W/m2 19.6403 19.6403 26.0000 1073.2701 1430.8669 Dom Table 9, Table 9a) May 28.5776 2.9052 0.6167 20.7114 19.6762 0.5529	Speci or 1103.2140 1440.6840 Th1 (C) Jun 28.8866 2.9258 0.4583 20.8482 19.6883 0.3753	gfic data Table 6b	Specific or Tab 0 0 0 0 0 0 893.5930 1223.6741 Aug 28.9445 2.9296 0.3961 20.8791 19.6906 0.2910	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 685.3426 1025.9288 Sep 28.7668 2.9178 0.6288 20.7564 19.6836 0.5408	factor Table 0.777 0.770 0.771 0.000 0.771 0.000	Nov 28.4454 2.8964 0.9595 19.6927 19.6709	20.9986 33.3081 88.3389 34.1097 144.8550 547.8918 21.0000 Dec 28.3085 2.8872 0.9801 19.2249 19.6654 0.9756	(80) (76) (82) (83) (84) (85) (85)
6. Solar gains [Jan] East West East Horizontal 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 tiving area fr	176.7553 590.4374 all tempera arring heati actor for g Jan 28.0212 2.8681 rea 0.9758 19.2687 19.6538 rouse 0.9703 17.3893 action	349.8883 761.5833 ture (heating periods ains for life Peb 28.0947 2.8730 0.9515 19.5408 19.6568 0.9409 17.7810	2.9 4.6 12.2 2.7 585.4910 984.4481 ong season) in the livitiving area, Mar 28.1671 2.8778 0.8940 19.9615 19.6597 0.8719 18.3743	mg area from fil, m (see Apr 28.5121 2.9008 0.7746 20.4212 19.6736	Solar flux Table 6a W/m2 19,6403 19,6403 26,0000 1073.2701 1430.8669 om Table 9, Table 9a) May 28.5776 2.9052 0.6167 20.7114 19.6762 0.5529 19.3568	Speci or or 1103.2140 1440.6840 1440.6840 1440.6840 1440.6886 2.9258 0.4583 20.8482 19.6883	gfic data Table 6b	Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 685.3426 1025.9288 Sep 28.7668 2.9178 0.6288 20.7564 19.6836 0.5408 19.4290 fLA =	Oct 28.5776 2.9052 0.8698 20.3046 19.6762 0.8328 18.8744 Living area	Nov 28.4454 2.8964 0.9595 19.6927 19.6709 0.9489 18.0155 a / (4) =	20.9986 33.3081 88.3389 34.1097 144.8550 547.8918 21.0000 Dec 28.3085 2.8872 0.9801 19.2249 19.6654 0.9756	(80) (76) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91)
6. Solar gains [Jan] East West East Horizontal 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h	176.7553 590.4374 Lal tempera Laring heati Lotor for g Jan 28.0212 2.8681 19.2687 19.6538 19.2687 19.6538 17.3893 Laction 18.2550 Lijustment	349.8883 761.5833 ture (heating periods ains for life Peb 28.0947 2.8730 0.9515 19.5408 19.6568 0.9409 17.7810	2.9 4.6 12.2 2.7 585.4910 984.4481 mg season) in the livi ving area, Mar 28.1671 2.8778 0.8940 19.9615 19.6597 0.8719 18.3743 19.1053	mg area from film (see Apr 28.5121 2.9008 0.7746 20.4212 19.6736 0.7322 19.0001	Solar flux Table 6a W/m2 19.6403 19.6403 26.0000 1073.2701 1430.8669 om Table 9, Table 9a) May 28.5776 2.9052 0.6167 20.7114 19.6762 0.5529 19.3568	Speci or	gfic data Table 6b	Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .885.3426 1025.9288 Sep 28.7668 2.9178 0.6288 20.7564 19.6836 0.5408 19.4290 fLA = 20.0404	fact: Table 0 0.77' 0.77' 0.77' 1.00' 417.6967 779.0323 Oct 28.5776 2.9052 0.8698 20.3046 19.6762 0.8328 18.8744	Nov 28.4454 2.8964 0.9595 19.6927 19.6948 18.0155 a / (4) = 18.7880	20.9986 33.3081 88.3389 34.1097 144.8550 547.8918 21.0000 Dec 28.3085 2.8872 0.9801 19.2249 19.6654 0.9756 17.3339 0.4606 18.2049 0.0000	(85) (76) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
6. Solar gains [Jan] East West East Horizontal 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad	176.7553 590.4374 Lal tempera Laring heati Lotor for g Jan 28.0212 2.8681 19.2687 19.6538 19.2687 19.6538 17.3893 Laction 18.2550 Lijustment	349.8883 761.5833 ture (heati 	2.9 4.6 12.2 2.7 585.4910 984.4481 mg season) in the livi ving area, Mar 28.1671 2.8778 0.8940 19.9615 19.6597 0.8719 18.3743 19.1053	mea m2 000 000 000 000 400 867.0094 1245.4219 mg area fromil,m (see Apr 28.5121 2.9008 0.7746 20.4212 19.67362 0.7322 19.0001 19.6547	Solar flux Table 6a W/m2 19.6403 19.6403 26.0000 1073.2701 1430.8669 om Table 9, Table 9a) May 28.5776 2.9052 0.6167 20.7114 19.6762 0.5529 19.3568	Speci or or 1103.2140 1440.6840 1440	gfic data Table 6b	Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .885.3426 1025.9288 Sep 28.7668 2.9178 0.6288 20.7564 19.6836 0.5408 19.4290 fLA = 20.0404	Oct 28.5776 2.9052 0.8698 20.3046 19.6762 0.8328 18.8744 Living area 19.5331	Nov 28.4454 2.8964 0.9595 19.6927 19.6948 18.0155 a / (4) = 18.7880	20.9986 33.3081 88.3389 34.1097 144.8550 547.8918 21.0000 Dec 28.3085 2.8872 0.9801 19.2249 19.6654 0.9756 17.3339 0.4606 18.2049 0.0000	(85) (76) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
6. Solar gains [Jan] East West East Horizontal Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati	176.7553 590.4374 mal tempera anal tempera rining heati guarante (17.00) 28.0212 2.8661 rea 0.9758 19.2687 19.6538 rouse 0.9703 17.3893 raction 18.2550 19.2550 19.2550	349.8883 761.5833 ture (heati- ng periods ains for li- Peb 28.0947 2.8730 0.9515 19.5408 19.6568 0.9409 17.7810 18.5915 18.5915	2.9 4.6 12.2 2.7 585.4910 984.4481 ng season) in the livi ving area, Mar 28.1671 2.8778 0.8940 19.9615 19.6597 0.8719 18.3743 19.1053	rea m2 000 000 000 400 867.0094 1245.4219 ong area from fil,m (see Apr 28.5121 2.9008 0.7746 20.4212 19.6736 0.7322 19.0001 19.6547	Solar flux Table 6a W/m2 19.6403 19.6403 19.6403 26.0000 1073.2701 1430.8669 Dom Table 9, May 28.5776 2.9052 0.6167 20.7114 19.6762 0.5529 19.3568 19.9807	Speci or 1103.2140 1440.68	Jul 28.8866 2.9258 0.3435 20.8889 19.6883 0.2458 19.5457 20.1644 20.1644	Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .885.3426 1025.9288 Sep 28.7668 2.9178 0.6288 20.7564 19.6836 0.5408 19.4290 fLA = 20.0404	Oct 28.5776 2.9052 0.8698 20.3046 19.6762 0.8328 18.8744 Living area 19.5331	Nov 28.4454 2.8964 0.9595 19.6927 19.6948 18.0155 a / (4) = 18.7880	20.9986 33.3081 88.3389 34.1097 144.8550 547.8918 21.0000 Dec 28.3085 2.8872 0.9801 19.2249 19.6654 0.9756 17.3339 0.4606 18.2049 0.0000	(85) (76) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
East West East West East Horizontal Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT	176.7553 590.4374	349.8883 761.5833 ture (heati- ng periods ains for li- Feb 28.0947 2.8730 0.9515 19.5408 19.6568 0.9409 17.7810 18.5915 18.5915	2.9 4.6 12.2 2.7 585.4910 984.4481 mg season) in the livi ving area, Mar 28.1671 2.8778 0.8940 19.9615 19.6597 0.8719 18.3743 19.1053	mg area from 11,m (see Apr 28.5121 2.9008 0.7746 20.4212 19.6736 19.6547 19.6547	Solar flux Table 6a W/m2 19.6403 19.6403 26.0000 1073.2701 1430.8669 om Table 9, Table 9a) May 28.5776 2.9052 0.6167 20.7114 19.6762 19.3568 19.9807	Speci or 1103.2140 1440.68	Jul 28.8866 2.9258 0.3435 20.8889 19.6883 0.2458 19.5457 20.1644	Specific or Tab O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .885.3426 1025.9288 Sep 28.7668 2.9178 0.6288 20.7564 19.6836 0.5408 19.4290 ftLa = 20.0404 20.0404	fact. Table 9 0.77' 0.77' 0.77' 1.00' 417.6967 779.0323 Oct 28.5776 2.9052 0.8698 20.3046 19.6762 0.8328 28.8744 Living are. 19.5331 19.5331	Nov 221.1554 606.3445 221.1554 606.3445 0.9595 19.6927 19.6927 19.6709 0.9489 18.0155 a / (4) = 18.7880	20.9986 33.3081 88.3389 34.1097 144.8550 547.8918 21.0000 Dec 28.3085 2.8872 0.9801 19.2249 19.6654 0.9756 617.3339 0.4606 18.2049 0.0000 18.2049	(85) (76) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
6. Solar gains [Jan] East West East Horizontal Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati	176.7553 590.4374 mal tempera anal tempera ring heati guan 28.0212 2.8681 rea 0.9758 19.2687 19.6538 rouse 0.9703 17.3893 raction 18.2550 19.2687 19.6588	349.8883 761.5833 ture (heati- ng periods ains for li- Feb 28.0947 2.8730 0.9515 19.5408 19.6568 0.9409 17.7810 18.5915 18.5915	2.9 4.6 12.2 2.7 585.4910 984.4481 ng season) in the livi ving area 28.1671 2.8778 0.8940 19.9615 19.6597 0.8719 18.3743 19.1053 19.1053	rea m2 000 000 000 400 867.0094 1245.4219 ng area frc nil,m (see Apr 28.5121 2.9008 0.7746 20.4212 19.6736 0.7322 19.0001 19.6547 Apr 0.7315 91.0859	Solar flux Table 6a W/m2 19.6403 19.6403 26.0000 1073.2701 1430.8669 Dom Table 9, Table 9a) May 28.5776 2.9052 0.6167 20.7114 19.6762 0.5529 19.3568 19.9807 May 0.5684 813.3294	Speci or 1103.2140 1440.6840 1440.6840 17h1 (C) Jun 28.8866 2.9258 0.4583 20.8482 19.6883 0.3753 19.5126 20.1278 20.1278 20.1278	Jul 28.8866 2.9258 0.3435 20.8889 19.6883 0.2458 19.5457 20.1644 20.1644	Aug 28.9445 2.9296 0.3961 20.1582 20.1582 Aug 0.3297 403.4024	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 685.3426 1025.9288 Sep 28.7668 2.9178 0.6288 20.7564 19.6836 0.5408 19.4290 fLA = 20.0404 20.0404	Gact. Table 9 0.77' 0.77' 0.77' 1.00' 417.6967 779.0323 Oct 28.5776 2.9052 0.8698 20.3046 19.6762 0.8328 12.8124 Living are. 19.5331 19.5331	Nov 28.4454 2.8964 0.9595 19.6927 19.6709 0.9489 18.0155 a / (4) = 18.7880 18.7880	20.9986 33.3081 88.3389 34.1097 144.8550 547.8918 21.0000 Dec 28.3085 2.8872 0.9801 19.2249 19.6654 0.9756 17.3339 0.4606 18.2049 0.0000 18.2049	(80) (76) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)





CALCULATION O	F DWELLIN	G EMISSI	ONS FOR	REGULA	TIONS CO	OMPLIAN	ICE 09	Jan 2014				
Month fracti 1.000 Space heating kWh	1 1558.0792 0 1.0000 51 570.9387	1.0000	1.0000	926.4068 1.0000 84.1296	611.8095 0.0000 0.0000	394.4990 0.0000 0.0000	415.1256 0.0000 0.0000	660.2128 0.0000 0.0000	1.0000	1.0000	1581.6954 1.0000 781.8359 3644.0249 49.3503	(97a) (98) (98)
8c. Space cooling requ	irement											
9a. Energy requirement	s - Individua	l heating s	ystems, inc	luding micro								
Fraction of space heat Fraction of space heat Efficiency of main spa Efficiency of secondar Space heating requirem	from seconda from main sy ice heating sy cy/supplementa	ry/suppleme stem(s) stem 1 (in	ntary system %)								0.0000 1.0000 249.9000 0.0000 1458.1932	(202) (206) (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	570.9387			84.1296	0.0000	0.0000	0.0000	0.0000	263.6023	535.6185	781.8359	(98)
	249.9000	249.9000		249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
	4 228.4669		84.9543	33.6653	0.0000	0.0000	0.0000	0.0000	105.4831	214.3331	312.8595	(211)
Water heating requirem 0.000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Efficiency of water he (217)m 175.100 Fuel for water heating	12 180.6987 tater 10 175.1000 176, kWh/month 103.1974	190.4344 175.1000 108.7575	171.6285 175.1000 98.0174	168.8542 175.1000 96.4330	151.8314 175.1000 86.7113	146.7253 175.1000 83.7952	159.7522 175.1000 91.2348	159.0781 175.1000 90.8498	177.9240 175.1000 101.6128	186.9838 175.1000 106.7869	200.0787 175.1000 175.1000 114.2654 1198.5628	(216) (217) (219)
Annual totals kWh/year Space heating fuel - n Space heating fuel - s Electricity for pumps central heating pun Total electricity for Electricity for lighti	aain system econdary and fans: ap the above, kW		ix L)								30.0000 30.0000 30.0000 324.4720	(215) (230c) (231)
Energy saving/generati PV Unit 0 (0.80 * 0.30 Total delivered energy	* 951 * 1.00) =	ces M ,N and	i Q)					-228.1478		-228.1478 2783.0802	
12a. Carbon dioxide em	nissions - Ind	ividual hea	ting system:	s including	micro-CHP							
Space heating - main s Space heating - second Water heating (other f Space and water heatin Pumps and fans Energy for lighting	ystem 1 lary uel)						Energy kWh/year 1458.1932 0.0000 1198.5628 30.0000 324.4720		ion factor kg CO2/kWh 0.5190 0.0000 0.5190 0.5190	k	Emissions og CO2/year 756.8023 0.0000 622.0541 1378.8564 15.5700 168.4009	(263) (264) (265) (267)
Energy saving/generat PV Unit Total CO2, kg/year Dwelling Carbon Dioxid	_						-228.1478		0.5190		-118.4087 1444.4186 19.5600	(272)
16 CO2 EMISSIONS ASSOC DER Total Floor Area Assumed number of occ CO2 emission factor ir CO2 emissions from app CO2 emissions from cor Total CO2 emissions Residual CO2 emissions Additional allowable e Resulting CO2 emissior Net CO2 emissions	npants Table 12 for cliances, equations offset from the clectricity gets	electricit tion (L14) on (L16) biofuel CHP	y displaced Wh/m²/year	from grid		TY GENERATI	ON TECHNOLOG	GIES		TFA N EF	19.5600 73.8400 2.3356 0.5190 16.5390 2.3707 38.4697 0.0000 0.0000 0.0000 38.4697	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7





CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014 (Version 9.92, January 2014) 1. Overall dwelling dimensions Volume (m3) 121.4815 (1b) - (3b) (m) 3.0500 (2b) 39.8300 (1b) First floor
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
Dwelling volume 34.0100 (1c) 2.7600 (2c) 93.8676 (1c) - (3c) 73.8400 215.3491 (5) 2. Ventilation rate secondarv other total m3 per hour 0 * 40 = 0 * 20 = 3 * 10 = 0 * 10 = Number of chimneys Number of open flues Number of intermittent fans Number of passive vents Number of flueless gas fires 0 0.0000 (6b) 30.0000 (7a) Air changes 30.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.1393 (8) Pressure test Measured/design AP50 0.3893 (18) Infiltration rate Number of sides sheltered - [0.075 x (19)] (21) = (18) x (20) (20) = 1 -0.9250 (20) Infiltration rate adjusted to include shelter factor 0.3601 (21) Feb 5.0000 1.2500 Jul 3.8000 Aug 3.7000 0.9250 Dec 4.7000 (22) 1.1750 (22a) 5.1000 1.2750 4.9000 1.2250 Wind speed 1.1000 1.0750 1.0750 1.1250 Wind factor 0.9500 0.9500 1.0000 Adj infilt rate 3. Heat losses and heat loss parameter U-value W/m2K 1.0000 A x U W/K 1.9100 19.2765 TER Opaque door TER Opaque door
TER Opening Type (Uw = 1.40)
TER Room Window (Uw = 1.70)
Floor 2 - To Stairwell
Wall 1
Wall 3 - Stairwell
Wall 4 - Dormer Cheeks
Wall 5 - Mansard
Flat Poof 14.5400 1.3258 (27)2.0200 1.2900 91.1400 3.2154 0.1677 16.4052 1.5918 105.8900 18.9400 18.9400 0.1800 3.4092 0.1908 (29a) 1.7000 2.7600 1.0600 0.1800 (29a) 0.1800 0.1300 0.1300 0.1300 0.8424 4.7996 0.0884 (29a) (30) (30) 4.6800 4.6800 Flat Roof Flat Roof - Dormer 2.0200 0.6800 Total net area of external elements Aum(A, m2) 173.1800 (31) Fabric heat loss, $W/K = Sum (A \times U)$ (26)...(30) + (32) = 50.3052 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 11.0469 (36) (33) + (36) = Total fabric heat loss 61.3521 (37) Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ Jul Mar 42.4473 Sep 40.1405 Oct 40.8576 Jan 43.0232 Feb 42.7324 Apr 41.1081 May 40.8576 Aug 39.4752 Nov 41.3644 39.6912 41.8943 (38) 39.6912 Heat transfer coeff 104.3753 Average = Sum(39)m / 12 104.0844 103.7993 102.4602 102.2096 101.0433 100.8273 Apr 1.3876 May 1.3842 Jun 1.3684 Aug 1.3655 Sep 1.3745 1.3982 (40) 1.3876 (40) 1.4135 1.4096 1.4057 1.3684 1.3842 1.3911 Days in month 31 28 31 30 31 30 31 30 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) 89.6712 (43) Jun Jul Sep Oct Daily hot water use 98.6383
Energy conte 146.2778 98.6383 (44) 141.6623 (45) 1410.8775 (45) 91.4646 127.9355 130.4518 132.0180 115.0965 110.4378 95.2994 88.3089 101.3358 102.5461 119.5076 Energy content (annual)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m =





CALCULA1	ION OF T	TARGET E	MISSION	NS 09 J	an 2014								
	21.9417	19.1903	19.8027	17.2645	16.5657	14.2949	13.2463	15.2004	15.3819	17.9261	19.5678	21.2493	(46)
Water storage Store volume												180.0000	
a) If manufa Temperature Enter (49) or	factor fro	m Table 2b	actor is kn	own (kWh/d	lay):							1.5520 0.5400 0.8381	(49)
Total storage	25.9803	23.4661		25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder c	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	
Primary loss Total heat re						22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	
Solar input	0.0000	0.0000	181.2607 0.0000	0.0000	0.0000	142.9536 0.0000	137.5516	150.5785 0.0000 Solar inpu	150.2003 0.0000 ut (sum of	168.7502 0.0000 months) = S	178.1060 0.0000 um(63)m =	190.9049 0.0000 0.0000	(63)
Output from w	195.5205		181.2607	162.7507	159.6805	142.9536	137.5516	150.5785 Total pe			178.1060 um(64)m =		
Heat gains fr	om water he 88.0315	78.1204	83.2901	76.3929	76.1147	69.8104	68.7569	73.0883	72.2199	79.1304	81.4986	86.4968	(65)
5. Internal g Metabolic gai													
(66)m Lighting gain	Jan 116.7815	Feb 116.7815			May 116.7815			Aug 116.7815	Sep 116.7815	Oct 116.7815	Nov 116.7815	Dec 116.7815	(66)
Appliances ga	18.3729	16.3187	13.2712	10.0472	7.5104	6.3406	6.8512	8.9055	11.9529	15.1770	17.7138	18.8836	(67)
Cooking gains	206.0886	208.2271	202.8380	191.3653	176.8830	163.2718	154.1786	152.0400	157.4291	168.9018	183.3841	196.9954	(68)
Pumps, fans	34.6782 3.0000	34.6782 3.0000			34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	34.6782 3.0000	
Losses e.g. e	vaporation	(negative v		le 5)	-93.4252	-93.4252	-93.4252	-93.4252	-93.4252	-93.4252	-93.4252	-93.4252	
Water heating			111.9491	106.1013	102.3047	96.9589	92.4151	98.2369	100.3055	106.3581	113.1925	116.2592	(72)
Total interna		401.8308	389.0928	368.5482	347.7326	327.6057	314.4794	320.2169	330.7219	351.4713	375.3248	393.1726	(73)
6. Solar gain													
[Jan]				m2	Solar flux Table 6a		g Fic data	Specific	FF data	Acce fact	or	Gains W	
				m2	Table 6a W/m2	Speci: or '	Fic data Table 6b		data le 6c	fact Table	or 6d	W	
East West			11.1	m2 400 000	Table 6a W/m2 19.6403 19.6403	Speci: or '	Fic data Fable 6b 0.6300 0.6300	0 0	data le 6c .7000	fact Table 0.77 0.77	or 6d 00	W 66.8658 20.4079	(80)
 East			11.1 3.4 2.0	m2 400 000 200	Table 6a W/m2 19.6403 19.6403 26.0000	Speci: or '	Fic data Fable 6b 0.6300 0.6300 0.6300	0 0 0	data le 6c .7000	fact Table 0.77	or 6d 00	W 66.8658	(80)
East West Horizontal	108.1189	214.0198	11.1 3.4 2.0	m2 400 000 200 530.3177	Table 6a W/m2 19.6403 19.6403 26.0000	Speci: or:	0.6300 0.6300 0.6300 0.6300	0 0 0 0	data le 6c .7000 .7000 .7000	fact Table 0.77 0.77 1.00	or 6d 00 00 00	W 66.8658 20.4079	(80) (82)
East West Horizontal Solar gains Total gains	108.1189 511.9368	214.0198 615.8506	11.1 3.4 2.0 358.1281 747.2210	m2 400 000 200530.3177 898.8659	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065	Speci: or 9	0.6300 0.6300 0.6300 0.6300 0.6300	0 0 0 546.5757 866.7926	data le 6c .7000 .7000 .7000	fact Table 0.77 0.77 1.00	or 6d 00 00 00 00	66.8658 20.4079 20.8452	(80) (82)
East West Horizontal 	108.1189 511.9368 nal tempera	214.0198 615.8506	11.1 3.4 2.0 358.1281 747.2210	m2 	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065	Speci: or 9	Fic data Pable 6b 0.6300 0.6300 0.6300 0.6300 641.2957 955.7751	0 0 0 546.5757 866.7926	data le 6c .7000 .7000 .7000	fact Table 0.77 0.77 1.00	or 6d 00 00 00 00	66.8658 20.4079 20.8452	(80) (82)
East West Horizontal Solar gains Total gains	108.1189 511.9368 nal tempera	214.0198 615.8506 ture (heati	358.1281 747.2210	m2 400 000 200 530.3177 898.8659	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065	Speci or 9	Fic data Pable 6b 0.6300 0.6300 0.6300 0.6300 641.2957 955.7751	0 0 0 546.5757 866.7926	data le 6c .7000 .7000 .7000	fact Table 0.77 0.77 1.00	or 6d 00 00 00 00	66.8658 20.4079 20.8452	(80) (82) (83) (84)
East West Horizontal	108.1189 511.9368 nal tempera 	214.0198 615.8506 ture (heati	358.1281 747.2210	m2 400 000 200 530.3177 898.8659	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 mm Table 9a) May 50.1692	Speci or 9	Fic data Pable 6b 0.6300 0.6300 0.6300 0.6300 641.2957 955.7751	0 0 0 546.5757 866.7926	data le 6c .7000 .7000 .7000	fact Table 0.77 0.77 1.00	or 6d 00 00 00 00	W 66.8658 20.4079 20.8452 88.6062 481.7788	(80) (82) (83) (84)
East West Horizontal	108.1189 511.9368 nal tempera 	214.0198 615.8506 ture (heati- ng periods ains for li Feb 49.2656	11.1 3.4 2.0 358.1281 747.2210 	m2 400 000 200 530.3177 898.8659 ng area frc nii,m (see Apr 50.0465 4.3364	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 mm Table 9a) May 50.1692	Speci. or ! 674.7869 1002.3927 Th1 (C) Jun 50.7483	Jul 50.7483	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data de 6c .7000 .7000 .7000 419.2021 749.9240 Sep 50.5237	fact Table 0.77 0.77 1.00 255.4954 606.9668	or 6d 00 00 00 135.2774 510.6023	88.6062 481.7788	(80) (82) (83) (84)
East West Horizontal Solar gains Total gains 7. Mean inter Temperature d Utilisation f tau alpha util living a	108.1189 511.9368 nal tempera uring heati actor for g Jan 49.1283 4.2752 rea 0.9962 19.5035 19.7530	214.0198 615.8506 ture (heati ng periods ains for li Feb 49.2656 4.2844	358.1281 747.2210 ng season) in the livi ving area, Mar 49.4009 4.2934	m2 400 000 200 530.3177 898.8659 ng area frc nii,m (see Apr 50.0465 4.3364	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 mm Table 9, Table 9a) May 50.1692 4.3446	Speci: or 1	Jul 50.7483 4.3832	0 0 0 0 546.5757 866.7926 Aug 50.8571 4.3905	data de 6c .7000 .7000 .7000 419.2021 749.9240 Sep 50.5237 4.3682	fact Table 0.77 0.77 1.00 255.4954 606.9668	or 6d 00 00 00 00 135.2774 510.6023 Nov 49.9217 4.3281	W 66.8658 20.4079 20.8452 88.6062 481.7788 21.0000 Dec 49.6654 4.3110	(80) (82) (83) (84) (85)
East West Horizontal Solar gains Total gains 7. Mean inter Temperature d Utilisation f tau alpha util living a	108.1189 511.9368 nal tempera uring heati actor for g Jan 49.1283 4.2752 rea 0.9962 19.5035 19.7530	214.0198 615.8506 	11.1 3.4 2.0 358.1281 747.2210 ng season) in the livi ving area, Mar 49.4009 4.2934 0.9745 20.0558	m2 400 000 200 530.3177 898.8659 ng area frc nil,m (see Apr 50.0465 4.3364 0.9169 20.4933	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 mm Table 9a) May 50.1692 4.3446 0.7899 20.8081	Speci. or ! 674.7869 1002.3927 Th1 (C) Jun 50.7483 4.3832 0.6081 20.9546	Jul 50.7483 4.3832 0.4563 20.9897	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 50.5237 4.3682 20.8635 19.7829 0.6945 19.6828	fact Table 0.77 0.77 1.00 255.4954 606.9668 Oct 50.1692 4.3446 0.9604 20.4144 19.7755 0.9409 19.1203	Nov 49.9217 4.3281 0.9925 19.8779 19.7702 0.9893 18.3492	0.9971 17.7559	(80) (82) (83) (84) (85) (86) (87) (88) (89) (90)
East West Horizontal Solar gains Total gains 7. Mean inter Temperature d Utilisation f tau alpha util living a MIT Th 2 util rest of	108.1189 511.9368 	214.0198 615.8506 ture (heati 	11.1 3.4 2.0 358.1281 747.2210 	m2 400 000 200 530.3177 898.8659 ng area frc nil,m (see Apr 50.0465 4.3364 0.9169 20.4933 19.7729 0.8883	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 mm Table 9, Table 9a) May 50.1692 4.3446 0.7899 20.8081 19.7755 0.7258	Speci:	Jul 50.7483 4.3832 0.4563 20.9897 19.7876 0.3351	346.5757 866.7926 Aug 50.8571 4.3905 0.5185 20.9825 19.7899 0.3903	data le 6c .7000 .7000 .7000 .7000 .7000 419.2021 749.9240 Sep 50.5237 4.3682 0.7848 20.8635 19.7829 0.6945 19.6828 ftA =	fact Table 0.77 0.77 1.00 255.4954 606.9668 Oct 50.1692 4.3446 0.9604 20.4144 19.7755	Nov 49,9217 4,3281 0,9925 19,8779 19,7702 0,9893 18,3492 a / (4) =	0.9961 17.7559 0.4658 4.310 0.9971	(86) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91)
East West Horizontal Solar gains Total gains Total gains 7. Mean inter Temperature d Utilisation f tau alpha util living a MIT Th 2 util rest of MIT 2 Living area f	108.1189 511.9368	214.0198 615.8506 	11.1 3.4 2.0 358.1281 747.2210 ng season) in the livi ving area, Mar 49.4009 4.2934 0.9745 20.0558 19.7589 0.9654 18.5933	m2 400 000 200 530.3177 898.8659 ng area frc nil,m (see Apr 50.0465 4.3364 0.9169 20.4933 19.7729 0.8883 19.2094	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 mm Table 9a, Table 9a, May 50.1692 4.3446 0.7899 20.8081 19.7755 0.7258 19.6030	Speci: or ' 674.7869 1002.3927 Th1 (C) Jun 50.7483 4.3832 0.6081 20.9546 19.7876 0.5079 19.7607	Jul 50.7483 4.3832 0.4563 20.9897 19.7876 0.3351 19.7844	Aug 50.8571 4.3905 0.5185 20.9825 19.7899 0.3903 19.7836	data le 6c .7000 .7000 .7000 .7000 .7000 419.2021 749.9240 Sep 50.5237 4.3682 0.7848 20.8635 19.7829 0.6945 19.6828 ftA =	fact Table 0.77 0.77 1.00 255.4954 606.9668 Oct 50.1692 4.3446 0.9604 20.4144 19.7755 0.9409 19.1203 Living are	Nov 49,9217 4,3281 0,9925 19,8779 19,7702 0,9893 18,3492 a / (4) =	0.9961 17.7559 0.4666 18.5472 0.0000 0.9971	(86) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
East West Horizontal	108.1189 511.9368 anal tempera uring heati actor for g Jan 49.1283 4.2752 rea 0.9962 19.5035 19.7530 house 0.9949 17.7913 raction 18.5800 djustment 18.5800	214.0198 615.8506 ture (heati- ng periods in Fob 49.2656 4.2844 0.9913 19.7063 19.7560 0.9883 18.0881 18.8334	358.1281 747.2210 358.1281 747.2210 ng season) in the livi ving area, Mar 49.4009 4.2934 0.9745 20.0558 19.7589 0.9654 18.5933 19.2669	m2 400 000 200 530.3177 898.8659 mg area frc nii,m (see Apr 50.0465 4.3364 0.9169 20.4933 19.7729 0.8883 19.7729 19.8007	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 m Table 9, May 50.1692 4.3446 0.7899 20.8081 19.7755 0.7258 19.6030 20.1580	Speci: or '	Jul 50.7483 4.3832 0.4563 20.9897 19.7876 20.3395 20.3395	346.5757 866.7926 Aug 50.8571 4.3905 0.5185 20.9825 19.7899 0.3903 19.7836 20.3358	Sep 50.5237 4.3682 0.7848 20.8635 19.7829 6.828 f.LA = 20.2266	Oct 50.1692 4.3446 0.9604 20.4144 19.7755 0.9409 19.1203 Living are 19.7164	Nov 49.9217 4.3281 0.9925 19.8779 19.7702 0.9893 18.3492 a / (4) = 19.0533	0.9971 19.4739 19.4666 17.7559 0.4666 18.5472 0.0000	(86) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
East West Horizontal	108.1189 511.9368	214.0198 615.8506 ture (heati 	11.1 3.4 2.0 358.1281 747.2210 ang season) in the livi ving area, Mar 49.4009 4.2934 0.9745 20.0558 19.7589 0.9654 18.5933 19.2669	m2 400 000 200 530.3177 898.8659 ng area frc ni1,m (see Apr 50.0465 4.3364 0.9169 20.4933 19.7729 0.8883 19.2094 19.8007	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 mm Table 9, Table 9a) May 50.1692 4.3446 0.7899 20.8081 19.7755 0.7258 19.6030 20.1580 20.1580	Speci. or 9 674.7869 1002.3927 Th1 (C) Jun 50.7483 4.3832 0.6081 20.9546 19.7876 0.5079 19.7607 20.3106 20.3106	Jul 50.7483 4.3832 0.4563 20.9897 19.7876 20.3395 20.3395	Aug 50.8571 4.3905 0.5185 20.9825 19.7899 0.3903 19.7836 20.3358 20.3358	Sep 50.5237 4.3682 0.7848 20.8635 19.7829 6.828 f.LA = 20.2266	Oct 50.1692 4.3446 0.9604 20.4144 19.7755 0.9409 19.1203 Living are 19.7164	Nov 49.9217 4.3281 0.9925 19.8779 19.7702 0.9893 18.3492 a / (4) = 19.0533	0.9971 19.4739 19.4666 17.7559 0.4666 18.5472 0.0000	(86) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
East West Horizontal Solar gains Total gains 7. Mean inter Temperature d Utilisation f tau alpha util living a MIT Th 2 util rest of MIT 2 Living area f MIT Temperature a adjusted MIT 8. Space heat	108.1189 511.9368 anal tempera uring heati actor for g Jan 49.1283 4.2752 rea 0.9962 19.5035 19.7530 house 0.9949 17.7913 raction 18.5800 djustment 18.5800	214.0198 615.8506 ture (heati- ng periods in Feb 49.2656 4.2844 0.9913 19.7063 19.7560 0.9883 18.0881 18.8334	11.1 3.4 2.0 358.1281 747.2210 	m2 400 000 200 530.3177 898.8659 ng area frc nil,m (see Apr 50.0465 4.3364 0.9169 20.4933 19.7729 0.8883 19.7729 19.8007	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 m Table 9, Table 9a) May 50.1692 4.3446 0.7899 20.8081 19.7755 0.7258 19.6030 20.1580 20.1580	Speci: or '	Jul 50.7483 4.3832 0.4563 20.9897 19.7876 20.3395 20.3395	Aug 50.8571 4.3905 0.5185 20.9825 19.7899 0.3903 19.7836 20.3358	Sep 50.5237 4.3682 0.7848 20.8635 19.7829 0.6945 19.6828 fLA = 20.2266	fact Table 0.77 0.77 1.00 255.4954 606.9668 Oct 50.1692 4.3446 0.9604 20.4144 19.7755 0.9409 19.1203 Living are 19.7164	Nov 49,9217 4,3281 0,9925 19,8779 19,7702 0,9893 18,3492 a / (4) = 19,0533	W 66.8658 20.4079 20.8452 88.6062 481.7788 21.0000 Dec 49.6654 4.3110 0.9971 19.4739 19.7647 0.9961 17.7559 0.4606 18.5472 0.0000 18.5472	(86) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
East West Horizontal	108.1189 511.9368 anal tempera auring heati actor for g Jan 49.1283 4.2752 rea 0.9962 19.5035 19.7530 house 0.9949 17.7913 raction 18.5800 djustment 18.5800 ing require Jan 0.9932 508.4385 4.3000	214.0198 615.8506 ture (heati- ng periods ains for li Feb 49.2656 4.2844 0.9913 19.7063 19.7560 0.9883 18.0881 18.8334 18.8334	11.1 3.4 2.0 358.1281 747.2210 ang season) in the livit ving area, Mar 49.4009 4.2934 0.9745 20.0558 19.7589 0.9654 18.5933 19.2669 19.2669	m2 400 000 200 530.3177 898.8659 ng area frc nil,m (see Apr 50.0465 4.3364 0.9169 20.4933 19.7729 0.8883 19.2094 19.8007 Apr 0.8891 799.1509	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 mm Table 9a) May 50.1692 4.3446 0.7899 20.8081 19.7755 0.7258 19.6030 20.1580 20.1580	Speci. or ' or ' 674.7869 1002.3927 Th1 (C) Jun 50.7483 4.3832 0.6081 20.9546 19.7876 0.5079 19.7607 20.3106 20.3106	Jul 50.7483 4.3832 0.4563 20.9897 19.7876 20.3395 20.3395 Jul 0.3912 373.9165	Aug 50.8571 4.3905 0.5185 20.9825 19.7899 0.3903 19.7836 20.3358 20.3358	Sep 50.5237 4.3682 20.8635 19.7829 20.2266 20.2266	fact Table 0.77 0.77 1.00 255.4954 606.9668 Oct 50.1692 4.3446 0.9604 20.4144 19.7755 0.9409 19.1203 Living are 19.7164 19.7164 Oct 0.9398 570.4014	Nov 49,9217 4,3281 0,9925 19,8779 19,7702 0,9893 18,3492 a / (4) = 19,0533	066.8658 20.4079 20.8452 88.6062 481.7788 21.0000 Dec 49.6654 4.3110 0.9971 19.4739 19.7647 0.9961 17.7559 0.4606 18.5472 0.0000 18.5472	(86) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
East West Horizontal	108.1189 511.9368	214.0198 615.8506 ture (heati- ng periods ains for li Feb 49.2656 4.2844 0.9913 19.7063 19.7560 0.9883 18.0881 18.8334 18.8334	11.1 3.4 2.0 358.1281 747.2210 	m2 400 000 200 530.3177 898.8659 ng area frc ni1,m (see Apr 50.0465 4.3364 0.9169 20.4933 19.7729 0.8883 19.2094 19.8007 Apr 0.8891 799.1509 8.9000 1116.8919	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 mm Table 9, Table 9a) May 50.1692 4.3446 0.7899 20.8081 19.7755 0.7258 19.6030 20.1580 20.1580	Speci. or : 674.7869 1002.3927 Th1 (C) Jun 50.7483 4.3832 0.6081 20.9546 19.7876 0.5079 19.7607 20.3106 20.3106	Jul 50.7483 4.3832 0.4563 20.9897 19.7876 0.3351 19.7844 20.3395 Jul 0.3912 373.9165 16.6000	Aug 50.8571 4.3905 0.5185 20.9825 19.7899 0.3903 19.7836 20.3358 20.3358	Sep 50.5237 4.3682 0.7848 20.8635 19.7829 0.6945 19.6828 20.2266 20.2266 Sep 0.7306 547.9114	fact Table 0.77 0.77 1.00 255.4954 606.9668 Oct 50.1692 4.3446 0.9604 20.4144 19.7755 0.9409 19.1203 Living are 19.7164 19.7164 Oct 0.9398 570.4014 10.6000	Nov 49.9217 4.3281 0.9925 19.8779 19.7702 0.9893 18.3492 a / (4) = 19.0533 19.0533	W 66.8658 20.4079 20.8452 88.6062 481.7788 21.0000 Dec 49.6654 4.3110 0.9971 19.4739 19.7647 0.9961 17.7559 0.4606 18.5472 Dec 0.9947 479.2071 4.2000	(86) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (93)
East West Horizontal 7. Mean inter Temperature d Utilisation f tau alpha util living a MIT Th 2 util rest of MIT 2 Living area f MIT Temperature a adjusted MIT Willisation Utilisation Useful gains Ext temp. Heat loss rat	108.1189 511.9368 anal tempera uring heati actor for g Jan 49.1283 4.2752 rea 0.9962 19.5035 19.7530 house 0.9949 17.7913 raction 18.5800 aljustment 18.5800 aljustment Jan 0.9932 508.4385 4.3000 e W 1490.4752 1.0000 kWh 730.6353	214.0198 615.8506 ture (heati ng periods ains for li Feb 49.2656 4.2844 0.9913 19.7063 19.7560 0.9883 18.0881 18.8334 18.8334	11.1 3.4 2.0 3.58.1281 747.2210	m2 400 000 200	Table 6a W/m2 19.6403 19.6403 26.0000 656.4739 1004.2065 m Table 9, Table 9a) May 50.1692 4.3446 0.7899 20.8081 19.7755 0.7258 19.6030 20.1580 20.1580 May 0.7475 750.6315 11.7000 864.4936	Speci. or 9 674.7869 1002.3927 Th1 (C) Jun 50.7483 4.3832 0.6081 20.9546 19.7876 0.5079 19.7607 20.3106 20.3106 Jun 0.5528 554.0864 14.6000 577.0169	Jul 50.7483 4.3832 0.4563 20.9897 19.7876 20.3395 20.3395 373.9165 16.6000 377.8538	Aug 50.8571 4.3905 0.5185 20.9825 19.7899 0.3903 19.7836 20.3358 20.3358 20.4497 389.7629 16.4000 396.8347	Sep 50.5237 4.3682 0.7848 20.8635 19.7829 0.6945 19.6828 fLA = 20.2266 20.2266	fact Table 0.77 0.77 1.00 255.4954 606.9668 Oct 50.1692 4.3446 0.9604 20.4144 19.7755 0.9409 19.1203 Living are 19.7164 19.7164 Oct 0.9398 570.4014 10.6000 931.7803 1.0000 268.8659	Nov 49.9217 4.3281 0.9925 19.8779 19.7702 0.9893 18.3492 a / (4) = 19.0533 19.0533 Nov 0.9868 503.8499 7.1000	W 66.8658 20.4079 20.8452 88.6062 481.7788 21.0000 Dec 49.6654 4.3110 0.9971 19.4739 19.7647 0.9961 17.7559 0.4606 18.5472 0.0000 18.5472 Dec 0.9947 479.2071 4.2000 1481.2936	(86) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97) (97) (98) (98)





CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable 9a. Energy requirements - Individual heating systems, including micro-CHP Fraction of space heat from secondary/supplementary system (Table 11)
Fraction of space heat from main system(s)
Efficiency of main space heating system 1 (in %)
Efficiency of secondary/supplementary heating system, %
Space heating requirement 0.0000 (201) 1.0000 (202) 93.5000 (206) 0.0000 (208) 3848.5746 (211) May Jun Aug Sep Apr Space heating requirement | T30.6353 | 566.8532 | 451.7790 | 58pace | heating | efficiency | (main | heating | system | 1) | 93.5000 | 93.5000 | 93.5000 | 58pace | heating | fuel | (main | heating | system) | 781.4281 | 606.2601 | 483.1860 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 10.5000 | 228.7735 84.7134 0.0000 0 0000 0 0000 0.0000 268.8659 521.2446 745.5524 (98) 93.5000 93.5000 0.0000 0.0000 0.0000 0.0000 93.5000 93.5000 93.5000 (210) 781.4281 606.2601 483.1860 244.6776
Water heating requirement
0.0000 0.0000 0.0000 90.6025 0.0000 0.0000 0.0000 0.0000 287.5572 557.4809 797.3822 (211) 0.0000 0.0000 Water neating requirement

195.5205 172.4128 181.2607 162.7507 159.6805 142.9536 137.5516 150.5785 150.2003 168.7502 178.1060 190.9049 (64)

Efficiency of water heater

79.8000 (216)

(217)m 88.0088 87.7557 87.1539 85.7221 83.2101 79.8000 79.8000 79.8000 79.8000 86.0508 87.5117 88.0921 (217) (21/)m 88.0088 87.7555 Fuel for water heating, kWh/month 222.1603 196.4689 196.4689 207.9777 189.8585 191.9003 179.1399 172.3704 188.6948 188.2209 196.1055 203.5226 216 7107 (219) 222.1603 196.460 Water heating fuel used Annual totals kWh/year Space heating fuel - main system 2353.1305 (219) 3848.5746 (211) Space heating fuel - secondary 0.0000 (215) Electricity for pumps and fans: central heating pump main heating flue fan
Total electricity for the above, kWh/year
Electricity for lighting (calculated in Appendix L)
Total delivered energy for all uses 30.0000 (230c) 45.0000 (230e) 75.0000 (231) 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Energy kWh/year 3848.5746 Emission factor Emissions kg CO2/kWh 0.2160 kg CO2/year 831.2921 (261) 0.0000 (263) Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans 0.0000 0.0000 (263) 508.2762 (264) 1339.5683 (265) 38.9250 (267) 168.4009 (268) 1546.8943 (272) 2353.1305 0.2160 75.0000 324.4720 Pumps and fans

Senergy for lighting 324.47

Total CO2, kg/m2/year

Emissions per m2 for space and water heating

Fuel factor (electricity)

Emissions per m2 for lighting

Emissions per m2 for pumps and fans

Target Carbon Dioxide Emission Rate (TER) = (18.1415 * 1.55) + 2.2806 + 0.5272, rounded to 2 d.p. 0.5190 18.1415 (272a) 1.5500 2.2806 (272b) 0.5272 (272c) 30.9300 (273)

