## **Energy Assessment**

## For the proposed development at:

8-10 George Street, Richmond, London, TW9 1JY

#### **Energy Calculations Ltd**

SAP ♦ CODE ♦ SBEM ♦ DESIGN

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#### 1. SUMMARY

It is our opinion that sufficient design works have been carried out at this early stage to demonstrate that the proposal is successfully addressing the requirements of policy 5.2 of the London Plan and the local energy policies of the Borough of Richmond.

The energy hierarchy has been adopted to follow a Be Lean, Be Clean, Be Green methodology. The preferred energy strategy is to reduce energy demand and consequently the amount of conditioning and renewable energy contribution needed. This starts with a fabric first approach to improve thermal elements and controlled fittings. The feasibility of CHP systems and decentralised energy networks has been considered within the Be Clean case.

The final Be Green improvements have additionally explored the adoption and effect of adding renewable energy. The most appropriate renewable energy source has been identified as solar photovoltaic which produce a carbon saving over the baseline emissions of 35% (average) for the new build section of the development and carbon off set payment for the conversion as the feasible roof space has been used for renewables for the new build part of the development.

The calculations provided, draw upon the detailed SAP 2013 assessment. This gives as accurate a guide as possible to the energy usage of the final development in operation.

The Energy Assessment relates to a Planning Application for the creation of two new dwellings at the existing site and conversion of existing commercial units into four flats.

The Energy Assessment sets out to meet the requirements of national and local policies with regard to energy conservation in dwellings, reductions in global climate change gas emissions and the use of renewable technologies to meet energy demand. In particular it meets the requirements of the London Plan and its implementation by the London Borough of Richmond.

The assessment of energy demand, the consequent reductions in that demand, and the choice of suitable renewable technologies follow a hierarchical stepwise process:

The development has been designed to use all electric for space heating, domestic hot water, lighting, and fans to try and future proof the development moving away from gas reducing the NOx emitted into the borough



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#### Table 1 shows the summary for the calculations

Table 1: New Build

Flat	TER CO₂/yr	Lean(DER) CO₂t/y	Percentage Reduction	Clean(DER) CO₂t/y	Percentage Reduction	Be Green (DER) CO₂t/y	Percentage Reduction
2:01	26.10	30.98	-18.69	24.40	6.52	16.68	36.10
3:01	32.22	39.54	-22.70	32.11	0.36	20.69	35.80

Table 2: Conversion

Unit	CO2 t/yr	SAP Rating	SAP Rating Environmental	
1:01	2.69	53 E	58 D	0
1:02	2.97	49 E	54 E	0
1:03	2.68	50 E	55 D	0
1:04	2.68	56 D	60 D	0

The Clean total energy requirements and carbon dioxide emissions have been calculated taking full account of all regulated emissions (space & hot water heating, and electricity for pumps, fans, lights). The Lean calculations was determined by using the orientation and the use of building elements (walls, windows etc.)

#### 2. INTRODUCTION

This Energy Assessment relates to a planning application for a new development comprising of 2 new dwellings above the existing commercial units at 8-10 George Street, Richmond, London TW9 1JY, and a conversion of an existing commercial units into four residential units.

The requirement for new developments to obtain a proportion of their energy needs from on-site renewable energy sources is now a well-established feature of planning policy.

This Energy Assessment sets out the applicable policies on energy and CO<sub>2</sub> emissions, and the methodology for and the results from an energy demand assessment.

It includes an overview of possible renewable energy technologies and identifies the technology most suitable for this development and reasons why other technologies have been excluded.

Finally, it shows that the selected renewable energy technology will reduce the development's predicted carbon dioxide emissions by **35**% relative to the baseline Case for the New build flats, where the photovoltaic is to be installed, and carbon off set payment for the conversion as its not feasible to install renewable energy for the conversions.

For conversions, Local Plan Policy LP22 applies. Conversions, where relevant, are expected to meet BREEAM Domestic Refurbishment 'excellent' rating."

As required by Local Plan LP22, the maximum internal water consumption of 110 litres per person per day will be achieved.

The development has been designed to use all electric for space heating, domestic hot water, lighting, and fans to try and future proof the development moving away from gas reducing the NOx emitted into the borough.

#### 3. PLANNING REQUIREDMENTS

#### 3.1 Planning policy LP22

6.3.12 Major residential developments (10 units or more) should achieve zero carbon standards in line with the London Plan. A zero-carbon home is one where at least 35% of regulated CO2 emissions reductions area chieved on-site, with the remaining emissions (up to 100%) to be offset through a contribution into the Council's Carbon Offset Fund. The Council has adopted the London Plan price of carbon which is £95 per tonne x 30 years equalling £2,8500 per tonne of carbon. Zero carbon standards will apply to major non-residential schemes from 2019. Where development viability is a concern, affordable housing will be prioritised over zero carbon contributions.

6.3.13 All other new residential schemes should achieve a 35% reduction in carbon dioxide emissions. The target of 35% is expressed as minimum improvement over the Target Emission Rate (TER) outlined in the national Building Regulations (2013).

6.3.14 The Council recognises that there may be instances where it is not technically feasible for a development to achieve a 35% reduction in carbon dioxide emissions over Building Regulations (2013). In such cases an applicant will have to demonstrate and set out clearly in the Energy Statement why the carbon dioxide emissions reduction target cannot be met on-site. Any shortfall in on-site reductions can exceptionally be met through a cash-in-lieu contribution to the Council's Carbon Offset Fund, agreed through a Section 106 legal agreement in line with the Planning Obligations SPD.

For conversions, Local Plan Policy LP22 applies. Conversions, where relevant, are expected to meet BREEAM Domestic Refurbishment 'excellent' rating."

#### 3.1.1 KYOTO PROTOCOL

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012. The major distinction between the Protocol and the Convention is that while the Convention encouraged industrialised countries to stabilize GHG emissions, the Protocol commits them to do so.

#### 3.1.2 BUILDING REGULATIONS - PART L 2010

This section of the building regulations deals with the conservation of energy in new domestic and commercial buildings; specifically the energy used for space heating/cooling, water heating, cooking, lighting and appliances. The methodology for the assessment of such has been adopted from the Building Research Establishment's Domestic Energy Model energy assessment method for the domestic portion of the building and Simplified Building Energy Model (SBEM) for the commercial units.

This method requires the calculation of a target emissions rate (TER), which assumes standard or typical building components and the calculation of the buildings actual emissions (DER for SAP). It is a requirement that the building's actual emissions will be lower than the target emission rate.

#### 3.1.3 PLANNING POLICY ASSESSMENT 22: RENEWABLE ENERGY (ODPM, 2004)

Planning Policy Assessment covers the consideration of issues relating to renewable energy technologies and their application to new developments. Technical advice and guidance on the various individual renewable technologies and examples of good practice within development plans and developments are also available. Requirements include:

- a) Renewable energy developments should be capable of being accommodated throughout England in locations where the technology is viable and environmental, economic, and social impacts can be addressed satisfactorily.
- b) The wider environmental and economic benefits of all proposals for renewable energy projects, whatever their scale, are material considerations that should be given significant weight in determining whether proposals should be granted planning permission.
- c) Development proposals should demonstrate any environmental, economic and social benefits as well as how any environmental and social impacts have been minimized through careful consideration of location, scale, design and other measures.

#### 3.1.4 THE LONDON PLAN, MAYOR OF LONDON,

This report has been prepared in accompaniment to a planning application for New development comprising of two new flats and four conversions the report seeks to address policy 5.2 of the London Plan as well as LBRUT policies CP1 and CP2 and policies DM H01, DM SDI and DM SD2 of the Development Management Plan. The extract below outlines the approach for producing energy assessments as per 'Energy Planning Greater London Authority guidance on preparing energy assessments 2018

"On 6 April 2014 the 2013 changes to Part L of the Building Regulations came into effect. Part L 2013 delivers an overall reduction in CO<sub>2</sub>emissions for new residential and new non domestic buildings, with the targets for individual buildings being differentiated according to building type. This reduction in CO<sub>2</sub>emissions affected the percentage reduction necessary above the Part L 2013 regulations to meet the Mayor's targets in the London Plan.

As outlined in the Sustainable, Design and Construction the Mayor has applied a 35 per cent carbon reduction target beyond Part L 2013 of the Building Regulations as specified in Policy 5.2 of the London Plan for 2018

Detailed energy statements should be submitted as part of major applications. This should demonstrate the predicted energy and associated carbon dioxide emission savings achieved through the incorporated of energy efficiency measures, decentralised energy and low/zero carbon technologies. This should be demonstrated in line with policy 5.2 of the London Plan, which requires a 35% reduction in CO<sub>2</sub> emissions above 2013 Building Regulations.

Though the requirements are less stringent for the conversion of an existing building, the strategy outlined in this report has aimed to achieve a 35% reduction in CO<sub>2</sub> emissions against a Part L1A. This target has been achieved following the energy hierarchy presented in the London Plan.

#### 4. CALCULATION METHODOLOGY

This Energy Assessment takes a standard hierarchical approach as follows:

#### 1. Lean

A calculation of baseline energy demand, demonstrates the projected annual heating, cooling and electricity demand of the development. The assessment shows the carbon dioxide emissions resulting from the predicted energy use complying with L1A building regulations.

#### 2. Clean

A calculation showing the improvement of the services and fabric over the baseline.

#### 3. Green

Details of renewable energy technologies to be incorporated in the development, demonstrating how much carbon dioxide emissions from expected energy use will be reduced through on-site renewable energy generation.

The starting point was to determine the performance of the "clean" for the dwellings using the orientation and a level of insulation performance and building services equipment consistent with the development achieving compliance with Approved Document L1A: 2013.

#### 4. Carbon off set payment - calculations

The Council recognises that there may be instances where it is not technically feasible for a development to achieve a 35% reduction in carbon dioxide emissions over Building Regulations (2013). In such cases an applicant will have to demonstrate and set out clearly in the Energy Statement why the carbon dioxide emissions reduction target cannot be met on-site. Any shortfall in on-site reductions can exceptionally be met through a cash-in-lieu contribution to the Council's Carbon Offset Fund,

#### 5. ENERGY DEMAND AND EFFICIENCY - Lean - New Build L1A

The total CO<sub>2</sub> emissions has been calculated taking full account of energy demands for space heating and hot water, and electricity for pumps, fans, lights.. The baseline was determined by using the typical orientation and the use of building elements (walls, windows etc.) with U-values and other reference values and in most cases consistent with achieving compliance with Approved Document Part LA: 2013. The tabulated calculations results are in appendix 1.

#### 5.1)) lean calculations

Element	U – Value Element	Element	U – Value Element
Walls	0.20	Wall to Hall	0.20
Door to flats	1.40	Windows (g-value 0.63)	0.84
Flat roof	0.14		

#### **Services**

- Accredited construction details applied to table K1
- Air pressure test 5.00
- Intermittent extract fans
- 100% Low energy lighting
- Spec heating, Electric panel heaters, with programmer, and thermostat
- Ventilation Intermittent extract fans
- Domestic hot water Water cylinder with minimum heat loss

Results: Show the CO<sub>2</sub> emissions from the baseline (lean) calculations.

Table 2:

Flat	TER CO₂/yr	Lean(DER) CO₂t/y	Percentage Reduction	
2:01	26.10	30.98	-18.69	
3:01	32.22	39.54	-22.70	

#### 5.1. Be Clean -Improved Efficiency and services

The following improvements have been applied to the services over the baseline(lean) calculations reducing the CO<sub>2</sub> emissions: Domestic .

#### 6.1) Improvements

- Wall U values improved to 0.18 W/m2K
- Air pressure test to be reduced to 4.00
- MVH system installed SFP 0.63 MVHR Efficiency 90%
- Independently assessed thermal bridging for lintels (Y = 0.050)

Table 3: Clean results

Flat	TER CO₂/yr	Lean(DER) CO₂t/y	Percentage Reduction	Clean(DER) CO₂t/y	Percentage Reduction
2:01	26.10	30.98	-18.69	24.40	6.52
3:01	32.22	39.54	-22.70	32.11	0.36

#### 6. Conversion Baseline - L2B

- 100 % Low energy lighting.
- Ventilation Intermittent extract fans.
- Internal water use 125ltr. Per person per day.
- Space heating Electric panel heater with programmer, TRVs, and Room Stat
- Water heating Water cylinder with minimum heat loss

U - Values: W/m2K requirements

Element	W/m2K to	Element	W/m2k to achieve
	achieve		
Windows & Roof lights (g- value 0.63)	1.60	New Door (default)	1.40
Existing walls – to be upgraded to achieve	0.30	Floor over commercial units to be upgraded to achieve	0.25
Roof Slope- to be upgraded to achieve	0.18	Loft / Void – to be upgraded to achieve	0.16
Flat roof – to be upgraded to achieve	0.18	Wall to hall to achieve	0.28
Wall to void / Dwarf wall – to achieve	0.28		

#### **Results**

Unit	CO2 t/yr	SAP Rating	Environmental	Reduction in Co2
1:01	2.69	53 E	58 D	0
1:02	2.97	49 E	54 E	0
1:03	2.68	50 E	55 D	0
1:04	2.68	56 D	60 D	0

#### 7. CONSIDERATION OF Renewable and low carbon technologies

Consideration of Heat and power:

Combined Heat and Power (CHP) and Combined Cooling Heat and Power (CCHP) or Tri-generation Systems are recognised as a very desirable way of reducing energy wastage and resulting carbon dioxide emissions.

While generally operating on fossil fuel, mainly natural gas, their advantage is that the waste heat normally associated with electricity generation is put to good use providing space heating and hot water. This means that the overall fuel efficiency can be increased significantly — typically to above 80% compared to 30-40% for grid electricity. The main effect is to approximately halve the carbon dioxide emissions associated with electricity use on the development for all the electricity produced by the CHP plant. However, space and water heating for the development is provided by mains gas and so a CHP unit would only reduce emissions associated with lighting, fans, pumps and domestic appliances. As such, the reduction in CO<sub>2</sub> would not be that great.

Generally CHP and CCHP are most suited to community heating systems particularly where there is a constant demand for heat throughout the year and therefore they are not considered to be viable on developments of less than approximately 50 units.

However, some systems for individual dwellings have been developed such as the Baxi Ecogen micro CHP. However the technology is new and is still proving its long term reliability.

The installation may be complex and can only be carried out by British Gas & one other supplier and therefore is relatively expensive. For these reasons it is considered that micro CHP installations are not a practical option at the present time for a very small development such as this.

#### 7.1 OVERVIEW OF RENEWABLE ENERGY

Energy from renewable sources has been defined in Article 2 of EU Directive 2010/13/EU 'on the energy performance of buildings' and includes wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. For the purposes of this energy Assessment and the use of renewable energy on a domestic scale these can be summarised as follows:

- \_ Bio-fuels combustion of solid or liquid bio-fuels to produce heat or electricity.
- \_ Decentralised energy.
- Heat pumps extraction of heat from the earth, atmosphere or water bodies.
- \_ Hydroelectricity use of water cycle driven flows to generate electricity.
- \_ Photovoltaic direct generation of electricity from sunlight.
- \_ Solar thermal direct heating of water for space heating or domestic hot water.
- \_ Wind turbines use of solar driven air movement to generate electricity.

The technologies and their potential application to this site are discussed in more detail in the following sections. However, one further pertinent point must be made. The reason for adopting renewable energy technologies is to reduce greenhouse gas emissions, mainly carbon dioxide, and none of the technologies are wholly "zero carbon". This is because, when the whole life cycle is taken into account some energy has to be put into every system to manufacture and maintain the equipment (which has a finite life) or to operate the equipment, and generally at present this energy is derived from non-renewable sources. Examples include the energy needed to refine and process the silicon used to manufacture photovoltaic panels, the diesel fuel used to transport wood pellets and to power the wood processing machinery for the production of wood fuel pellets.

Finally, due to the dynamic and innovative nature of the renewable energy technology industry even apparently similar products can differ in vital practical details which means that detailed design of installations must be undertaken by experts, often working closely with the product manufacturers, as virtually no two products are identical or interchangeable.

The following sections contain a summary of each possibly applicable technology, and a comparison of the advantages and disadvantages of technologies relevant to this development.

#### 7.2 DECENTRALISED ENERGY

In addition to addressing the well understood and widely accepted planning policy requirement to install systems that will deliver a proportion of the development's energy needs from renewable sources, a further consideration is the availability of decentralised energy. If it is feasible, new developments should incorporate community energy generating schemes so that future developments can be connected or where there are existing networks, the feasibility of connecting the subject development should be investigated. However in this case the development is too small to feasibly construct a new community heating scheme and at present, there is no such network available locally.

#### 7.3 BIO-FUELS

Key planning and design issues regarding the use of bio-fuels include the building space and organisation to accommodate and operate the plant. The equipment would plant space and access and maintenance. Facilities are required for fuel storage and must be provided along with loading access for the fuel to be safely and efficiently delivered and stored. Finally, systems utilising bio fuels, particularly biomass, are rarely available at the small scale that would be appropriate for use in a building where the heat loads are so low.

For these reasons the use of bio-fuels is not considered suitable for this development.

#### 7.4 HEAT PUMPS

Heat pumps collect low temperature heat from renewable sources and "concentrate" it to a usable temperature. Fossil fuel based (grid) electricity is generally required to operate the pumps and the renewable component of the output is therefore by convention taken as the difference between the output energy and the input energy. A typical heat pump can deliver 3 kWh of heat energy for every 1 kWh of input energy i.e. an efficiency of 300%. A heat pump operating in this way would therefore be deemed to have delivered 2 kWh of renewable energy.

#### 7.4.1 Ground source heat pumps

There are two types of ground source heat pump system - a closed loop and open loop system. The first circulates anti-freeze through plastic pipe horizontally or vertically, the second uses ground water. Generally they work best where there is a constant heating or cooling demand or the property is off mains gas. In this case the property has access to mains gas and would not have a constant energy demand. Due to the small scale of the site a vertical closed loop system could be considered. Typically boreholes are around 10-100m deep and it is estimated that 1-2 boreholes might be required.

The viability of a heat pump is dependent on the site ground conditions and geology and this requires a geological desk study and trial boreholes to obtain the necessary information. An environmental impact assessment is generally not required for a closed loop system. There is no visual impact to consider as the system is hidden from view.

Due to the uncertainty regarding ground conditions and the small scale of the development a ground source heat pump system is not considered suitable for this development.

#### 7.5 HYDROELECTRICITY

There is no suitable source of water in the locality which could be utilised as an energy source.

#### 7.6 PHOTOVOLTAIC

Photovoltaic (PV) systems use areas of semiconductor material that produce electricity when exposed to light. They are connected to the building electricity supply via an inverter which converts the output to a form which is compatible with the mains electricity voltage and frequency. This also allows excess electricity to be exported at times when the actual demand from the dwellings is less than that being produced by the PV system. This ensures that all the electricity produced is used and achieves a reduction in carbon dioxide emissions. For all purposes relating to planning, the exported electricity is by convention treated as if it were used on site.

The output of photovoltaic systems is generally specified as kW peak, or kWp with each 1kWp of system expected to produce an average 800 kWh of electricity per year, although this may be reduced depending on location, orientation and over shading. The area required to produce an output of 1 kWp varies but for

this exercise 6.7m<sup>2</sup> has been used. (The developer will be required to submit a quotation and technical evaluation to ensure that the calculated quantity of panels will produce the required on site generation per annum)

Because the availability of sunlight, to produce electricity, will generally not align with demand, it is normal for the system to be connected to the electricity grid and excess production exported. The introduction of the feed-in-tariff has improved the economics of solar PV systems.

The installation of renewable technology ensures compliance with the London Plan a total size of approximately 1900 KWh will achieve the reduction required. There are no direct environmental consequences from the installation of PV panels but the installation can have a visual impact that may require consideration.

#### 7.7 SOLAR THERMAL PANELS

Solar thermal panels harness solar energy to heat domestic hot water. They are usually used in conjunction with the main heating system as they can only provide a portion of the demand for hot water, depending on the time of year. Overall, it is estimated that a suitably sized system can provide up to 60% of the annual energy demand for providing hot water These require the installation of a water cylinder in each dwelling. This is not currently planned for as it is proposed to use a combi boiler due to the small size of the dwellings. It is for this reason that solar thermal is not considered entirely suitable for the development.

#### 7.8 WIND TURBINES

Micro wind turbines produce electricity and can be grid-connected in the same way as photovoltaic panels.

Although wind turbines are one of the most cost effective renewable energy technologies, for smaller turbines the capital cost is relatively high compared to the amount of power generated. Adjacent trees and buildings create turbulence and the location affects wind speed and to be effective an average wind speed of no less than 5m/s is required. From the Energy Saving Trust's wind prediction tool, the predicted average wind speed at the development site is 2.4 m/s, significantly less than 5 m/s. In addition noise and vibration from roof mounted turbines can prove unacceptable and wind turbines are less likely to meet with the approval of local residents and planners.

For these reasons wind turbines are not considered suitable for this development.

#### 8. Be Green - Renewable - Conclusion

All possible renewable energy technologies were evaluated in relation to the site, starting with Combined Heat and Power (CHP). Most technologies were excluded because of the small scale of the development and location. One technology was identified as being most suitable for installation; the use of photovoltaic (PV) panels mounted on the roof of the development. It has been calculated that a suitably sized installation to offset 1900 Kwh photovoltaic would contribute to a reduction in carbon dioxide emissions of compared with the TER (target emissions rate)

Photovoltaic Panel systems convert energy from the sun into electricity through semi-conductor cells mounted in collector panels. The panels are connected to an inverter to turn the DC output into AC for use in the building to which they are attached and to be fed back into the grid when not required.

The development has been designed to use all electric for space heating, domestic hot water, lighting, and fans to try and future proof the development moving away from gas reducing the NOx emitted into the borough

Table 5:

Flat	TER CO₂/yr	Lean(DER) CO₂t/y	Percentage Reduction	Clean(DER) CO₂t/y	Percentage Reduction	Be Green (DER) CO <sub>2</sub> t/y	Percentage Reduction
2:01	26.10	30.98	-18.69	24.40	6.52	16.68	36.10
3:01	32.22	39.54	-22.70	32.11	0.36	20.69	35.80

Unit	CO2 t/yr	SAP Rating Environmental		Reduction in Co2
1:01	2.69	53 E	58 D	0
1:02	2.97	49 E	54 E	0
1:03	2.68	50 E	55 D	0
1:04	2.68	56 D	60 D	0

The new build dwellings CO<sub>2</sub> emissions are to be reduced by 35.95 % for this has been achieved through energy efficiency measures, using improved building fabric, increasing the efficiency of the building services and finally the installation of a renewable energy source.

#### 9.10 Carbon off set

Its proposed for the conversion section of the development a carbon off set payment for the 35 % reduction in Co2. It has been calculated the total  $CO_2$  for the conversion as 10.73 t/yr and 35% reduction being 3.77 t/yr. The London plan set this as £95/tonne per year over 30 years which is calculated as £10,744.50

#### 10: Photovoltaic Requirements

Total Photovoltaic = 1900 kWh = approximately 15.90 m2

PV apportioned as follows: Flat 2:01 = 800

Flat 3:01 = 1100

The output of photovoltaic systems is generally specified as kW peak, or kWp with each 1 kWp of system expected to produce an average 800 kWh of electricity per year, although this may be reduced depending on location, orientation and over shading. The area required to produce an output of 1 kWp varies but for this exercise 6.7m<sup>2</sup> has been used.

The developer will be required to submit a quotation and technical evaluation to ensure that the calculated quantity of panels will produce the required on site generation per annum.

## Appendix 1

SAP Calculations (Green New Build) Flat 2.01

## **Energy Calculations Ltd**

**SAP ◆ CODE ◆ SBEM ◆ DESIGN** 

01754-761035



# SAP Report Submission for Building Regulations Compliance

Client: Carlford Properties Limited

Project: Flat 2:01, 9-10 George Street

Richmond, London, TW9 1JY

Contact: Matthew Carter

**Energy Calculations Limited** 

mcarter@energycalculations.co.uk

Report Issue Date: 30/11/2020

EXCELLENCE IN ENERGY ASSESSMENT

#### PREDICTED ENERGY ASSESSMENT

Flat 2:01, 9-10 George Street,

Dwelling type:
Flat, Mid-Terrace
Richmond.

Date of assessment: 30/11/2020

Richmond, Date of assessment: 30/11/2020 London.

London, Produced by: Energy Calculations Limited
TW9 1JY

Total floor area: 53.8 m<sup>2</sup>

DRRN: 5270-3390-0951

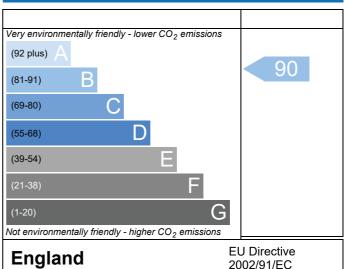
This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.

# Very energy efficient - lower running costs (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (21-38) F (1-20) G Not energy efficient - higher running costs England EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

## Environmental Impact (CO<sub>2</sub>) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.





## THERMAL BRIDGING

## **Calculation Type: New Build (As Designed)**

Property Reference	016859	016859			Issued on Date	30/11/2020	
Assessment	003 - Green			Prop Type Ref			
Reference							
Property	Flat 2:01, 9-10 George St	reet, Richmon	d, London, TW	/9 1JY			
SAP Rating		82 B	DER	16.68	TER	26.10	
Environmental		90 B	% DER <ter< th=""><th></th><th colspan="3">36.10</th></ter<>		36.10		
CO <sub>2</sub> Emissions (t/ye	ear)	0.65	DFEE	32.95	TFEE	42.89	
General Requireme	ents Compliance	Pass	% DFEE <tfi< th=""><th>E</th><th>23.18</th><th></th></tfi<>	E	23.18		
Assessor Details		Ar. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, acarter@energycalculations.co.uk					
Client	Carlford Properties						

	Junction detail	Source Psi Type (W/m		Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	9.83	0.55	
External wall	E3 Sill	Table K1 - Approved	0.040	1.80	0.07	
External wall	E4 Jamb	Table K1 - Approved	0.050	16.86	0.84	
External wall	E7 Party floor between dwellings (in blocks of flats)	Independently assessed	0.000	22.25	0.00	
External wall	E14 Flat roof	Table K1 - Default	0.080	4.84	0.39	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	2.55	0.23	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	5.10	-0.46	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	10.20	0.61	

Total: 2.24 W/mK: Y-Value: 0.039 W/m²K:



#### Energy Calculations Ltd

Property Reference	016859	016859			Issued on Date	30/11/2020	
Assessment	003 - Green		Р	rop Type Ref			
Reference							
Property	Flat 2:01, 9-10 George St	reet, Richmon	d, London, TW9 1	JY			
SAP Rating		82 B	DER	16.68	TER	26.10	
Environmental		90 B	% DER <ter< th=""><th></th><th colspan="3">36.10</th></ter<>		36.10		
CO <sub>2</sub> Emissions (t/ye	ear)	0.65	DFEE	32.95	TFEE	42.89	
General Requireme	ents Compliance	Pass	% DFEE <tfee< th=""><th></th><th colspan="3">23.18</th></tfee<>		23.18		
Assessor Details	. 0,	Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, ter@energycalculations.co.uk  Assessor ID 7869				7869-0001	
Client	Carlford Properties						



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

REGULATIONS COM	PLIANCE REPORT - Approve	d Document L1A, 2013 Edition	n, England	
DWDIII TWO AG DDG				
DWELLING AS DES:	total floor area 54 m <sup>2</sup>			
This report cove	ers items included within			
It is not a comp	plete report of regulation	ons compliance.		
Fuel factor:1.55 Target Carbon D: Dwelling Carbon	eating:Electricity 5 (electricity) ioxide Emission Rate (TE Dioxide Emission Rate (			
1b TFEE and DFEE Target Fabric En Dwelling Fabric	E nergy Efficiency (TFEE)4: Energy Efficiency (DFEE			
2 Fabric U-value	 es			
External wall Party wall		(	OK OK	
Roof Openings	0.14 (max. 0.20) 0.88 (max. 2.00)	0.14 (max. 0.35) 1.40 (max. 3.30)	OK OK	
2a Thermal brid		thermal transmittances for	each junction	
Air permeability Maximum	y at 50 pascals:	4.00 (design value) 10.0		OK
4 Heating effic: Main heating sys Panel, convector	iency	Room heaters - Electric		
Secondary heating		None		
5 Cylinder insu: Hot water storag Permitted by DBS	lation ge SCG 1.41	Measured cylinder loss: 1.	07 kWh/day	
Primary pipeworl	k insulated:	No primary pipework		
6 Controls Space heating co	ontrols:	Programmer and appliance to	hermostats	OK
Hot water contro	ols:	Cylinderstat		OK
7 Low energy lic Percentage of f:	ghts ixed lights with low-ene:	rgy fittings:100%		
Minimum		75%		OK
8 Mechanical ver Continuous supp Specific fan por	ly and extract system	0.63		
Maximum		0.63 1.5		OK
MVHR efficiency Minimum:	:	90% 70%		OK
9 Summertime ter Overheating rish Based on:		Medium		OK
Overshading: Windows facing 1	North:	Average 5.97 m <sup>2</sup> , No overhang		
Windows facing I	East:	14.11 m², No overhang		
Windows facing N Air change rate		3.00 m <sup>2</sup> , No overhang 8.00 ach		
Blinds/curtains	:	None		
10 Key features Party wall U-val	lue	0.00 W/m <sup>2</sup> K		
Window U-value		0.84 W/m²K		
Thermal bridging Photovoltaic ar:		0.039 W/m <sup>2</sup> K 800.00 kWh/Year		



CALCULATIO	ON OF D	WELLING	S EMISSI	ONS FOR	REGULAT	IONS CO	OMPLIAN	CE 09	Jan 2014				
SAP 2012 WORKSHE					9.92, Januar ICE 09 3	ry 2014) Jan 2014							
. Overall dwell	ing dimen	sions											
round floor otal floor area welling volume	n TFA = (1	a)+(1b)+(1c	:)+(1d)+(1e)	(ln)	5	53.8000		Area (m2) 53.8000 (		y height (m) 2.5500 ( (3d)+(3e).		Volume (m3) 137.1900 137.1900	(4)
. Ventilation r	ate												
					main heating	Se	econdary heating	c	ther	tota	ıl r	m3 per hour	
umber of chimne umber of open f umber of interm umber of passiv umber of fluele	lues mittent fa ve vents				0	+ +	0	+ +	0 = 0		0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000	(6b) (7a) (7b)
nfiltration due ressure test easured/design nfiltration rat	AP50	eys, flues	and fans	= (6a)+(6b)	+(7a)+(7b)+	(7c) =					Air change / (5) =	0.0000 Yes 4.0000 0.2000	
umber of sides								(	20) = 1 -	[0.075 x	(19)] =		(19)
nfiltration rat	e adjuste	d to includ	e shelter f	actor						) = (18) x		0.1550	
nd speed nd 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		
infilt rate Balanced mechan	0.1976 nical vent	0.1938 ilation wit	0.1899 h heat reco	0.1705 overy	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821	(22b)
mechanical ve balanced with			ciency in %	allowing f	for in-use fa	actor (from	m Table 4h)	=				0.5000 76.5000	
ffective ac	0.3151	0.3113	0.3074	0.2880	0.2841	0.2648	0.2648	0.2609	0.2725	0.2841	0.2919	0.2996	(25)
. Heat losses a	and heat 1	oss paramet	er										
Lement				Gross	Openings		tArea	U-value	AxU		value	AxK	
oor to Hall .ndows (Uw = 0.	.84)			m2	m2	1 23	m2 .8600 .0800	W/m2K 1.4000 0.8127	W/K 2.6040 18.7570		:J/m2K	kJ/K	(26) (27)
w Wall ill to hall sternal Roof 1 otal net area o	of evterna	l elemente		34.5500 22.1900 1.0000	23.0800 1.8600	20 1	.4700 .3300 .0000 .7400	0.1800 0.1705 0.1400	2.0646 3.4660 0.1400	18	.0000	103.2300 365.9400 9.0000	(29a)
where heat loss arty Wall 1 arty Floor 1 arty Ceilings 1 aternal Wall 1	s, W/K = S					45 52 51		30) + (32) = 0.0000	27.0316 0.0000	180 30 30	.0000	8197.2000 1584.0000 1554.0000 248.7600	(33) (32) (32d) (32b)
eat capacity Cm mermal mass par mermal bridges	rameter (T	MP = Cm / T						(28)	.(30) + (32)			224.2032 2.2352	(35) (36)
otal fabric hea entilation heat		culated mon	thlv (38)m	= 0 33 x (2	5)m x (5)					(33)	+ (36) =	29.2667	(37)
	Jan 14.2666	Feb 14.0911	Mar 13.9157	Apr 13.0385	May 12.8631	Jun 11.9859	Jul 11.9859	Aug 11.8105	Sep 12.3368	Oct 12.8631	Nov 13.2140	Dec 13.5648	(38)
eat transfer co verage = Sum(39	43.5333	43.3579	43.1824	42.3053	42.1298	41.2527	41.2527	41.0773	41.6036	42.1298	42.4807	42.8316 42.2614	
P P (average)	Jan 0.8092	Feb 0.8059	Mar 0.8026	Apr 0.7863	May 0.7831	Jun 0.7668	Jul 0.7668	Aug 0.7635	Sep 0.7733	Oct 0.7831	Nov 0.7896	Dec 0.7961 0.7855	
ys in month	31	28	31	30	31	30	31	31	30	31	30		(41)
Water heating	energy r	equirements	(kWh/year)										
sumed occupanc erage daily ho		se (litres/	day)									1.8021 77.0004	
aily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)



CALCULAT	ION OF I	OWELLIN	G EMISSI	ONS FOR	R REGULA	TIONS CO	OMPLIAN	ICE 09	Jan 2014				
Energy conte Energy content Distribution 1	(annual)			98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207 Total = Si	112.0185 im(45)m =	121.6449 1211.5155	
Water storage	18.8412	16.4787		14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(46)
Store volume a) If manufac Temperature Enter (49) or	turer declar	m Table 2b	actor is kn	own (kWh/c	lay):							90.0000 1.0700 0.6000 0.6420	(48) (49)
Total storage		17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder co	19.9020		r storage 19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(57)
Primary loss Total heat rec				ed for each	month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Solar input Output from w/	0.0000	127.8338	133.2654	118.0929	114.7346 0.0000	0.0000	95.7326 0.0000	106.9187 0.0000 Solar inp	107.3159 0.0000 ut (sum of 1	122.5227 0.0000 months) = Si	131.2785 0.0000 um(63)m =	141.5469 0.0000 0.0000	(63)
odepac 110m w/		127.8338	133.2654	118.0929	114.7346	101.0933	95.7326		107.3159 er year (kWl				
Heat gains fro		ating, kWh/ 50.9085	month 53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	
5. Internal ga	ins (see T	able 5 and	5a)										
Metabolic gair	s (Table 5	), Watts										_	
(66) m	90.1060				May 90.1060		Jul 90.1060	Aug 90.1060	Sep 90.1060	Oct 90.1060	Nov 90.1060	Dec 90.1060	(66)
Lighting gains	14.0045	12.4387	10.1158	7.6583	5.7247	4.8330		6.7881	9.1109	11.5684	13.5021	14.3937	(67)
Appliances gai Cooking gains	157.0879	158.7180	154.6102	145.8653	134.8264	124.4514	117.5203	115.8902	119.9980	128.7429	139.7818	150.1568	(68)
Pumps, fans	32.0106 0.0000				32.0106	32.0106	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	
Losses e.g. ev	aporation		alues) (Tab			-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	
Water heating	gains (Tab			67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	
Total internal	gains	296.9452		270.5970		238.5073	228.0637	232.9986	241.2054	257.6052	276.4464	290.3464	
6. Solar gains													
[Jan]			А	rea m2	Solar flux Table 6a W/m2	Speci:	g Fic data Table 6b	Specific or Tab	FF data le 6c	Acces facto Table (	or	Gains W	
			5.9 14.1 3.0	rea m2  700 100 000	Solar flux Table 6a W/m2 10.6334 19.6403 19.6403	Speci: or !	g fic data Table 6b  0.6300 0.6300 0.6300	Specific or Tab.	data	facto	or 5d 00		(76)
[Jan]  North East West	122.1004		5.9 14.1 3.0	rea m2	Solar flux Table 6a W/m2 10.6334 19.6403 19.6403	Speci:	gfic data Table 6b 0.6300 0.6300 0.6300	Specific or Tab.	data le 6c .7000 .7000	facto Table 6 0.770 0.770	00 00 00 151.9877	19.4007 84.6927 18.0070	(76) (80)
[Jan]  North East West  Solar gains	122.1004 420.7600	237.9782 534.9233	5.9 14.1 3.0 393.8584 680.6793	rea m2	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403  727.6857 982.0501	Speci: or:	gfic data Table 6b 0.6300 0.6300 0.6300 712.5836 940.6473	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	factor Table (0.770 0.770 0.770	00 00 00 151.9877	19.4007 84.6927 18.0070	(76) (80)
North East West Solar gains Total gains	122.1004 420.7600	237.9782 534.9233 ture (heati	5.9 14.1 3.0 393.8584 680.6793	700 100 000 	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403  727.6857 982.0501	Speci: or:	gfic data Table 6b 0.6300 0.6300 0.6300 712.5836 940.6473	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	factor Table (0.770 0.770 0.770	00 00 00 151.9877	19.4007 84.6927 18.0070	(76) (80) (83) (84)
North East West Solar gains Total gains Total gains Tutal gains	122.1004 420.7600 mal tempera rining heating cotor for grant Jan 76.9662 6.1311	237.9782 534.9233 ture (heati	5.9 14.1 3.0 393.8584 680.6793	700 100 000 583.7316 854.3286	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403  727.6857 982.0501  mm Table 9, 5 Table 9a) May 79,5301	Speci: or:	gfic data Table 6b 0.6300 0.6300 0.6300 712.5836 940.6473	Specific or Tab.  0 0 0 0 0 0 0 603.1592 836.1578	data le 6c .7000 .7000 .7000	factor Table (0.770 0.770 0.770	or od	W 19.4007 84.6927 18.0070 100.6286 390.9751	(76) (80) (83) (84)
North East West Solar gains Total gains Total gains Total gains	122.1004 420.7600 mal tempera rining heating cotor for grant Jan 76.9662 6.1311	237.9782 534.9233 ture (heati ng periods ains for li Feb 77.2776	393.8584 680.6793 ng season) in the livi ving area, Mar 77.5915 6.1728	700 100 000 	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403  727.6857 982.0501  om Table 9, 19.6403 May 79.5301 6.3020	751.3026 989.8099	gfic data rable 6b 	Specific or Tab.  0 0 0 0 0 603.1592 836.1578	data le 6c .7000 .7000 .7000 460.5485 701.7539	factor Table 6 0.77( 0.7	Nov 78.8732 6.2582	W 19.4007 84.6927 18.0070 100.6286 390.9751 21.0000 Dec 78.2271 6.2151	(76) (80) (83) (84)
North East West Solar gains Total gains Total gains Tutal gains	122.1004 420.7600 anal tempera- ring heating to the form for good of the form	237.9782 534.9233 ture (heati- ng periods ains for li Feb 77.2776 6.1518 0.9466 20.6089	393.8584 680.6793 ng season) in the livi ving area, Mar 77.5915 6.1728	700 100 000 583.7316 854.3286	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403  727.6857 982.0501  Table 9a) May 79.5301 6.3020 0.3982 20.9985	751.3026 989.8099	712.5836 940.6473	Specific or Tab.  0 0 0  603.1592 836.1578  Aug 81.5680 6.4379	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 .7539 Sep 80.5362 6.3691 0.4083	factor Table 6 0.77( 0.7	Nov 78.8732 6.2582 0.9592 20.6325 20.2624	19.4007 84.6927 18.0070 100.6286 390.9751 21.0000 Dec 78.2271 6.2151 0.9896 20.3200 20.2567	(86) (87) (88)
North East West Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h	122.1004 420.7600 	237.9782 534.9233 ture (heati 	393.8584 680.6793 ng season) in the livi ving area, Mar 77.5915 6.1728 0.8222 20.8643	700 100 000 583.7316 854.3286	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403  727.6857 982.0501  Table 9a) May 79.5301 6.3020 0.3982 20.9985	751.3026 989.8099 Th1 (C) Jun 81.2212 6.4147 0.2667 20.9999	Jul 81.2212 6.4147 0.1930 21.0000	Specific or Tab.  0 0 0  603.1592 836.1578  Aug 81.5680 6.4379 0.2260 21.0000	data le 6c .7000 .7000 .7000 .7000 460.5485 701.7539 Sep 80.5362 6.3691 0.4083 20.9988 20.2765 0.3658 20.2757	factor Table 6 0.77( 0.77( 0.77( 0.77) 282.5215 540.1267  Oct 79.5301 6.3020 0.7589 20.9421 20.2680 0.7182 20.2098	Nov 78.8732 6.2582 0.9592 20.6325 20.2624 0.9484 19.8041	19.4007 84.6927 18.0070 100.6286 390.9751 21.0000 Dec 78.2271 6.2151 0.9896 20.3200 20.2567 0.9869 19.3528	(86) (87) (88) (89) (90)
North East West Solar gains Total gains Total gains Total gains Timperature du Utilisation fatau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr	122.1004 420.7600 Mal temperal mal temperal man fo.9662 6.1311 man co.9850 20.3628 20.2454 man co.9812 19.4055 matching temperal man co.9812 19.4055 matching temperal	237.9782 534.9233 ture (heati 	393.8584 680.6793 ang season) in the liviving area, Mar 77.5915 6.1728 0.8222 20.8643 20.2510 0.7956	700 100 000 583.7316 854.3286 393 area frc ni1,m (see Apr 79.2003 6.2800 0.5893 20.9827 20.2652 0.5560 20.2479	Table 6a W/m2  10.6334 19.6403 19.6403  727.6857 982.0501  m Table 9a, Table 9a) May 79.5301 6.3020 0.3982 20.9985 20.2680 0.3671	751.3026 989.8099 Th1 (C) Jun 81.2212 6.4147 0.2667 20.9999 20.2822 0.2368	Jul 81.2212 6.4147 0.1930 21.0000 20.2822 0.1615	Specific or Tab.  0 0 0 0 0 603.1592 836.1578  Aug 81.5680 6.4379 0.2260 21.0000 20.2851 0.1909	data le 6c .7000 .7000 .7000 .7000  460.5485 701.7539  Sep 80.5362 6.3691 0.4083 20.9988 20.2765 0.3658 20.2757	factor Table ( 0.77( 0.7	Nov 78.8732 6.2582 0.9592 20.6325 20.2624 0.9484 1.9 (4) =	19.4007 84.6927 18.0070 100.6286 390.9751 21.0000 Dec 78.2271 6.2151 0.9896 20.3200 20.2567 0.9869 19.3528 0.5948	(86) (87) (88) (89)
North East West Solar gains Total gains  7. Mean interr Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT 2 Living area fr MIT	122.1004 420.7600 all tempera: aring heatisetor for gradius of the second of the sec	237.9782 534.9233 ture (heati- ng periods ains for li- Feb 77.2776 6.1518 0.9466 20.6089 20.2482 0.9352 19.7547 20.2628	5.9 14.1 3.0 393.8584 680.6793  ang season) in the livi ving area, Mar 77.5915 6.1728 0.8222 20.8643 20.2510 0.7956 20.0948 20.5525	700 100 000 583.7316 854.3286 	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403  727.6857 982.0501  om Table 9a) May 79.5301 6.3020 0.3982 20.9985 20.2680 0.3671 20.2668 20.7020	751.3026 989.8099 Th1 (C) Jun 81.2212 6.4147 0.2667 20.9999 20.2822 0.2368 20.2822	Jul 81.2212 6.4147 0.1930 21.0000 20.2822 0.1615 20.2822	Aug 81.5680 6.4379 0.2260 21.0000 20.2851 0.1909 20.2851	data le 6c .7000 .7000 .7000 .460.5485 701.7539 Sep 80.5362 6.3691 0.4083 20.9988 20.2765 0.3658 20.2757 fLA =	factor Table 6 0.77( 0.7	Nov 78.8732 6.2582 0.9592 20.6325 20.2624 0.9484 19.8041 1/(4) = 20.2968	19.4007 84.6927 18.0070 100.6286 390.9751 21.0000 Dec 78.2271 6.2151 0.9896 20.3200 20.2567 0.9869 19.3528 0.5948 19.9281 0.0000	(86) (87) (88) (89) (90) (91) (92)
North East West Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fn MIT Temperature ac	122.1004 420.7600 	237.9782 534.9233 ture (heati- ng perioda ains for li- peb 77.2776 6.1518 0.9466 20.6089 20.2482 0.9352 19.7547 20.2628 20.2628	5.9 14.1 3.0 393.8584 680.6793  in the livit ving area, Mar 77.5915 6.1728 0.8222 20.8643 20.2510 0.7956 20.0948 20.5525 20.5525	m2 m2 m2 m3	Solar flux Table 6a W/m2  10.6334 19.6403  727.6857 982.0501  Table 9, May 79.5301 6.3020 0.3982 20.9985 20.2680 0.3671 20.2668 20.7020 20.7020	751.3026 989.8099 751.3026 989.8099 751.3026 989.8099 751.3026 81.2212 6.4147 0.2667 20.9999 20.2822 0.2368 20.2822 20.7091 20.7091	Jul 81.2212 6.4147 0.1930 21.0000 20.2822 0.1615 20.7091 20.7091	Specific or Tab.  0 0 0 0 0 0 0 603.1592 836.1578  Aug 81.5680 6.4379 0.2260 21.0000 20.2851 0.1909 20.2851 20.7103	data le 6c .7000 .7000 .7000 .7000 .7000  460.5485 701.7539  Sep 80.5362 6.3691 0.4083 20.9988 20.2765 0.3658 20.2757 fLA = 20.7058	Oct 79.5301 6.3020 0.7589 20.9421 20.2680 0.7182 20.2098 Living area 20.6454	Nov 78.8732 6.2582 0.9592 20.6325 20.2624 0.9484 19.8041 1/(4) = 20.2968	19.4007 84.6927 18.0070 100.6286 390.9751 21.0000 Dec 78.2271 6.2151 0.9896 20.3200 20.2567 0.9869 19.3528 0.5948 19.9281 0.0000	(86) (87) (88) (89) (90) (91) (92)
North East West Solar gains Total gains 7. Mean interr Temperature du Utilisation fe tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ac adjusted MIT 8. Space heati	122.1004 420.7600 	237.9782 534.9233 ture (heati ng periods ains for li Feb 77.2776 6.1518 0.9466 20.6089 20.2482 0.9352 19.7547 20.2628 20.2628	5.9 14.1 3.0 393.8584 680.6793  mg season) in the livi ving area, Mar 77.5915 6.1728 0.8222 20.8643 20.2510 0.7956 20.0948 20.5525 20.5525	700 100 000 583.7316 854.3286  ng area fro nil, m (see Apr 79.2003 6.2800 0.5893 20.9827 20.2652 0.5560 20.2479 20.6850 20.6850	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403  727.6857 982.0501  mag Table 9a) May 79.5301 6.3020 0.3982 20.9985 20.2680 0.3671 20.2668 20.7020 20.7020	751.3026 989.8099 Th1 (C)  Jun 81.2212 6.4147 0.2667 20.9999 20.2822 20.7091 20.7091	Jul 81.2212 6.4147 0.1930 21.20000 20.2822 20.7091 20.7091 Jul 0.1802	Aug 81.5680 6.4379 0.2260 21.0000 20.2851 20.7103 20.7103	data le 6c .7000 .7000 .7000 .7000 460.5485 701.7539  Sep 80.5362 6.3691 0.4083 20.9988 20.2765 0.3658 20.2757 fLA = 20.7058 20.7058	factor Table 6 0.77( 0.7	Nov 78.8732 6.2582 0.9592 20.6325 20.2624 19.8041 1/(4) = 20.2968 Nov 0.9489	W 19.4007 84.6927 18.0070 100.6286 390.9751 21.0000 Dec 78.2271 6.2151 0.9896 20.3200 20.2567 0.9869 19.3528 0.5948 19.9281 0.0000 19.9281	(85) (86) (87) (88) (89) (90) (91) (92)
North East West Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ac adjusted MIT  8. Space heati	122.1004 420.7600 	237.9782 534.9233 ture (heati ng periods ains for li Feb 77.2776 6.1518 0.9466 20.6089 20.2482 0.9352 19.7547 20.2628 20.2628	5.9 14.1 3.0 393.8584 680.6793  mg season) in the livi ving area, Mar 77.5915 6.1728 0.8222 20.8643 20.2510 0.7956 20.0948 20.5525 20.5525	m2 m2 m2 m3	Solar flux Table 6a W/m2  10.6334 19.6403  727.6857 982.0501  Table 9, Tabl	751.3026 989.8099 751.3026 989.8099 751.3026 989.8099 751.3026 6.4147 0.2667 20.9999 20.2822 0.2368 20.2822 20.7091 20.7091	Jul 81.2212 6.4147 0.1930 21.20000 20.2822 20.7091 20.7091 Jul 0.1802	Aug 81.5680 6.4379 0.2260 21.0000 20.2851 20.7103 20.7103	data le 6c .7000 .7000 .7000 .7000 460.5485 701.7539  Sep 80.5362 6.3691 0.4083 20.9988 20.2765 0.3658 20.2757 fLA = 20.7058 20.7058	factor Table (	Nov 78.8732 6.2582 0.9592 20.6325 20.2624 19.8041 1/(4) = 20.2968 Nov 0.9489	W 19.4007 84.6927 18.0070 100.6286 390.9751 21.0000 Dec 78.2271 6.2151 0.9896 20.3200 20.2567 0.9869 19.3528 0.5948 19.9281 0.0000 19.9281	(85) (86) (87) (88) (89) (90) (91) (92) (93)
North East West	122.1004 420.7600  Lal tempera and tempera	237.9782 534.9233 ture (heati ng perioda ains for li Feb 77.2776 6.1518 0.9466 20.6089 20.2482 0.9352 19.7547 20.2628 20.2628	5.9 14.1 3.0 393.8584 680.6793  mg season) in the livi ving area, Mar 77.5915 6.1728 0.8222 20.8643 20.2510 0.7956 20.0948 20.5525 20.5525	m2  700  100  100  100  583.7316  854.3286	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403 727.6857 982.0501  Table 9, 7 Table 9, 7 Table 93 May 79.5301 6.3020 0.3982 20.9985 20.2668 20.7020 20.7020  May 0.3856 378.6735 11.7000 379.2534	751.3026 989.8099 Th1 (C) Jun 81.2212 6.4147 0.2667 20.9999 20.2822 20.7091 20.7091 Jun 0.2546 251.9870 14.6000	Jul 81.2212 6.4147 0.1930 21.0000 20.2822 20.7091 20.7091 Jul 0.1802 169.5110 16.6000	Specific or Tab.  0	data le 6c .7000 .7000 .7000 .7000 .7000  460.5485 701.7539  Sep 80.5362 6.3691 0.4083 20.9988 20.2765 0.3658 20.2757 fLA = 20.7058 20.7058  Sep 0.3910 274.3983	factor Table 6 0.77( 0.7	Nov 78.8732 6.2582 0.9592 20.6325 20.2624 0.9484 19.8041 14 / (4) = 20.2968 20.2968	19.4007 84.6927 18.0070 100.6286 390.9751 21.0000 Dec 78.2271 6.2151 0.9896 20.3200 20.2567 0.9869 19.3528 0.5948 19.9281 0.0000 19.9281	(86) (87) (88) (89) (90) (91) (92) (93)



CALCULATION OF DWELL	NG EMISSI	ONS FOR	REGULA	TIONS CO	OMPLIAN	ICE 09	Jan 2014	ļ.		
Space heating per m2								(98)	) / (4) =	13.0864 (99)
8c. Space cooling requirement										
Not applicable										
NOC applicable										
9a. Energy requirements - Individ										
Fraction of space heat from secon Fraction of space heat from main Efficiency of main space heating Efficiency of secondary/supplement Space heating requirement	system(s) system 1 (in	%)	m (Table 11	)						0.0000 (201) 1.0000 (202) 100.0000 (206) 0.0000 (208) 704.0480 (211)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement 201.0401 111.349		5.1805	0.4315	0.0000	0.0000	0.0000	0.0000	17.6188	110.9222	214.5496 (98)
Space heating efficiency (main he	0 100.0000		100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating 201.0401 111.349		5.1805	0.4315	0.0000	0.0000	0.0000	0.0000	17.6188	110.9222	214.5496 (211)
Water heating requirement 0.0000 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 requirement										
145.5102 127.833 Efficiency of water heater	8 133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469 (64) 100.0000 (216)
(217)m 100.0000 100.000 Fuel for water heating, kWh/month		100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
145.5102 127.833 Water heating fuel used Annual totals kWh/year		118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469 (219) 1445.8455 (219)
Space heating fuel - main system Space heating fuel - secondary										704.0480 (211) 0.0000 (215)
Electricity for pumps and fans: (BalancedWithHeatRecovery, D. mechanical ventilation fans (S Total electricity for the above, Electricity for lighting (calcula	FP = 0. kWh/year	7875)	1.2500, SFP	= 0.7875)						131.8053 (230a) 131.8053 (231) 247.3239 (232)
Energy saving/generation technology Total delivered energy for all us		ces M ,N an	d Q)							2529.0226 (238)
12a. Carbon dioxide emissions - 1	ndividual hea	ting system	s including	micro-CHP						
Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating						Energy kWh/year 704.0480 0.0000 1445.8455		ion factor kg CO2/kWh 0.5190 0.0000 0.5190	k	Emissions dg CO2/year 365.4009 (261) 0.0000 (263) 750.3938 (264) 1115.7947 (265)
Pumps and fans Energy for lighting						131.8053 247.3239		0.5190 0.5190		68.4069 (267) 128.3611 (268)
Energy saving/generation technol PV Unit Total CO2, kg/year						-800.0000		0.5190		-415.2000 (269) 897.3627 (272)
Dwelling Carbon Dioxide Emission	rate (DER)									16.6800 (273)
16 CO2 EMISSIONS ASSOCIATED WITH DER Total Floor Area Assumed number of occupants CO2 emission factor in Table 12 : CO2 emissions from appliances, ec CO2 emissions from cooking, equat Total CO2 emissions Residual CO2 emissions offset fro Additional allowable electricity Resulting CO2 emissions offset fro Net CO2 emissions	or electricit uation (L14) ion (L16) m biofuel CHP generation, k	y displaced Wh/m²/year	from grid			ON TECHNOLO	GIES		TFA N EF	16.6800 ZC1 53.8000 1.8021 0.5190 17.3024 ZC2 3.0158 ZC3 36.9982 ZC4 0.0000 ZC5 0.0000 ZC7 36.9982 ZC8



#### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHE CALCULATION OF T	ARGET EMIS	SIONS	09 Jan 20	(Version	9.92, Januar	y 2014)							
1. Overall dwell	ing dimens	ions						Area	Stor	ey height		Volume	
Ground floor Total floor area Dwelling volume	a TFA = (1a	)+(1b)+(1c	e) + (1d) + (1e)	)(1n)	5	3.8000		(m2) 53.8000		(m) 2.5500		(m3)	(1b) - (3b) (4) (5)
2. Ventilation r	ate												
					main heating		econdary heating		other	tot	al m	3 per hour	
Number of chimne Number of open f Number of interm Number of passiv Number of fluele	flues mittent fan ve vents				0	+ +	0	+ +	0 = 0		0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 20.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration due Pressure test Measured/design Infiltration rat Number of sides	AP50 :e	ys, flues	and fans	= (6a)+(6b)	+(7a)+(7b)+(	7c) =				20.0000	Air change	0.1458 Yes 5.0000 0.3958	
Shelter factor Infiltration rat	e adjusted	to includ	e shelter :	factor					(20) = 1 -	[0.075 x		0.7750 0.3067	
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	0.3911 0.5765	0.3834 0.5735	0.3757 0.5706	0.3374 0.5569	0.3297 0.5544	0.2914 0.5425	0.2914 0.5425	0.2837 0.5403		0.3297 0.5544	0.3451 0.5595	0.3604 0.5649	
3. Heat losses a Element  TER Opaque door  TER Opening Type New Wall Wall to hall External Roof 1 Total net area of Fabrich heat loss	e (Uw = 1.4	0) elements		Gross m2 34.5500 22.1900 1.0000	Openings m2 11.6000 1.8600	1. 11. 22. 20.	m2 .8600 .6000 .9500 .3300 .0000 .7400 (26)(3	U-value W/m2K 1.0000 1.3258 0.1800 0.1800 0.1300	A x W/ 1.860 15.378 4.131 3.659 0.130	K 10 18 18 10 10	-value kJ/m2K	A x K kJ/K	(26) (27) (29a) (29a) (30) (31) (33)
Thermal mass par Thermal bridges Total fabric hea	(Sum(L x P									(33)	+ (36) =	250.0000 3.7517 28.9109	(36)
Ventilation heat				= 0.33 x (2		Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer co	26.0985 eff	25.9641	25.8323	25.2133	25.0975	24.5584	24.5584	24.4586	24.7661	25.0975	25.3318	25.5767	
Average = Sum(39	55.0094 9) m / 12 =	54.8749	54.7432	54.1242	54.0084	53.4693	53.4693	53.3695	53.6770	54.0084	54.2427	54.4876 54.1237	
HLP HLP (average) Days in month	Jan 1.0225	Feb 1.0200	Mar 1.0175	Apr 1.0060	May 1.0039	Jun 0.9939	Jul 0.9939	Aug 0.9920	Sep 0.9977	Oct 1.0039	Nov 1.0082	Dec 1.0128 1.0060	
	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heating	g energy re	quirements	(kWh/year	)									
Assumed occupance Average daily ho		e (litres/	day)									1.8021 77.0004	
Daily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	84.7004 .25.6082 (annual)	81.6204 109.8578	78.5404 113.3634 5) m	75.4604 98.8329	72.3803 94.8326	69.3003 81.8333	69.3003 75.8306	72.3803 87.0167		78.5404 102.6207 Total = S	81.6204 112.0185 Sum(45)m =	84.7004 121.6449 1211.5155	(45)
	18.8412 pss: arer declar actor from	16.4787 ed loss fa	17.0045	14.8249 own (kWh/da	14.2249 y):	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467 90.0000 1.0406 0.5400 0.5619	(47) (48) (49)



CALCULATI	ON OF T	ARGET E	MISSION	IS 09 J	lan 2014								
Total storage 1		15 7000	17 4106	16 0555		16 0577		17 4106	16 0555	17 4106	16 0555		, F. 6.
If cylinder cor	17.4196 ntains dedi 17.4196	15.7338 cated sola: 15.7338	17.4196 r storage 17.4196	16.8577 16.8577	17.4196 17.4196	16.8577	17.4196 17.4196	17.4196 17.4196	16.8577 16.8577	17.4196 17.4196	16.8577 16.8577	17.4196 17.4196	
Primary loss Total heat requ	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	
			154.0454	138.2026 0.0000	135.5146	121.2030	116.5126 0.0000	127.6987 0.0000 Solar inp	127.4256 0.0000 ut (sum of	143.3027 0.0000 months) = Si	151.3882 0.0000 um(63)m =	162.3269 0.0000 0.0000	(63)
Output from w/h	166.2902	146.6028	154.0454	138.2026	135.5146	121.2030	116.5126	127.6987 Total pe	127.4256 er vear (kW	143.3027 h/year) = Si	151.3882	162.3269 1690.5133	
Heat gains from	water hea 74.3103	ting, kWh/r 65.9237	70.2389	64.3577	64.0774	58.7053	57.7593	61.4787	60.7743	66.6670	68.7419	72.9925	
5. Internal gai  Metabolic gains													
(66)m	Jan	Feb	Mar 90.1060	Apr 90.1060	May 90.1060	Jun 90.1060	Jul 90.1060	Aug 90.1060	Sep 90.1060	Oct 90.1060	Nov 90.1060	Dec 90.1060	(66)
Lighting gains	(calculate	d in Append	dix L, equa	tion L9 or		see Table 5		6.7960	9.1215	11.5819	13.5178	14.4105	
Appliances gair	ns (calcula	ted in Appe	endix L, eq	uation L13		lso see Tab	le 5	115.8902	119.9980	128.7429	139.7818	150.1568	
Cooking gains (		in Append: 32.0106	ix L, equat: 32.0106	ion L15 or 32.0106	L15a), also 32.0106	see Table 32.0106	5 32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	(69)
Pumps, fans Losses e.g. eva					3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	
Water heating o	gains (Tabl	e 5)	-72.0848		-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	
Total internal		98.1008	94.4072	89.3857 295.9500	86.1256	81.5352	77.6334	82.6326 258.3506	84.4088	89.6062	95.4749	98.1082	
	324.0200	322.3037	312.1768	293.9300	279.7151	263.8570	253.4138	230.3306	266.5601	282.9627	301.8062	315.7073	(73)
6. Solar gains													
[Jan]				rea m2	Solar flux Table 6a W/m2	or		Specific or Tab		Acce: facto Table	or	Gains W	
North East West			3.00 7.00 1.5	000 900 100	10.6334 19.6403 19.6403		0.6300 0.6300 0.6300	0 0 0	.7000 .7000 .7000	0.77 0.77 0.77	00	9.7491 42.5564 9.0635	(76)
Solar gains			197.9577 510.1344		365.7407 645.4558		358.1499 611.5638		231.4766 498.0367	141.9986 424.9613	76.3908 378.1970	50.5771 366.2843	
7. Mean interna													
Temperature dur												21.0000	(85)
Utilisation fac						Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau alpha	67.9177 5.5278	68.0841 5.5389	68.2480 5.5499	69.0285 5.6019	69.1765 5.6118	69.8739 5.6583	69.8739 5.6583	70.0046 5.6670	69.6036 5.6402	69.1765 5.6118	68.8777 5.5918	68.5681 5.5712	
util living are	0.9952	0.9891	0.9675	0.8895	0.7260	0.5262	0.3836	0.4349	0.7020	0.9396	0.9894	0.9963	(86)
MIT Th 2	20.0437	20.2019	20.4629	20.7657 20.0783	20.9396 20.0801	20.9917 20.0885	20.9988	20.9977	20.9627 20.0852	20.7087 20.0801	20.3194 20.0765	20.0145 20.0727	
util rest of ho	ouse 0.9937	0.9857	0.9574	0.8594	0.6696	0.4545	0.3047	0.3501	0.6246	0.9156	0.9854	0.9952	(89)
MIT 2 Living area fra			19.4023	19.8196	20.0265	20.0834	20.0880	20.0891		19.7573 Living area	a / (4) =	18.7606 0.5948	(91)
MIT Temperature adj			20.0332	20.3824	20.5696	20.6236	20.6298	20.6295	20.5963	20.3232		0.0000	
adjusted MIT	19.5386	19.7262	20.0332	20.3824	20.5696	20.6236	20.6298	20.6295	20.5963	20.3232	19.8688	19.5064	(93)
8. Space heatin	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation Useful gains Ext temp.	4.3000	0.9842 434.9157 4.9000	0.9570 488.1990 6.5000	0.8701 512.7892 8.9000	0.7005	0.4970 318.7952 14.6000	0.3517 215.0877 16.6000	0.4006	0.6691 333.2510 14.1000	0.9228 392.1486 10.6000	0.9843 372.2613 7.1000		(95)
	W 838.2635 1.0000	813.5853 1.0000	740.8486 1.0000	621.4733 1.0000	479.0333 1.0000	322.0802	215.4694	225.7285	348.7024 0.0000	525.1354 1.0000	692.6121 1.0000	834.0099	
Space heating k	:Wh		187.9713	78.2525		0.0000	0.0000	0.0000	0.0000	98.9422		349.5555 1558.9329	(98)
Space heating p	per m2									(98)	) / (4) =	28.9764	
8c. Space cooli													
Not applicable													



#### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Ind	ividual heatir	g systems, inc		o-CHP							
Fraction of space heat from s Fraction of space heat from m Efficiency of main space heat Efficiency of secondary/supple Space heating requirement	econdary/suppl ain system(s) ing system 1 (	ementary syste	m (Table 11							0.0000 1.0000 93.5000 0.0000 1667.3079	(202) (206) (208)
Jan Fo	eb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	.4660 187.97		20.0297	0.0000	0.0000	0.0000	0.0000	98.9422	230.6526	349.5555	(98)
93.5000 93	.5000 93.50		93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
	ing system) .1562 201.03	88 83.6925	21.4222	0.0000	0.0000	0.0000	0.0000	105.8206	246.6872	373.8562	(211)
Water heating requirement 0.0000 0	.0000 0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating											
	.6028 154.04	54 138.2026	135.5146	121.2030	116.5126	127.6987	127.4256	143.3027	151.3882	162.3269	
	.2716 85.34	58 83.3632	81.0337	79.8000	79.8000	79.8000	79.8000	83.8491	85.9341	79.8000 86.8088	
	onth .9316 180.49	56 165.7837	167.2323	151.8834	146.0057	160.0234	159.6812	170.9055	176.1678	186.9935	
Water heating fuel used Annual totals kWh/year Space heating fuel - main sys Space heating fuel - secondar										2026.9572 1667.3079 0.0000	(211)
Electricity for pumps and fan- central heating pump main heating flue fan Total electricity for the abo Electricity for lighting (cal- Total delivered energy for al-	ve, kWh/year culated in App	endix L)								30.0000 45.0000 75.0000 247.6113 4016.8765	(230e) (231) (232)
12a. Carbon dioxide emissions	- Individual	heating system	s including	micro-CHP							
Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans Energy for lighting Total CO2, kg/m2/year Emissions per m2 for space an Fuel factor (electricity) Emissions per m2 for lighting Emissions per m2 for pumps an Target Carbon Dioxide Emission	d water heatir d fans	ā				Energy kWh/year 1667.3079 0.0000 2026.9572 75.0000 247.6113		ion factor kg CO2/kWh 0.2160 0.0000 0.2160 0.5190	3	Emissions cg CO2/year 360.1385 0.0000 437.8228 797.9613 38.9250 128.5103 965.3965 14.8320 1.5500 2.3887 0.7235 26.1000	(263) (264) (265) (267) (268) (272) (272a) (272b) (272c)

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#### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSH	FABRIC ENE	RGY EFFICIE	NCY 0	9 Jan 2014		_							
1. Overall dwel	ling dimen	sions											
Ground floor Total floor are. Dwelling volume	a TFA = (1	a)+(1b)+(1c	:)+(1d)+(1e	)(ln)	5	3.8000		Area (m2) 53.8000		y height (m) 2.5500 (3d)+(3e)		Volume (m3) 137.1900 137.1900	(1b) - (3b
2. Ventilation	rate												
					main heating		econdary heating		other	tota	al m	3 per hour	
Number of chimn Number of open Number of inter Number of passi Number of fluel	flues mittent fa ve vents				0 0	+ +	0 0	+ +	0 = 0		0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 20.0000 0.0000	(6b) (7a) (7b)
Infiltration du Pressure test Measured/design Infiltration ra	AP50 te		and fans	= (6a)+(6b)	+(7a)+(7b)+(	7c) =				20.0000	Air change / (5) =	0.1458 Yes 4.0000 0.3458	(8)
Number of sides Shelter factor Infiltration ra			e shelter	factor					(20) = 1 -	[0.075 x ) = (18) :		0.7750 0.2680	
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	0.3417 0.5584	0.3350 0.5561	0.3283 0.5539	0.2948 0.5434	0.2881 0.5415	0.2546 0.5324	0.2546 0.5324	0.2479 0.5307	0.2680 0.5359	0.2881 0.5415	0.3015 0.5454	0.3149 0.5496	(22b)
3. Heat losses	and heat 1	oss paramet	er	Gross	Openings		tArea	U-value	A x U		-value	AxK	
Door to Hall Windows (Uw = 0 New Wall Wall to hall External Roof 1 Total net area		l elements	Aum (A. m2)	m2 34.5500 22.1900 1.0000	m2 23.0800 1.8600	1. 23. 11. 20.	m2 .8600 .0800 .4700 .3300 .0000	W/m2K 1.4000 0.8127 0.1800 0.1705 0.1400	W/K 2.6040 18.7570 2.0646 3.4660 0.1400	1	9.0000 8.0000 9.0000	kJ/K 103.2300 365.9400 9.0000	(26) (27) (29a) (29a)
Fabric heat loss Party Wall 1 Party Floor 1 Party Ceilings Internal Wall 1	s, W/K = S					45. 52. 51.		30) + (32) 0.0000	= 27.0316 0.0000	18) 3) 2)	0.0000 0.0000 0.0000 9.0000	8197.2000 1584.0000 1036.0000 248.7600	(33) (32) (32d) (32b)
Heat capacity Confidence Thermal mass parameter Thermal bridges Total fabric heat	rameter (T (Sum(L x	MP = Cm / T						(28)	(30) + (32)		(32e) = + (36) =	11544.1300 214.5749 2.2352 29.2667	(35) (36)
Ventilation hear	t loss cal Jan 25.2790	culated mon Feb 25.1764	thly (38)m Mar 25.0758	= 0.33 x (2 Apr 24.6033	25)m x (5) May 24.5150	Jun 24.1035	Jul 24.1035	Aug 24.0273	Sep 24.2620	Oct 24.5150	Nov 24.6938	Dec 24.8807	(38)
Heat transfer co Average = Sum(3	54.5457	54.4431	54.3425	53.8701	53.7817	53.3702	53.3702	53.2940	53.5287	53.7817	53.9605	54.1475 53.8697	
HLP HLP (average)	Jan 1.0139	Feb 1.0120	Mar 1.0101	Apr 1.0013	May 0.9997	Jun 0.9920	Jul 0.9920	Aug 0.9906	Sep 0.9950	Oct 0.9997	Nov 1.0030	Dec 1.0065 1.0013	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heating	g energy r	equirements	(kWh/year	)									
Assumed occupant Average daily h		se (litres/	day)									1.8021 77.0004	
Daily hot water	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	84.7004 125.6082 (annual)	81.6204 109.8578	78.5404 113.3634	75.4604 98.8329	72.3803 94.8326	69.3003 81.8333	69.3003 75.8306	72.3803 87.0167		78.5404 102.6207 Total = Si	81.6204 112.0185 um(45)m =	84.7004 121.6449 1211.5155	(45)
Distribution lo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)



later storage	ION OF FA	ABRIC EI	NERGY EF	FICIENC	Y 09 Ja	n 2014							
otal storage													
f cylinder co	0.0000 ntains dedic	0.0000 cated solar	0.0000 r storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
rimary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
leat gains fro	m water head 26.6918		month 24.0897	21.0020	20.1519	17.3896	16.1140	18.4910	18.7119	21.8069	23.8039	25.8495	(65)
. Internal ga													
Metabolic gain	Jan	Feb	Mar	Apr		Jun	Jul	Aug	Sep	Oct	Nov	Dec	
66)m ighting gains	(calculated	d in Append	dix L, equat	tion L9 or		see Table 5			90.1060	90.1060	90.1060	90.1060	
ppliances gai	ns (calculat	ted in Appe	endix L, equ	ation L13		lso see Tab	le 5	6.7881	9.1109	11.5684	13.5021	14.3937	
ooking gains	(calculated	in Appendi	ix L, equati	ion L15 or	134.8264 L15a), also	see Table	5		119.9980	128.7429	139.7818	150.1568	
umps, fans	0.0000	0.0000	0.0000	0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	
osses e.g. ev	-72.0848	-72.0848	alues) (Tabl -72.0848		-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
ater heating	35.8760		32.3787	29.1694	27.0859	24.1522	21.6586	24.8536	25.9887	29.3104	33.0610	34.7440	(72)
otal internal		255.9277	247.1365	232.7249	217.6688	203.4684	194.4329	197.5637	205.1294	219.6535	236.3767	249.3263	(73)
. Solar gains													
Jan]			Aı					Specific or Tabl	FF data le 6c	Acce fact Table	or	Gains W	
orth			5.97	700						0.77	00	19.4007	
ast est 			14.11 3.00	100 )00 	10.6334 19.6403 19.6403		0.6300 0.6300	0. 0.	.7000 .7000	0.77 0.77		84.6927 18.0070	
olar gains otal gains					727.6857 945.3545					282.5215 502.1750		100.6286 349.9549	
. Mean intern	al temperati	ure (heatir	ng season)										
emperature du tilisation fa	ring heating	g periods i ins for liv	in the livir	ng area fro nil,m (see	om Table 9, Table 9a)		Jul	Aug	Sep	Oct	Nov	21.0000 Dec	(85)
au lpha	58.7893 4.9193		59.0091			60.0841		60.1700	59.9062	59.6244			
			4.9339	59.5266 4.9684	4.9750	5.0056	60.0841 5.0056	5.0113	4.9937	4.9750	59.4268 4.9618	59.2217 4.9481	
il living ar	ea 0.9921				4.9750 0.5183	5.0056 0.3564			4.9937 0.5414				(86)
TT 1 2	0.9921 19.9185 20.0718	4.9267	4.9339	4.9684 0.7272 20.8822			5.0056	5.0113		4.9750	4.9618	4.9481	(87)
T 1 2 il rest of h	0.9921 19.9185 20.0718 ouse 0.9900 19.0910	4.9267 0.9732 20.1991	4.9339 0.9046 20.5788	4.9684 0.7272 20.8822	0.5183	0.3564	5.0056 0.2587 20.9996	5.0113 0.3056 20.9991	0.5414 20.9818 20.0875 0.4749 20.0787	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404	(87) (88) (89) (90)
T 2 cil rest of h	0.9921 19.9185 20.0718 ouse 0.9900 19.0910 action 19.5832	4.9267 0.9732 20.1991 20.0734 0.9665	4.9339 0.9046 20.5788 20.0749 0.8841	4.9684 0.7272 20.8822 20.0822 0.6868	0.5183 20.9794 20.0836 0.4706	0.3564 20.9974 20.0900 0.3063	5.0056 0.2587 20.9996 20.0900 0.2053	5.0113 0.3056 20.9991 20.0912 0.2455	0.5414 20.9818 20.0875 0.4749 20.0787	4.9750 0.8741 20.7558 20.0836 0.8390	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293	(87) (88) (89) (90) (91) (92)
TT 1 2 11 rest of h 1T 2 1ving area fr 1T 1T 1mmperature ad	0.9921 19.9185 20.0718 ouse 0.9900 19.0910 action 19.5832 justment	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289	4.9684 0.7272 20.8822 20.0822 0.6868 19.9978	0.5183 20.9794 20.0836 0.4706 20.0714	0.3564 20.9974 20.0900 0.3063 20.0889	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909	0.5414 20.9818 20.0875 0.4749 20.0787 fLA =	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) =	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948	(87) (88) (89) (90) (91) (92)
IT h 2 til rest of h IT 2 iving area fr TT emperature ad djusted MIT	0.9921 19.9185 20.0718 ouse 0.9900 19.0910 action 19.5832 justment 19.5832	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344	4.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293 20.6293	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311 20.6311	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000	(87) (88) (89) (90) (91) (92)
IT h 2 til rest of h IT 2 iving area fr TT emperature ad jjusted MIT . Space heati	0.9921 19.9185 20.0718 ouse 0.9900 19.0910 action 19.5832 justment 19.5832	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344	4.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159 20.6159	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106 20.4106	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185 19.9185	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000 19.5293	(87) (88) (89) (90) (91) (92)
IT h 2 til rest of h IT 2 iving area fr TT memperature ad dijusted MIT . Space heati	0.9921 19.9185 20.0718 ouse 0.9900 action 19.5832 justment 19.5832   grequirem Jan 0.9886 374.7757	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623 19.8623	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344	4.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239 20.5239 Apr 0.7068 577.0455	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293 20.6293	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310 20.6310 	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311 20.6311	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159 20.6159	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106 20.4106	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185 19.9185 Nov 0.9742 378.3279	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000 19.5293	(87) (88) (89) (90) (91) (92) (93)
IT n 2 til rest of h IT 2 living area fr IT Emperature ad adjusted MIT . Space heatities are seful gains at temp. and loss rate	0.9921 19.9185 20.0718 ouse 0.9900 19.0910 action 19.5832 justment 19.5832   g requirement 4.3000 W 833.6319	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623 19.8623	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344 20.2344 Mar 0.8880 569.1798 6.5000 746.3630	4.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239 20.5239 Apr 0.7068 577.0455 8.9000 626.1781	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115  May 0.4983 471.0843 11.7000 479.2756	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293 20.6293 Jun 0.3361 320.8596 14.6000 321.7830	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310 20.6310	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311 20.6311	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159 20.6159  Sep 0.5139 342.0633 14.1000 348.7862	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106 20.4106	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185  Nov 0.9742 378.3279 7.1000 691.6937	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000 19.5293 Dec 0.9919 347.1183 4.2000	(87) (88) (89) (90) (91) (92) (93) (94) (95) (96)
T 2 2 iil rest of h T 2 ving area fr T mmperature ad tjusted MIT  Space heati  iilisation neful gains it temp. at loss rate onth fracti	0.9921 19.9185 20.0718 ouse 0.9900 19.0910 action 19.5832 justment 19.5832  Jan 0.9886 374.7757 4.3000 W 833.6319 1.0000 kWh	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623 19.8623	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344 20.2344  Mar 0.8880 569.1798 6.5000 746.3630 1.0000	A.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239 20.5239  Apr 0.7068 577.0455 8.9000 626.1781 1.0000	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115  May 0.4983 471.0843 11.7000 479.2756 1.0000	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293 20.6293 Jun 0.3361 320.8596 14.6000 321.7830 0.0000	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310 20.6310 Jul 0.2371 215.0118 16.6000 215.1340 0.0000	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311 20.6311 Aug 0.2813 225.2087 16.4000 225.4916 0.0000	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159 20.6159 Sep 0.5139 342.0633 14.1000 348.7862 0.0000	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106 20.4106	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185 19.9185  Nov 0.9742 378.3279 7.1000 691.6937 1.0000	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000 19.5293 Dec 0.9919 347.1183 4.2000 830.0444 1.0000	(87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97a)
IT h 2 til rest of h IT 2 iving area fr IT memperature ad fijusted MIT  . Space heati  tilisation seful gains kt temp. seat loss rate onth fracti pace heating	0.9921 19.9185 20.0718 ouse 0.9900 19.0910 action 19.5832 justment 19.5832  ng requireme Jan 0.9886 374.7757 4.3000 W 833.6319 1.0000 kWh 341.3890	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623 19.8623	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344 20.2344  Mar 0.8880 569.1798 6.5000 746.3630 1.0000	4.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239 20.5239 Apr 0.7068 577.0455 8.9000 626.1781	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115  May 0.4983 471.0843 11.7000 479.2756	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293 20.6293 Jun 0.3361 320.8596 14.6000 321.7830	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310 20.6310	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311 20.6311	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159 20.6159  Sep 0.5139 342.0633 14.1000 348.7862	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106 20.4106 0ct 0.8525 428.1168 10.6000 527.6281 1.0000	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185  Nov 0.9742 378.3279 7.1000 691.6937	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000 19.5293 Dec 0.9919 347.1183 4.2000	(87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97a) (98) (98)
IT h 2 til rest of h IT 2 lving area fr IT memperature ad djusted MIT  . Space heati  tilisation seful gains kt temp. seat loss rate onth fracti pace heating pace heating	0.9921 19.9185 20.0718 0use 0.9900 19.0910 action 19.5832 justment 19.5832  ng requireme Jan 0.9886 374.7757 4.3000 W 833.6319 1.0000 kWh 341.3890 per m2	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623 19.8623 	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344 20.2344  Mar 0.8880 569.1798 6.5000 746.3630 1.0000	A.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239 20.5239  Apr 0.7068 577.0455 8.9000 626.1781 1.0000	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115  May 0.4983 471.0843 11.7000 479.2756 1.0000	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293 20.6293 Jun 0.3361 320.8596 14.6000 321.7830 0.0000	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310 20.6310 Jul 0.2371 215.0118 16.6000 215.1340 0.0000	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311 20.6311 Aug 0.2813 225.2087 16.4000 225.4916 0.0000	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159 20.6159 Sep 0.5139 342.0633 14.1000 348.7862 0.0000	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106 20.4106 0ct 0.8525 428.1168 10.6000 527.6281 1.0000	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185 19.9185 Nov 0.9742 378.3279 7.1000 691.6937 1.0000 225.6234	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000 19.5293  Dec 0.9919 347.1183 4.2000 830.0444 1.0000 359.2970 1400.8537	(87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97a) (98) (98)
IT h 2 til rest of h IT 2 iving area fr IT emperature ad djusted MIT  . Space heati  tilisation seful gains xt temp. eat loss rate onth fracti pace heating pace heating pace heating pace heating pace heating pace heating	0.9921 19.9185 20.0718 0use 0.9900 19.0910 action 19.5832 justment 19.5832  Jan 0.9886 374.7757 4.3000 W 833.6319 1.0000 kWh 341.3890 per m2	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623 19.8623	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344 20.2344  Mar 0.8880 569.1798 6.5000 746.3630 1.0000 131.8243	A.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239 20.5239	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293 20.6293  Jun 0.3361 320.8596 14.6000 321.7830 0.0000 0.0000	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310 20.6310	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311 20.6311 Aug 0.2813 225.2087 16.4000 225.4916 0.0000 0.0000	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159 20.6159 Sep 0.5139 342.0633 14.1000 348.7862 0.0000	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106 20.4106 0ct 0.8525 428.1168 10.6000 527.6281 1.0000	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185 19.9185 Nov 0.9742 378.3279 7.1000 691.6937 1.0000 225.6234	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000 19.5293  Dec 0.9919 347.1183 4.2000 830.0444 1.0000 359.2970 1400.8537	(87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97a) (98) (98)
pace heating pace heating pace heating  c. Space cool alculated for xt. temp.	0.9921 19.9185 20.0718 0use 0.9900 19.0910 action 19.5832 justment 19.5832  Jan 0.9886 374.7757 4.3000 W 833.6319 1.0000 kWh 341.3890 per m2	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623 19.8623	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344 20.2344  Mar 0.8880 569.1798 6.5000 746.3630 1.0000 131.8243	A.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239 20.5239	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293 20.6293 Jun 0.3361 320.8596 14.6000 321.7830 0.0000 0.0000	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310 20.6310	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311 20.6311 Aug 0.2813 225.2087 16.4000 225.4916 0.0000 0.0000	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159 20.6159 Sep 0.5139 342.0633 14.1000 348.7862 0.0000	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106 20.4106 0ct 0.8525 428.1168 10.6000 527.6281 1.0000	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185 19.9185 Nov 0.9742 378.3279 7.1000 691.6937 1.0000 225.6234	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000 19.5293  Dec 0.9919 347.1183 4.2000 830.0444 1.0000 359.2970 1400.8537	(87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97a) (98) (98)
IT h 2 til rest of h IT 2 iving area fr IT emperature ad djusted MIT  . Space heati seful gains xt temp. eat loss rate onth fracti pace heating pace heating pace heating pace heating c. Space cool alculated for	0.9921 19.9185 20.0718 0use 0.9900 19.0910 action 19.5832 justment 19.5832  Jan 0.9886 374.7757 4.3000 W 833.6319 1.0000 kWh 341.3890 per m2	4.9267 0.9732 20.1991 20.0734 0.9665 19.3679 19.8623 19.8623	4.9339 0.9046 20.5788 20.0749 0.8841 19.7289 20.2344 20.2344 20.2344 20.2344 20.3344 20.3344 20.3344 20.3344 20.3344 20.3344 20.3344 20.3344 20.3344 20.3344	A.9684 0.7272 20.8822 20.0822 0.6868 19.9978 20.5239 20.5239  Apr 0.7068 577.0455 8.9000 626.1781 1.0000 35.3755	0.5183 20.9794 20.0836 0.4706 20.0714 20.6115 20.6115	0.3564 20.9974 20.0900 0.3063 20.0889 20.6293 20.6293  Jun 0.3361 320.8596 14.6000 321.7830 0.0000 0.0000	5.0056 0.2587 20.9996 20.0900 0.2053 20.0899 20.6310 20.6310	5.0113 0.3056 20.9991 20.0912 0.2455 20.0909 20.6311 20.6311 20.6311 20.6312  Aug 16.4000 0.0000 Aug 16.4000	0.5414 20.9818 20.0875 0.4749 20.0787 fLA = 20.6159 20.6159 Sep 0.5139 342.0633 14.1000 348.7862 0.0000 0.0000	4.9750 0.8741 20.7558 20.0836 0.8390 19.9037 Living are 20.4106 20.4106 Oct 0.8525 428.1168 10.6000 527.6281 1.0000 74.0364 (98	4.9618 0.9812 20.2521 20.0808 0.9754 19.4289 a / (4) = 19.9185  Nov 0.9742 378.3279 7.1000 691.6937 1.0000 225.6234 ) / (4) =	4.9481 0.9945 19.8624 20.0780 0.9930 19.0404 0.5948 19.5293 0.0000 19.5293  Dec 0.9919 347.1183 4.2000 830.0444 1.0000 359.2970 1400.8537 26.0382	(87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97a) (98) (98) (99)



CALCULAT	ION OF FA	ABRIC EN	ERGY EF	FICIENCY	09 Ja	n 2014							
Month fracti Space cooling		0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	
Space cooling Cooled fractio Intermittency		0.0000 e 10b)	0.0000	0.0000	0.0000	493.9644	545.4096	447.1298	0.0000 fC =	0.0000 cooled area	0.0000	0.0000 1486.5038 1.0000	(104)
Space cooling	0.0000 kWh	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	
Space cooling Space cooling Energy for spa Energy for spa Total Dwelling Fabri	ce heating ce cooling	0.0000	0.0000 FEE)	0.0000	0.0000	123.4911	136.3524	111.7825	0.0000	0.0000	0.0000	0.0000 371.6259 6.9075 26.0382 6.9075 32.9457 32.9	(107) (108) (99) (108)



#### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHI CALCULATION OF	EET FOR Ne	w Build (As	Designed)	(Version	9.92, Januar								
1. Overall dwell	ling dimen	sions											
Ground floor Total floor area Dwelling volume			:)+(1d)+(1e	)(1n)	5	3.8000		Area (m2) 53.8000		rey height (m) 2.5500 ()+(3d)+(3e)		Volume (m3) 137.1900	(1b) - (3b) (4) (5)
2. Ventilation	rate 												
Number of chimne Number of open : Number of inter Number of passi Number of fluele	flues mittent fa ve vents				main heating 0 0		econdary heating 0 0	+ +	-	tot = =	0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 20.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration due Pressure test Measured/design Infiltration rat Number of sides	AP50 te		and fans	= (6a)+(6b)	+(7a)+(7b)+(	7c) =				20.0000	Air change / (5) =	0.1458 Yes 5.0000 0.3958	(8)
Shelter factor Infiltration rat	te adjuste	d to includ	e shelter	factor						- [0.075 x 21) = (18)		0.7750 0.3067	
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	0.3911 0.5765	0.3834 0.5735	0.3757 0.5706	0.3374 0.5569	0.3297 0.5544	0.2914 0.5425	0.2914 0.5425	0.2837 0.5403		0.3297 0.5544	0.3451 0.5595	0.3604 0.5649	
3. Heat losses a	and heat 1	oss paramet	er	Gross m2	Openings m2	Net	tArea m2	U-value W/m2K	A x	/K	-value kJ/m2K	A x K kJ/K	
TER Opaque door TER Opening Type New Wall Wall to hall External Roof 1 Total net area Fabric heat loss	e (Uw = 1.	l elements	Aum(A, m2)	34.5500 22.1900 1.0000	11.6000 1.8600	11 22 20 1	.8600 .6000 .9500 .3300 .0000 .7400	1.0000 1.3258 0.1800 0.1800 0.1300 30) + (32)		88 10 94 00			(26) (27) (29a) (29a) (30) (31) (33)
Thermal mass par Thermal bridges Total fabric hea	(Sum(L $x$									(33)	+ (36) =	250.0000 3.7517 28.9109	(36)
Ventilation hear	t loss cal	culated mor	thly (38)m Mar	= 0.33 x (2	25)m x (5) May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer co	26.0985	25.9641	25.8323	25.2133	25.0975	24.5584	24.5584	24.4586		25.0975	25.3318	25.5767	(38)
Average = Sum(3	55.0094	54.8749 Feb	54.7432 Mar	54.1242 Apr	54.0084 May	53.4693 Jun	53.4693 Jul	53.3695 Aug	53.6770 Sep	54.0084 Oct	54.2427 Nov	54.4876 54.1237 Dec	
HLP HLP (average) Days in month	1.0225	1.0200	1.0175	1.0060	1.0039	0.9939	0.9939	0.9920	0.9977	1.0039	1.0082	1.0128 1.0060	(40)
	31	28	31	30	31	30	31	31	. 30	31	30	31	(41)
4. Water heating	g energy r	equirements	(kWh/year	)								1 0003	(42)
Assumed occupant Average daily ho		se (litres/	day)									1.8021 77.0004	
Daily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte : Energy content Distribution los	84.7004 125.6082 (annual)	81.6204 109.8578	78.5404 113.3634	75.4604 98.8329	72.3803 94.8326	69.3003 81.8333	69.3003 75.8306	72.3803 87.0167		78.5404 102.6207 Total = S	81.6204 112.0185 um(45)m =		(45)
Water storage lo	0.0000 oss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	
If cylinder con				0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)



CALCULAT	ION OF T	ARGET F	ABRIC EN	NERGY EI	FFICIENCY	09 Ja	n 2014						
Primary loss Heat gains from	0.0000	0.0000 ting kWh/	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
neat gains iro	26.6918	23.3448	24.0897	21.0020	20.1519	17.3896	16.1140	18.4910	18.7119	21.8069	23.8039	25.8495	(65)
5. Internal ga													
Metabolic gain													
(66) m	Jan 90.1060	Feb 90.1060			May 90.1060	Jun 90.1060	Jul 90.1060	Aug 90.1060	Sep 90.1060	Oct 90.1060	Nov 90.1060	Dec 90.1060	(66)
Lighting gains	14.0208	12.4531	10.1276	7.6672	5.7313	4.8386	5.2283	6.7960	9.1215	11.5819	13.5178	14.4105	(67)
Appliances gai	157.0879	158.7180	154.6102	145.8653	134.8264	124.4514	117.5203	115.8902	119.9980	128.7429	139.7818	150.1568	(68)
Cooking gains Pumps, fans			32.0106 0.0000		32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	32.0106 0.0000	
Losses e.g. ev	aporation (	negative v	alues) (Tab		-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	
Water heating	gains (Tabl		32.3787	29.1694	27.0859	24.1522	21.6586	24.8536	25.9887	29.3104	33.0610	34.7440	
Total internal		255.9422	247.1483	232.7338	217.6755	203.4741	194.4390	197.5715	205.1400	219.6669	236.3924	249.3430	(73)
6. Solar gains													
[Jan]				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 6	or	Gains W	
North East West				000 900				0	.7000 .7000 .7000	0.770 0.770 0.770	0.0	9.7491 42.5564 9.0635	(76)
Solar gains Total gains		119.6106 375.5528	197.9577 445.1059	293.3891 526.1229	365.7407 583.4161	377.6101 581.0842	358.1499 552.5889	303.1532 500.7248	231.4766 436.6166	141.9986 361.6655	76.3908 312.7831	50.5771 299.9201	
7. Mean intern	al temperat	ure (heati	ng season)										
Temperature du Utilisation fa	 ring heatin	g periods	in the livi	ng area fro	om Table 9, 1							21.0000	(85)
tau alpha	Jan 67.9177 5.5278	Feb 68.0841 5.5389	Mar 68.2480 5.5499	Apr 69.0285 5.6019	May 69.1765 5.6118	Jun 69.8739 5.6583	Jul 69.8739 5.6583	Aug 70.0046 5.6670	Sep 69.6036 5.6402	Oct 69.1765 5.6118	Nov 68.8777 5.5918	Dec 68.5681 5.5712	
util living ar	ea 0.9981	0.9949	0.9819	0.9245	0.7787	0.5764	0.4238	0.4858	0.7717	0.9682	0.9957	0.9987	(86)
MIT Th 2	19.9262 20.0646	20.0884	20.3619 20.0687	20.6980 20.0783	20.9140 20.0801	20.9870 20.0885	20.9981 20.0885	20.9960	20.9400 20.0852	20.6206 20.0801	20.2070 20.0765	19.8973 20.0727	
util rest of h	0.9975 19.0824	0.9933 19.2456	0.9758 19.5170	0.9010 19.8436	0.7243 20.0263	0.4997 20.0829	0.3371 20.0880	0.3921 20.0889	0.6962 20.0542	0.9536 19.7804	0.9940 19.3723	0.9982 19.0603	(90)
Living area fr MIT	19.5843	19.7469	20.0195	20.3518	20.5543	20.6207	20.6293	20.6284	fLA = 20.5811	Living area 20.2802	19.8688	0.5948 19.5582	
Temperature ad adjusted MIT		19.7469	20.0195	20.3518	20.5543	20.6207	20.6293	20.6284	20.5811	20.2802	19.8688	0.0000 19.5582	(93)
8. Space heati	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation Useful gains Ext temp.	0.9971	0.9926	0.9754	0.9087 478.0876 8.9000	May 0.7535 439.5828 11.7000	0.5451 316.7397 14.6000	0.3887	0.4480	0.7390	0.9573 346.2185 10.6000	0.9935	0.9979 299.2861 4.2000	(95)
Heat loss rate		814.7230 1.0000	740.1004	619.8175 1.0000	478.2054 1.0000	321.9204	215.4435	225.6702	347.8836	522.8101	692.6135 1.0000	836.8287 1.0000	(97)
Space heating				102.0455	28.7352	0.0000	0.0000	0.0000	0.0000	131.3842	274.9347	399.9317 1850.9977	(98)
Space heating	per m2									(98)	/ (4) =	34.4052	
8c. Space cool	ing require	ment											
Calculated for	June, July Jan	and Augus Feb	t. See Table Mar	e 10b Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp. Heat loss rate		4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(100)
Utilisation Useful loss Total gains Month fracti	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	502.6116 0.9626 483.7993 747.0169 1.0000	395.6730 0.9837 389.2317 712.4069 1.0000	405.6081 0.9734 394.8009 652.8061 1.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	(101) (102) (103)
Space cooling Space cooling	kWh 0.0000	0.0000	0.0000	0.0000	0.0000	189.5167	240.4423	191.9559	0.0000	0.0000	0.0000	0.0000 621.9149	
Cooled fractio	n								fC =	cooled area	a / (4) =	1.0000	



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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY					09 Jar	n 2014						
Intermittency factor (Tab 0.0000	le 10b) 0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh 0.0000 Space cooling Space cooling per m2 Energy for space heating Energy for space cooling	0.0000	0.0000	0.0000	0.0000	47.3792	60.1106	47.9890	0.0000	0.0000	0.0000	0.0000 155.4787 2.8899 34.4052 2.8899	(107) (108) (99) (108)
Total Target Fabric Energy Effi	ciency (TFE	E)									37.2951 42.9	(109)



CALCULATION	ON OF HE	AT DEM	IAND	09 Jan 20	)14								
SAP 2012 WORKSH CALCULATION OF		09 Ja	an 2014	(Version	9.92, Januar	ey 2014)							
1. Overall dwel	ling dimens	ions											
Ground floor Total floor are Dwelling volume		)+(1b)+(1c)	)+(1d)+(1e	e)(ln)	5	33.8000		Area (m2) 53.8000	•	y height (m) 2.5500 (3d)+(3e)		Volume (m3) 137.1900 137.1900	(1b) - (3b) (4) (5)
2. Ventilation	rate												
					main heating		econdary heating		other	tota		n3 per hour	
Number of chimn Number of open Number of inter Number of passi Number of fluel	flues mittent fan: ve vents				0	+ +	0	+ +	0 = 0		0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration du Pressure test Measured/design Infiltration ra Number of sides	AP50 te	ys, flues a	and fans	= (6a)+(6b)	+(7a)+(7b)+(	(7c) =				0.0000	Air change / (5) =	0.0000 Yes 4.0000 0.2000	
Shelter factor Infiltration ra		to include	e shelter	factor					(20) = 1 - (21)		(19)] = x (20) =	0.7750 0.1550	(20)
Wind speed Wind factor	Jan 3.7000 0.9250	Feb 3.5000 0.8750	Mar 3.5000 0.8750	Apr 3.4000 0.8500	May 3.4000 0.8500	Jun 3.1000 0.7750	Jul 3.2000 0.8000	Aug 3.0000 0.7500		Oct 3.1000 0.7750	Nov 3.0000 0.7500	Dec 3.4000 0.8500	
Adj infilt rate Balanced mecha	0.1434	0.1356 lation with	0.1356 n heat rec	0.1318	0.1318	0.1201	0.1240	0.1163	0.1124	0.1201	0.1163	0.1318	(22b)
If mechanical v If balanced wit	entilation:				or in-use fa	actor (from	n Table 4h)	=				0.5000 76.5000	
Effective ac	0.2609	0.2531	0.2531	0.2493	0.2493	0.2376	0.2415	0.2338	0.2299	0.2376	0.2338	0.2493	(25)
3. Heat losses  Element	and neat 10:	ss paramete		Gross	Openings		:Area	U-value	A x U	K-	-value	AxK	
Door to Hall				m2	m2	1.	m2 .8600	W/m2K 1.4000	W/K 2.6040		kJ/m2K	kJ/K	(26)
Windows (Uw = 0 New Wall Wall to hall External Roof 1 Total net area		alamante i	11m(A m2)	34.5500 22.1900 1.0000	23.0800 1.8600	11. 20. 1.	.0800 .4700 .3300 .0000 .7400	0.8127 0.1800 0.1705 0.1400	18.7570 2.0646 3.4660 0.1400	1	9.0000 B.0000 9.0000	103.2300 365.9400 9.0000	(29a)
Fabric heat los Party Wall 1 Party Floor 1 Party Ceilings Internal Wall 1	s, W/K = Sur		, , , , , , , ,			45. 52. 51.	(26)(3 .5400 .8000 .8000	0.0000	= 27.0316 0.0000	31 31	0.0000 0.0000 0.0000 9.0000	8197.2000 1584.0000 1554.0000 248.7600	(33) (32) (32d) (32b)
Heat capacity Control of thermal mass parthermal bridges Total fabric he	rameter (TM (Sum(L x P:	P = Cm / T1						(28)	(30) + (32)		(32e) = + (36) =	12062.1300 224.2032 2.2352 29.2667	(35) (36)
Ventilation hea	t loss calc	ulated mont	thly (38)m Mar	1 = 0.33 x (2 Apr	5)m x (5) May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer c	11.8105	11.4597	11.4597	11.2842	11.2842	10.7579	10.9334	10.5825		10.7579	10.5825	11.2842	(38)
Average = Sum(3	41.0773 9)m / 12 =	40.7264	40.7264	40.5510	40.5510	40.0247	40.2001	39.8492	39.6738	40.0247	39.8492	40.5510 40.3171	
HLP HLP (average) Days in month	Jan 0.7635	Feb 0.7570	Mar 0.7570	Apr 0.7537	May 0.7537	Jun 0.7440	Jul 0.7472	Aug 0.7407	Sep 0.7374	Oct 0.7440	Nov 0.7407	Dec 0.7537 0.7494	
	31	28	31	30	31	30	31	31	. 30	31	30	31	(41)
4. Water heatin													
Assumed occupan	 су											1.8021	
Average daily h	or water use	= (iltres/	ra À l									77.0004	(43)



Feb

Mar

Apr

May

Jan Daily hot water use 84.7004

Dec

84.7004 (44)

Jun

Jul

Aug

Sep

75.4604

Oct

CALCULAT	TION OF H	HEAT DEN	MAND	09 Jan 2	014								
Energy conte Energy content Distribution	t (annual)			98.8329	94.8326	81.8333	75.8306	87.0167	88.0559		112.0185 um(45)m =		
Water storage	18.8412	16.4787		14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(46)
Store volume a) If manufac Temperature Enter (49) or	cturer decla	n Table 2b	actor is kn	own (kWh/d	lay):							90.0000 1.0700 0.6000 0.6420	(48) (49)
Total storage	loss		19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	
If cylinder co	ontains dedi		r storage	19.2600		19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	
Primary loss Total heat red	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Solar input	0.0000		133.2654	118.0929	114.7346	101.0933	95.7326 0.0000	0.0000	0.0000	122.5227 0.0000 months) = S	0.0000	141.5469 0.0000 0.0000	(63)
Output from w	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326			122.5227 h/year) = S			(64)
Heat gains fro			month 53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	(65)
5. Internal ga	ains (see Ta	able 5 and	5a)										
Metabolic gair	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gains	s (calculate	ed in Appen	dix L, equa	tion L9 or		see Table 5			108.1272	108.1272	108.1272	108.1272	
Appliances ga:	ins (calcula	ated in App	endix L, eq	uation L13		lso see Tab		16.9702	22.7773	28.9211	33.7552	35.9843	
Cooking gains	(calculated	d in Append	ix L, equat	ion L15 or		see Table	5	172.9705	179.1014	192.1536	208.6295	224.1146	
Pumps, fans Losses e.g. ev	0.0000	47.6148 0.0000	0.0000	47.6148 0.0000		47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	
Losses e.g. ev Water heating	-72.0848	-72.0848	-72.0848		-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water Heating Total internal	77.5354	75.7567	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
iotai interna.		427.4031	411.7714	387.5541	362.9839	340.6793	327.4056	333.8864	347.6008	371.9940	399.1727	419.5203	(73)
6. Solar gains													
[Jan]			A	rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific		Acce fact Table	or	Gains W	
			5.9 14.1 3.0	rea m2  700 100	Solar flux Table 6a W/m2 11.9672 22.3142 22.3142	Speci or '	g fic data Table 6b 0.6300 0.6300 0.6300	Specific or Tabl	data e 6c 7000 7000	fact	or 6d 00		(76)
[Jan]  North East West  Solar gains	138.5159	234.5422	5.9 14.1 3.0	rea m2  700 100 000  595.1852	Solar flux Table 6a W/m2 11.9672 22.3142 22.3142	Speci or '	g fic data Table 6b 0.6300 0.6300 0.6300	Specific or Tabl  0. 0. 0. 653.1849	data e 6c 7000 7000 7000 496.0487	fact Table 0.77 0.77 0.77	or 6d 00 00 00 00	21.8343 96.2231 20.4585	(76) (80) (83)
[Jan] North East West Solar gains Total gains	138.5159 569.1794	234.5422 661.9454	5.9 14.1 3.0 393.7062 805.4775	rea m2 700 100 000 595.1852 982.7392	Solar flux Table 6a W/m2 11.9672 22.3142 22.3142 724.4903 1087.4742	Speci or '	fic data Table 6b 0.6300 0.6300 0.6300 754.9220 1082.3277	Specific or Tabl  0. 0. 0. 653.1849 987.0713	data e 6c 7000 7000 7000 496.0487	fact Table 0.77 0.77 0.77	or 6d 00 00 00 00	21.8343 96.2231 20.4585	(76) (80) (83)
[Jan]  North East West  Solar gains Total gains  7. Mean interr	138.5159 569.1794 nal temperat	234.5422 661.9454 ture (heati	5.9 14.1 3.0 393.7062 805.4775	rea m2	Solar flux Table 6a W/m2 11.9672 22.3142 22.3142 724.4903 1087.4742	Speci or '	fic data Table 6b 0.6300 0.6300 0.6300 754.9220 1082.3277	Specific or Tabl  0. 0. 0. 653.1849 987.0713	data e 6c 7000 7000 7000 496.0487	fact Table 0.77 0.77 0.77	or 6d 00 00 00 00	21.8343 96.2231 20.4585	(76) (80) (83) (84)
[Jan]  North East West  Solar gains Total gains  7. Mean interr Temperature du Utilisation fa	138.5159 569.1794 nal temperat uring heatir actor for gator for gator for 6.4379	234.5422 661.9454 ture (heati	5.9 14.1 3.0 393.7062 805.4775	rea m2	Solar flux Table 6a W/m2 11.9672 22.3142 22.3142 724.4903 1087.4742	Speci or '	fic data Table 6b 0.6300 0.6300 0.6300 754.9220 1082.3277	Specific or Tabl  0. 0. 0. 653.1849 987.0713	data e 6c 7000 7000 7000 496.0487	fact Table 0.77 0.77 0.77	or 6d 00 00 00 00	21.8343 96.2231 20.4585 113.0005 532.5208	(76) (80) (83) (84)
[Jan]  North East West  Solar gains Total gains  7. Mean interr Temperature du Utilisation fa	138.5159 569.1794 nal temperat uring heatir actor for gator for gator for 6.4379	234.5422 661.9454 ture (heating periods ains for lively periods ains for lively periods ains for lively periods according to the periods according	393.7062 805.4775 ng season) in the livi ving area, Mar 82.2708	rea m2	Solar flux Table 6a W/m2  11.9672 22.3142 22.3142  724.4903 1087.4742  mm Table 9a May 82.6267	Speci. or ' 797.3978 1138.0771 Th1 (C) Jun 83.7132	fic data Table 6b 0.6300 0.6300 0.6300 754.9220 1082.3277	Specific or Tabl  0. 0. 0. 653.1849 987.0713	data e 6c 7000 7000 7000 496.0487 843.6495	fact Table 0.77 0.77 0.77 308.4008 680.3948	or 6d 00 00 00 172.1866 571.3593	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267	(76) (80) (83) (84)
[Jan]  North East West  Solar gains Total gains  7. Mean interr Temperature du Utilisation fa tau alpha util living an	138.5159 569.1794  nal temperat  uring heatir actor for ge Jan 81.5680 6.4379 rea 0.9089 20.7543 20.2851 house	234.5422 661.9454 cure (heating periods ains for 1imes Feb 82.2708 6.4847 0.8259 20.8761 20.2908	393.7062 805.4775 393.7062 805.4775 in the livi ving area, Mar 82.2708 6.4847 0.6462 20.9731 20.2908	rea m2 700 100 000	Table 6a W/m2  11.9672 22.3142 22.3142  724.4903 1087.4742  om Table 9a) May 82.6267 6.5084 0.2796 20.9999 20.2936	797.3978 1138.0771 Th1 (C) Jun 83.7132 6.5809 0.1583 21.0000 20.3022	gfic data Table 6b 0.6300 0.6300 0.6300 754.9220 1082.3277 Jul 83.3478 6.5565 0.0929 21.0000 20.2993	Specific or Tabl  0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0	data e 6c 7000 7000 7000 496.0487 843.6495 Sep 84.4535 6.6302 0.2586 21.0000 20.3079	fact Table 0.77 0.77 0.77 308.4008 680.3948 Oct 83.7132 6.5809 0.5256 20.9946 20.3022	Nov 84.0817 6.6054 0.8063 20.9143 20.3050	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2236	(76) (80) (83) (84) (85) (86) (87) (88)
[Jan]  North East West  Solar gains Total gains  7. Mean interr Temperature du Utilisation fa tau alpha util living an  MIT Th 2 util rest of h	138.5159 569.1794 	234.5422 661.9454 ture (heating periods ains for lively periods ains for lively periods ains for lively periods 6.4847 0.8259 20.8761	393.7062 805.4775 ang season)  in the livi ving area, Mar 82.2708 6.4847 0.6462 20.9731	rea m2	Table 6a W/m2  11.9672 22.3142 22.3142  724.4903 1087.4742  m Table 9a) May 82.6267 6.5084 0.2796 20.9999	797.3978 1138.0771 Th1 (C) Jun 83.7132 6.5809 0.1583 21.0000	Jul 83.3478 6.5565 0.0929 21.0000	Specific or Tabl  0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0	data e 6c 7000 7000 7000 496.0487 843.6495 Sep 84.4535 6.6302 0.2586 21.0000 20.3079	fact Table 0.77 0.77 0.77 308.4008 680.3948  Oct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975	Nov 84.0817 6.6054 0.8063 20.9143 20.7758 20.2107	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.7218 20.2936 0.9125 19.9493	(86) (87) (88) (89) (90)
North East West Solar gains Total gains Total gains Total gains The perature dust of the second seco	138.5159 569.1794  mal temperaturing heatir actor for garge 31.5680 6.4379 rea 0.9089 20.7543 20.2851 house 0.8919 19.9846 raction 20.4424	234.5422 661.9454 ture (heating periods ains for lifeb 82.2708 6.4847 0.8259 20.8761 20.2908 0.8010	393.7062 805.4775 ang season) in the livi ving area, Mar 82.2708 6.4847 0.6462 20.9731 20.2908 0.6149	rea m2	Table 6a W/m2 22.3142	797.3978 1138.0771  Th1 (C) Jun 83.7132 6.5809 0.1583 21.0000 20.3022 0.1337	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 0.0668	Specific or Tabl  0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0	data e 6c 7000 7000 7000 496.0487 843.6495 Sep 84.4535 6.6302 0.2586 21.0000 20.3079	fact Table 0.77 0.77 0.77 308.4008 680.3948  Oct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861	Nov 84.0817 6.6054 0.8063 20.9143 20.7758 20.2107	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088	(76) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91)
North East West  Solar gains Total gains  7. Mean interr Temperature di Utilisation fa tau alpha util living an MIT Th 2 Living area fo	138.5159 569.1794  mal temperat  ming heatir actor for ge Jan 81.5680 6.4379 rea 0.9089 20.7543 20.2851 house 0.8919 19.9846 raction 20.4424 djustment	234.5422 661.9454 ture (heating periods ains for livel Feb 82.2708 6.4847 0.8259 20.8761 20.2908 0.8010 20.1468	393.7062 805.4775 393.7062 805.4775 in the livi ving area, Mar 82.2708 6.4847 0.6462 20.9731 20.2908 0.6149 20.2625	rea m2 700 100 000 595.1852 982.7392  mg area fro nil, m (see Apr Apr 82.6267 6.5084 0.4363 20.9977 20.2936 0.4075 20.2915	724.4903 1087.4742 724.4903 1087.4742 724.4903 1087.4742 724.4903 1087.4742 724.4903 1087.4742 724.4903 1087.4742	797.3978 1138.0771 Th1 (C) Jun 83.7132 6.5809 0.1583 21.0000 20.3022 0.1337 20.3022	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 0.0668 20.2993	Specific or Tabl  0. 0. 0. 0. 653.1849 987.0713  Aug 84.0817 6.6054 0.1130 21.0000 20.3050 0.0850 20.3050	data e 6c 7000 7000 7000 496.0487 843.6495 Sep 84.4535 6.6302 0.2586 21.0000 20.3079 0.2261 20.3079 fla	fact Table 0.77 0.77 0.77 308.4008 680.3948  Oct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975 Living are	Nov 84.0817 6.6054 0.8063 20.9143 20.3050 0.7758 20.2107 a / (4) =	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948	(86) (87) (88) (89) (89) (90) (91) (92)
North East West Solar gains Total gains Total gains Total gains Total gains  7. Mean interr Temperature di Utilisation fatau alpha util living an MIT Th 2 Living area for MIT 3 Living area for MIT 2 Living area for MIT 3 Living area for MIT 3 Living area for MIT 4 Living area for MIT 5 Living area for MIT 4 Living area for MIT 4 Living area for MIT 5 Living area for MIT 4 Living area for MIT 4 Living area for MIT 5 Living area for MIT 4 Living area for MIT 4 Living area for MIT 5 Living area for MIT 6 Living area for MIT 6 Living area for MIT 7 Living area for MIT 6 Living area for MIT 7 Living area for MIT 7 Living area for MIT 8 Living area for MIT 9	138.5159 569.1794  anal temperat curing heatin actor for ga Jan 81.5680 6.4379 rea 0.9089 20.7543 20.2851 house 0.8919 19.9846 raction 20.4424 djustment 20.4424  ing requirem	234.5422 661.9454 ture (heating periods ains for lipe Feb 82.2708 6.4847 0.8259 20.8761 20.2908 0.8010 20.1468 20.5806 20.5806	393.7062 805.4775 ang season)  in the liviving area, Mar 82.2708 6.4847 0.6462 20.9731 20.2908 0.6149 20.2625 20.6851 20.6851	rea m2  700 100 000  595.1852 982.7392  mg area fro nil, m (see Apr 82.6267 6.5084 0.4363 20.9977 20.2936 0.4075 20.2915 20.7115	Table 6a W/m2 22.3142	797.3978 1138.0771  Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000 20.3022 0.1337 20.3022 20.7172 20.7172	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 20.7161 20.7161	Specific or Tabl  0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0	data e 6c 7000 7000 7000 496.0487 843.6495 Sep 84.4535 6.6302 0.2586 21.0000 20.3079 0.2261 20.3079 fLA = 20.7195	fact Table 0.77 0.77 0.77 308.4008 680.3948 Oct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975 Living are 20.7122	Nov 84.0817 6.6054 0.8063 20.9143 20.3750 20.2107 a / (4) = 20.6292	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088	(86) (87) (88) (89) (89) (90) (91) (92)
[Jan]  North East West  Solar gains Total gains  7. Mean interr Temperature dutilisation for the second sec	138.5159 569.1794  nal temperat uring heatir actor for ge Jan 81.5680 6.4379 rea 0.9089 20.7543 20.2851 house 0.8919 19.9846 raction 20.4424 djustment 20.4424 djustment 20.4424 5.55000	234.5422 661.9454 ture (heating periods ains for lipe Feb 82.2708 6.4847 0.8259 20.8761 20.2908 0.8010 20.1468 20.5806 20.5806	393.7062 805.4775 ang season)  in the liviving area, Mar 82.2708 6.4847 0.6462 20.9731 20.2908 0.6149 20.2625 20.6851 20.6851	rea m2 700 100 000	Table 9a, Table	797.3978 1138.0771  Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000 20.3022 0.1337 20.3022 20.7172 20.7172	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 20.7161 20.7161	Specific or Tabl  0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0	data e 6c 7000 7000 7000 496.0487 843.6495 Sep 84.4535 6.6302 0.2586 21.0000 20.3079 0.2261 20.3079 fLA = 20.7195	fact Table 0.77 0.77 0.77 308.4008 680.3948 Oct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975 Living are 20.7122	Nov 84.0817 6.6054 0.8063 20.9143 20.3750 20.2107 a / (4) = 20.6292	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088	(86) (87) (88) (89) (90) (91) (92) (93)
[Jan]  North East West  Solar gains Total gains  7. Mean interr Temperature di Utilisation fe tau alpha util living an  MIT Th 2 util rest of !  MIT 2 Living area fr MIT Temperature ac adjusted MIT  8. Space heat:	138.5159 569.1794  nal temperat uring heatir actor for ge Jan 81.5680 6.4379 rea 0.9089 20.7543 20.2851 house 0.8919 19.9846 raction 20.4424 djustment 20.4424 djustment 20.4424 5.55000	234.5422 661.9454 ture (heating periods ains for lively peb 82.2708 6.4847 0.8259 20.8761 20.2908 0.8010 20.1468 20.5806 20.5806	393.7062 805.4775 ang season)  in the livi ving area, Mar 82.2708 6.4847 0.6462 20.9731 20.2908 0.6149 20.2625 20.6851 20.6851	rea m2 700 100 000	Solar flux Table 6a W/m2  11.9672 22.3142 22.3142  724.4903 1087.4742  m Table 9a) May 82.6267 6.5084 0.2796 20.9999 20.2936 0.2533 20.2935 20.7137 20.7137	797.3978 1138.0771  Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000 20.3022 0.1337 20.3022 20.7172 20.7172	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 20.7161 20.7161 Jul 0.0823 89.0866	Specific or Tabl  0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0	data e 6c 7000 7000 7000 496.0487 843.6495 Sep 84.4535 6.6302 0.2586 21.0000 20.3079 0.2261 20.7195 20.7195 20.7195	fact Table 0.77 0.77 0.77 0.77 308.4008 680.3948  Oct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975 Living are 20.7122 20.7122	Nov 84.0817 6.6054 0.8063 20.9143 20.3050 0.7758 20.2107 a / (4) = 20.6292 20.6292	21.8343 96.2231 20.4585  113.0005 532.5208  21.0000  Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088 0.0000 20.4088	(86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97)



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

CALCIII ATIONI	OF HEAT DEMAND	09 Jan 2014
	UJE EIEAT DEMAMIA	ug lan zu a

Space heating RHI space heating demand 236.2342 (98) 236 (98)



#### **CALCULATION OF ENERGY RATINGS** 09 Jan 2014 SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF ENERGY RATINGS 09 Jan 2014 1. Overall dwelling dimensions Volume (m) 2.5500 (2b) (m3) 137.1900 (1b) - (3b) 53.8000 (1b) Ground floor Total floor area TFA = (1a) + (1b) + (1c) + (1d) + (1e) ... (1n)53.8000 $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) =$ 137.1900 (5) Dwelling volume main secondary total m3 per hour heating 0 0 0 \* 40 = 0 \* 20 = 0 \* 10 = Number of chimneys 0.0000 Number of open flues Number of intermittent fans (6b) (7a) Number of passive vents Number of flueless gas fires 0 \* 10 = 0.0000 (7b) Air changes per hour 0.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 (8) 4.0000 0.2000 (18) Infiltration rate Number of sides sheltered 3 (19) - [0.075 x (19)] (21) = (18) x (20) Shelter factor Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Sep 4.0000 1.0000 Apr 4.4000 Aug 3.7000 0.9250 1.1750 (22a) Wind speed 5.1000 1.2750 5.0000 4.9000 1.2250 3.8000 3.8000 4.3000 4.5000 1.1000 1.1250 Wind factor Adj infilt rate 0.1976 0.1938 0.1899 0.1705 0.1666 0.1473 0.1434 0.1550 0.1744 0.1821 (22b) 0.1473 0.1666 Balanced mechanical ventilation with heat recovery If mechanical ventilation: If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.5000 (23a) 76.5000 (23c) Effective ac 0.3151 0.3113 0.3074 0.2880 0.2841 0.2648 0.2648 0.2609 0.2725 0.2841 0.2919 0.2996 (25) K-value Element Gross Openings NetArea U-value AxU W/m2K 1.4000 0.8127 W/K kJ/m2K kJ/K Door to Hall Windows (Uw = 0.84) New Wall 2.6040 18.7570 2.0646 (26) (27) 34.5500 103.2300 (29a) 23.0800 11.4700 20.3300 0.1800 365.9400 (29a) Wall to hall 22.1900 1.8600 3.4660 18.0000 Total net area of external elements Aum(A, m2) Fabric heat loss, W/K = Sum (A x U) 1 0000 0.1400 0.1400 9.0000 9.0000 (30) (26)...(30) + (32) = (33) 8197.2000 (32) 1584.0000 (32d) 1554.0000 (32b) 248.7600 (32c) 45.5400 Party Wall 1 Party Floor 1 Party Ceilings 1 Internal Wall 1 180.0000 0.0000 0.0000 52.8000 51.8000 27.6400 30.0000 Heat capacity Cm = Sum (A $\times$ k) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L $\times$ Psi) calculated using Appendix K) Total fabric heat loss (28)...(30) + (32) + (32a)...(32e) =12062.1300 (34) 224.2032 (35) 2.2352 (36) 29.2667 (37) (33) + (36) = Dec 13.5648 (38) Heat transfer coeff 43.5333 Average = Sum(39)m / 12 = 43.3579 43.1824 42.3053 42.1298 41.2527 41.2527 41.0773 41.6036 42.1298 42.4807 42.8316 (39) 42.2614 (39) Dec 0.7961 (40) 0.7855 (40) Nov 0.7896 May 0.7831 Aug 0.7635 0.8092 0.8026 0.7863 0.8059 0.7668 0.7668 0.7831 HLP (average) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) 1.8021 (42) 77.0004 (43)



Jan

Daily hot water use

Feb

81.6204

Mar

78.5404

Apr

75.4604

May

72.3803

Dec

84.7004 (44)

Jul

Aua

Sep

75.4604

Oct

78.5404

Nov

Jun

CALCULAT	ION OF E	NERGY F	RATINGS	09 Jar	2014								
Energy conte Energy content	(annual)			98.8329	94.8326	81.8333	75.8306	87.0167	88.0559			121.6449 1211.5155	
Distribution lo	18.8412		45)m 17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(46)
Water storage : Store volume a) If manufact Temperature : Enter (49) or	turer decla factor from (54) in (55	n Table 2b	actor is kno	own (kWh/d	ay):							90.0000 1.0700 0.6000 0.6420	(48) (49)
Total storage	19.9020		19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder com		17.9760	19.9020		19.9020 0.0000	19.2600	19.9020 0.0000	19.9020 0.0000	19.2600 0.0000	19.9020	19.2600	19.9020 0.0000	
Total heat requ	uired for w 145.5102	vater heati 127.8338		ed for each	month		95.7326 0.0000	106.9187 0.0000	107.3159	122.5227	131.2785		(62)
Output from w/l		127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785		(64)
Heat gains from			month 53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	er year (kWl 44.6866	50.0430	52.6542	56.3685	
5. Internal ga:													
Metabolic gains	s (Table 5)	, Watts							Com	0.24	Non	Doo	
(66)m Lighting gains	108.1272		Mar 108.1272					Aug 108.1272	Sep 108.1272	Oct 108.1272	Nov 108.1272	Dec 108.1272	(66)
Appliances gain	35.0113	31.0967	25.2895	19.1458	14.3117	12.0825	13.0556	16.9702	22.7773	28.9211	33.7552	35.9843	(67)
Cooking gains	234.4595	236.8925	230.7615	217.7094	201.2335	185.7484	175.4034	172.9705	179.1014	192.1536	208.6295	224.1146	(68)
Pumps, fans	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000				47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	
Losses e.g. eva	-72.0848	-72.0848	-72.0848		-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating	77.5354		72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal		427.4031	411.7714	387.5541	362.9839	340.6793	327.4056	333.8864	347.6008	371.9940	399.1727	419.5203	(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	Acce: facto Table	or	Gains W	
[Jan]			5.9 14.1 3.0	rea m2  700 100	Solar flux Table 6a W/m2 10.6334 19.6403	Speci or	g fic data Table 6b  0.6300 0.6300 0.6300	Specific or Tab	data le 6c	facto	or 6d 00		(76)
[Jan] North East West	122.1004	237.9782	5.9 14.1 3.00	rea m2 700 100 000	Solar flux Table 6a W/m2 10.6334 19.6403 19.6403	Speci or  751.3026	g fic data Table 6b 0.6300 0.6300 0.6300	Specific or Tab: 0 0 0 0	data le 6c .7000 .7000 .7000	factor Table (0.77) 0.77) 0.77)	00 00 00 00 151.9877	19.4007 84.6927 18.0070	(76) (80)
[Jan]  North East West  Solar gains Total gains 7. Mean intern.	122.1004 552.7639	237.9782 665.3813	5.9° 14.1° 3.0° 393.8584 805.6298	rea m2 700 100 000 583.7316 971.2856	Solar flux Table 6a W/m2 10.6334 19.6403 19.6403 727.6857 1090.6696	Speci or  751,3026 1091,9818	gfic data Table 6b	Specific or Tab.	data le 6c .7000 .7000 .7000	factor Table (0.77) 0.77) 0.77)	00 00 00 00 151.9877	19.4007 84.6927 18.0070	(76) (80)
[Jan]  North East West  Solar gains Total gains  7. Mean international description of the second sec	122.1004 552.7639 al temperat	237.9782 665.3813 cure (heati	393.8584 805.6298	rea m2	Table 6a W/m2 10.6334 19.6403	Speci or 751.3026 1091.9818	gfic data Table 6b	Specific or Tab.	data le 6c .7000 .7000 .7000	factor Table (0.77) 0.77) 0.77)	00 00 00 00 151.9877	19.4007 84.6927 18.0070	(76) (80) (83) (84)
North East West Solar gains Total gains 7. Mean internate du: Utilisation fact	122.1004 552.7639 al temperat 	237.9782 665.3813 cure (heati	393.8584 805.6298	rea m2	Table 6a W/m2 10.6334 19.6403	Speci or 751.3026 1091.9818	gfic data Table 6b	Specific or Tab.	data le 6c .7000 .7000 .7000	factor Table (0.77) 0.77) 0.77)	00 00 00 00 151.9877	W 19.4007 84.6927 18.0070 100.6286 520.1489	(76) (80) (83) (84)
North East West Solar gains Total gains 7. Mean internation Temperature du: Utilisation factau alpha	122.1004 552.7639 al temperat 	237.9782 665.3813 cure (heati- ng periods sins for li Feb 77.2776	5.9 14.1: 3.00 393.8584 805.6298 ng season) in the livin ving area, 1 Mar 77.5915	rea m2 770 100 000 971.2856 971.2856 100 area fron il,m (see Apr 79.2003	Table 6a W/m2  10.6334 19.6403 727.6857 1090.6696  m Table 9a) May 79.5301	751.3026 1091.9818	fic data Table 6b 0.6300 0.6300 0.6300 712.5836 1039.9892	Specific or Tab.  0 0 0 0 0	data de 6c .7000 .7000 .7000 460.5485 808.1493	fact: Table 0 0.771 0.771 0.775 282.5215 654.5154	Dr 6d 00 00 00 151.9877 551.1604	19.4007 84.6927 18.0070 100.6286 520.1489 21.0000 Dec 78.2271	(76) (80) (83) (84)
North East West	122.1004 552.7639 al temperat- ring heatir ctor for ga Jan 76.9662 6.1311 ea 0.9480 20.5862 20.2454	237.9782 665.3813 cure (heati 	393.8584 805.6298 ng season) in the livin ving area, 1 Mar 77.5915 6.1728	rea m2 700 100 000 583.7316 971.2856  ng area fro nil, m (see Apr 79.2003 6.2800	Table 6a W/m2  10.6334 19.6403 19.6403 727.6857 1090.6696  m Table 9a May 79.5301 6.3020	751.3026 1091.9818 Thl (C) Jun 81.2212 6.4147	Jul 81,2212 6,4147	Specific or Tab.  0 0 0  603.1592 937.0456	data de 6c .7000 .7000 .7000 .7000 460.5485 808.1493 Sep 80.5362 6.3691	fact: Table ( 0.77) 0.77) 0.77) 282.5215 654.5154  Oct 79.5301 6.3020 0.6508 20.9750	Nov 78.8732 6.2582	19.4007 84.6927 18.0070 100.6286 520.1489 21.0000 Dec 78.2271 6.2151 0.9592 20.5490	(76) (80) (83) (84) (85)
[Jan]  North East West  Solar gains Total gains  7. Mean internation Temperature du: Utilisation fact tau alpha util living are MIT Th 2 util rest of he	122.1004 552.7639 al temperat ring heatir ctor for ga Jan 76.9662 6.1311 ea 0.9480 20.5862 20.2454 ouse 0.9372	237.9782 665.3813 cure (heati ng periods sins for li Feb 77.2776 6.1518 0.8799 20.7704 20.2482 0.8602	393.8584 805.6298 ang season) in the livin ving area, 19 Mar 77.5915 6.1728 0.7335 20.9281 20.2510 0.7039	rea m2	Table 6a W/m2 10.6334 19.6403	751.3026 1091.9818 Th1 (C) Jun 81.2212 6.4147 0.2418 21.0000 20.2822 0.2147	Jul 81.2212 6.4147 0.1745 21.0000 20.2822 0.1461	Specific or Tab.  0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000  460.5485 808.1493  Sep 80.5362 6.3691 0.3549 20.9995 20.2765 0.3178	fact: Table 0 0.771 0.771 0.771 282.5215 654.5154  Oct 79.5301 6.3020 0.6508 20.9750 20.2680 0.6101	Nov 78.8732 6.2582 0.8901 20.7955 20.2624 0.8683	19.4007 84.6927 18.0070 100.6286 520.1489 21.0000 Dec 78.2271 6.2151 0.9592 20.5490 20.2567 0.9504	(76) (80) (83) (84) (85) (86) (87) (88) (89)
[Jan]  North East West  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	122.1004 552.7639 al temperat ring heatir ctor for ga Jan 76.9662 6.1311 ea 0.9480 20.2454 ouse 0.9372 19.7196 action	237.9782 665.3813 cure (heati 19 periods ains for li Feb 77.2776 6.1518 0.8799 20.7704 20.2482 0.8602 19.9701	393.8584 805.6298 393.8584 805.6298 ing season) in the livin ving area, in Mar 77.5915 6.1728 0.7335 20.9281 20.2510 0.7039 20.1711	700 100 000 583.7316 971.2856 971.2856 0.2800 0.5225 20.9910 20.2652 0.4920 20.2563	Table 6a W/m2  10.6334 19.6403 19.6403 19.6403 727.6857 1090.6696  Table 9a) May 79.5301 6.3020 0.3589 20.9992 20.2680 0.3308 20.2673	751.3026 1091.9818 Th1 (C) Jun 81.2212 6.4147 0.2418 21.0000 20.2822 0.2147 20.2822	Jul 81.2212 6.4147 0.1745 21.0000 20.2822 0.1461 20.2822	Aug 81.5680 6.4379 0.2016 21.0000 20.2851 0.1703 20.2851	data le 6c .7000 .7000 .7000 .7000 .7000  460.5485 808.1493  Sep 80.5362 6.3691 0.3549 20.9995 20.2765 0.3178 20.2762 fLA =	fact: Table 0 0.771 0.771 0.771 282.5215 654.5154  Oct 79.5301 6.3020 0.6508 20.9750 20.2680 0.6101 120.2440 Living area	Nov 78.8732 6.2582 0.8901 20.7955 20.2624 0.8683 20.0209 a / (4) =	19.4007 84.6927 18.0070 100.6286 520.1489 21.0000 Dec 78.2271 6.2151 0.9592 20.5490 20.2567 0.9504 19.6778 0.5948	(86) (87) (88) (89)
North East West 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 from	122.1004 552.7639 al temperat 	237.9782 665.3813 cure (heati ng periods sins for li Feb 77.2776 6.1518 0.8799 20.7704 20.2482 0.8602	393.8584 805.6298 ang season) in the livin ving area, 19 Mar 77.5915 6.1728 0.7335 20.9281 20.2510 0.7039	rea m2	Table 6a W/m2 10.6334 19.6403	751.3026 1091.9818 Th1 (C) Jun 81.2212 6.4147 0.2418 21.0000 20.2822 0.2147	Jul 81.2212 6.4147 0.1745 21.0000 20.2822 0.1461	Specific or Tab.  0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000  460.5485 808.1493  Sep 80.5362 6.3691 0.3549 20.9765 0.3178 20.2765	Get 79.5301 6.3020 0.6508 20.9750 20.2680 0.6101 20.2440	Nov 78.8732 6.2582 0.8901 20.7955 20.2624 0.8683 20.0209	19.4007 84.6927 18.0070 100.6286 520.1489 21.0000 Dec 78.2271 6.2151 0.9592 20.5490 20.2567 0.9504 19.6778	(86) (87) (88) (84) (85)
North East West Solar gains Total gains 7. Mean internet Temperature du: Utilisation fact tau alpha util living are MIT Th 2 util rest of he MIT 2 Living area from MIT Temperature ad; adjusted MIT 8. Space heatin	122.1004 552.7639 al temperat 	237.9782 665.3813 Eure (heati ng periods ains for li Feb 77.2776 6.1518 0.8799 20.7704 20.2482 0.8602 19.9701 20.4461 20.4461	393.8584 805.6298 393.8584 805.6298 in the livir ving area, mar 77.5915 6.1728 0.7335 20.9281 20.2510 0.7039 20.1711 20.6214	rea m2 7700 100 100 000 583.7316 971.2856  onil,m (see Apr 79.203 6.2800 0.5225 20.9910 20.2652 0.4920 20.2563 20.6933 20.6933	Table 6a W/m2  10.6334 19.6403 19.6403 19.6403 19.6403 19.6403 19.6403 19.6403 0.320 0.3589 20.9992 20.2680 0.3308 20.2673 20.7026	751.3026 1091.9818 Th1 (C) Jun 81.2212 6.4147 0.2418 21.0000 20.2822 0.2147 20.2822 20.7091	Jul 81.2212 6.4147 0.1745 21.0000 20.2822 20.7091 20.7091	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  460.5485 808.1493  Sep 80.5362 6.3691 0.3549 20.9995 20.2765 0.3178 20.2762 fLA = 20.7064	Oct 79.5301 6.3020 0.6508 20.9750 20.2680 0.6101 20.2440 Living area 20.6788	Nov 78.8732 6.2582 0.8901 20.7955 20.2624 0.8683 20.0209 a / (4) = 20.4816	19.4007 84.6927 18.0070 100.6286 520.1489 21.0000 Dec 78.2271 6.2151 0.9592 20.5490 20.2567 0.9504 19.6778 0.5948 20.1960 0.0000	(86) (87) (88) (84) (85)
North East West	122.1004 552.7639 al temperat ring heatir ctor for ge Jan 76.9662 6.1311 ea 0.9480 20.2454 ouse 0.9372 19.7196 action 20.2350 justment 20.2350	237.9782 665.3813 cure (heati log periods ins for li Feb 77.2776 6.1518 0.8799 20.7704 20.2482 0.8602 19.9701 20.4461 20.4461	393.8584 805.6298 ng season) in the livin ving area, 1 Mar 77.5915 6.1728 0.7335 20.9281 20.2510 0.7039 20.1711 20.6214	rea m2 700 100 000 583.7316 971.2856  ng area fro nil, m (see Apr 79.2003 6.2800 0.5225 20.9910 20.2652 0.4920 20.2563 20.6933 20.6933	Table 6a W/m2  10.6334 19.6403 19.6403 727.6857 1090.6696  Table 9a) May 79.5301 6.3020 0.3589 20.9992 20.2680 0.3308 20.2673 20.7026	751.3026 1091.9818 Th1 (C) Jun 81.2212 6.4147 0.2418 21.0000 20.2822 0.2147 20.2822 20.7091 20.7091	Jul 81.2212 6.4147 0.1745 21.0000 20.2822 20.7091 20.7091	Aug 81.5680 6.4379 0.2016 21.0000 20.2851 20.7103 20.7103	data le 6c .7000 .7000 .7000 .7000 .7000 460.5485 808.1493  Sep 80.5362 6.3691 0.3549 20.9995 20.2765 0.3178 20.2762 fLA = 20.7064 20.7064	Oct 79.5301 6.3020 0.6508 20.9750 20.2480 0.6101 20.2440 Living area 20.6788 20.6788	Nov 78.8732 6.2582 0.8901 20.7955 20.2624 0.8683 20.0209 a / (4) = 20.4816	19.4007 84.6927 18.0070 100.6286 520.1489 21.0000 Dec 78.2271 6.2151 0.9592 20.5490 20.2567 0.9504 19.6778 0.5948 20.1960 0.0000 20.1960	(86) (87) (88) (84) (85)
North East West Solar gains Total gains Total gains Total gains Total gains The standard gains Temperature duitable gains The standard gains The standard gains The standard gains The standard gains Temperature add gains	122.1004 552.7639 al temperat 	237.9782 665.3813 cure (heati ng periods sins for li Feb 77.2776 6.1518 0.8799 20.7704 20.2482 19.9701 20.4461 20.4461	393.8584 805.6298 393.8584 805.6298 in the livir ving area, mar 77.5915 6.1728 0.7335 20.9281 20.2510 0.7039 20.1711 20.6214	rea m2 700 100 000 583.7316 971.2856  ng area fro nil,m (see Apr 79.2003 6.2800 0.5225 20.9910 20.2652 0.4920 20.2563 20.6933 20.6933	Table 6a W/m2  10.6334 19.6403 19.6403 19.6403 19.6403 19.6403 19.6403 19.6403 0.320 0.3589 20.9992 20.2680 0.3308 20.2673 20.7026	751.3026 1091.9818 Th1 (C) Jun 81.2212 6.4147 0.2418 21.0000 20.2822 20.7091 20.7091	Jul 81.2212 6.4147 0.1745 21.0000 20.2822 20.7091 20.7091 Jul 0.1630	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  460.5485 808.1493  Sep 80.5362 6.3691 0.3549 20.9765 0.3178 20.2762 fLA = 20.7064 20.7064  Sep 0.3399	Get Table (10,77) (10,	Nov 78.8732 6.2582 0.8901 20.7955 20.2624 0.8683 20.0209 a / (4) = 20.4816	19.4007 84.6927 18.0070 100.6286 520.1489 21.0000 Dec 78.2271 6.2151 0.9592 20.5490 20.2567 0.9504 19.6778 0.5948 20.1960	(85) (86) (87) (88) (89) (90) (91) (92) (93)
North East West Solar gains Total gains Total gains Total gains Themperature du Utilisation fact tau alpha util living are MIT Th 2 util rest of he MIT 2 Living area from MIT Temperature ad adjusted MIT  8. Space heatin	122.1004 552.7639 al temperat 	237.9782 665.3813 cure (heati ag periods sins for li Feb 77.2776 6.1518 0.8799 20.7704 20.2482 0.8602 19.9701 20.4461 20.4461	A: 5.9' 14.1' 3.0' 393.8584 805.6298  ng season) in the livit ving area, i Mar 77.5915 6.1728 0.7335 20.9281 20.2510 0.7039 20.1711 20.6214 20.6214	rea m2 700 100 000	Solar flux Table 6a W/m2  10.6334 19.6403 19.6403 727.6857 1090.6696  Table 9a) May 79.5301 6.3020 0.3589 20.2680 0.3308 20.2673 20.7026 20.7026	751.3026 1091.9818 Th1 (C) Jun 81.2212 6.4147 0.2418 21.0000 20.2822 0.2147 20.2822 20.7091 20.7091	Jul 81.2212 6.4147 0.1745 21.0000 20.2822 20.7091 20.7091 Jul 0.1630 169.5122 16.6000	Specific or Tab.  0 0 0  0 0 0  603.1592 937.0456  Aug 81.5680 6.4379 0.2016 21.0000 20.2851 0.1703 20.2851 20.7103 20.7103  Aug 0.1889 177.0520	data le 6c .7000 .7000 .7000 .7000 .7000 .7000  460.5485 808.1493  Sep 80.5362 6.3691 0.3549 20.9995 20.2765 0.3178 20.2762 fLA = 20.7064 20.7064  Sep 0.3399 274.6609 14.1000	Oct 79.5301 6.3020 0.6508 20.9750 20.2480 0.6101 20.0478 20.6788 20.6788	Nov 78.8732 6.2582 0.8901 20.7955 20.2624 0.8683 20.0209 a / (4) = 20.4816 20.4816	19.4007 84.6927 18.0070 100.6286 520.1489 21.0000 Dec 78.2271 6.2151 0.9592 20.5490 20.2567 0.9504 19.6778 0.5948 20.1960 0.0000 20.1960 Dec 0.9496 493.9573 4.2000	(86) (87) (88) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97)



## CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement	
Not applicable	
9a. Energy requirements - Individual heating systems, including micro-CHP	
Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (20	)1)
Fraction of space heat from main system(s) 1.0000 (20 Efficiency of main space heating system 1 (in %) 100.0000 (20 Efficiency of secondary/supplementary heating system, % 0.0000 (20 Efficiency of secondary/supplementary heating system, %	)6) )8)
Space heating requirement  434.2199 (21  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	1)
Space heating requirement 130.7454 65.8827 22.8674 2.6841 0.2367 0.0000 0.0000 0.0000 0.0000 7.5812 61.9882 142.2342 (98	3)
Space heating efficiency (main heating system 1) 100.0000 100.0000 100.0000 100.0000 0.0000 0.0000 0.0000 0.0000 100.0000 100.0000 100.0000 (21	١٥)
Space heating fuel (main heating system) 130.7454 65.8827 22.8674 2.6841 0.2367 0.0000 0.0000 0.0000 7.5812 61.9882 142.2342 (21	
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 (21	.5)
Water heating	
Water heating requirement 145.5102 127.8338 133.2654 118.0929 114.7346 101.0933 95.7326 106.9187 107.3159 122.5227 131.2785 141.5469 (64	
Efficiency of water heater 100.0000 (21 (217)m 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 (21 (217)m 100.0000	
Fuel for water heating, kWh/month 145.5102 127.8338 133.2654 118.0929 114.7346 101.0933 95.7326 106.9187 107.3159 122.5227 131.2785 141.5469 (21	
Water heating fuel used Annual totals kWh/year	
Space heating fuel - main system 434.2199 (21 Space heating fuel - secondary 0.0000 (21	
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875) mechanical ventilation fans (SFP = 0.7875)  Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)  131.8053 (23 247.3239 (23	31)
Energy saving/generation technologies (Appendices M , N and Q)	2)
Total delivered energy for all uses 2259.1945 (23	18)
10a. Fuel costs - using Table 12 prices	
Fuel Fuel price Fuel cost	
Space heating - main system 1   13.1900   57.2736 (24	12) 17) 19) 19)
Energy saving/generation technologies	,
PV Unit 0.0000 13.1900 0.0000 (25 Total energy cost 297.9878 (25	
lla. SAP rating - Individual heating systems	
Energy cost deflator (Table 12): Energy cost factor (ECF)  SAP value  SAP rating (Section 12)  SAP band  O.4200 (25  1.2667 (25  2.3288  82 (25  82 (25  83 (25  84 (25  85  85 (25  85  85 (25  85 (25  85  85 (25  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85 (25  85  85  85 (25  85  85 (25  85  85  85 (25  85  85  85 (25  85  85  85 (25  85  85  85 (25  85  85  85 (25  85  85  85  85 (25  85  85  85  85 (25  85  85  85  85 (25  85  85  85  85  85  85  85  85  85	57)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP	
Energy Emission factor Emissions kWh/year kg CO2/kWh kg CO2/year	
Space heating - main system 1         434.2199         0.5190         225.3601 (26           Space heating - secondary         0.0000         0.0000         0.0000 (26	53)
Water heating (other fuel)         1445.8455         0.5190         750.3938 (26           Space and water heating         975.7539 (26         975.7539 (26	55)
Pumps and fans     131.8053     0.5190     68.4069 (26       Energy for lighting     247.3239     0.5190     128.3611 (26	
Energy saving/generation technologies PV Unit -800.0000 0.5190 -415.2000 (26	501
Total kg/year	72)
COZ emissions per mz 14.000 (27)	-,



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

## CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency
Main heating environmental impact
Mater heating



## CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	EPC COSTS,	EMISSIONS	AND PRIMARY	ENERGY	9.92, Januar 09 Jan 201	. 4							
1. Overall dwel													
Ground floor Total floor are Dwelling volume		a)+(1b)+(1c	:)+(1d)+(1e)	(1n)	5	53.8000		Area (m2) 53.8000		y height (m) 2.5500 (3d)+(3e)		Volume (m3) 137.1900	(1b) - (3b) (4) (5)
2. Ventilation	rate												
					main	se	econdary		other	tot	al r	m3 per hour	
Number of chimn Number of open Number of inter Number of passi Number of fluel	flues mittent fa: ve vents				heating 0 0	+ +	heating 0 0	+ +	0 = 0 =		0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000	(6b) (7a) (7b)
Infiltration du Pressure test Measured/design Infiltration ra	AP50 te	eys, flues	and fans	= (6a)+(6b)	+(7a)+(7b)+(	(7c) =				0.0000	Air change / (5) =	0.0000 Yes 4.0000 0.2000	(18)
Number of sides Shelter factor Infiltration ra		d to includ	e shelter f	actor					(20) = 1 - (21		x (19)] = x (20) =	0.7750 0.1550	
Wind speed Wind factor	Jan 3.7000 0.9250	Feb 3.5000 0.8750	Mar 3.5000 0.8750	Apr 3.4000 0.8500	May 3.4000 0.8500	Jun 3.1000 0.7750	Jul 3.2000 0.8000	Aug 3.0000 0.7500		Oct 3.1000 0.7750	Nov 3.0000 0.7500	Dec 3.4000 0.8500	
Adj infilt rate		0.1356	0.1356	0.1318	0.1318	0.1201	0.1240	0.1163		0.1201	0.1163	0.1318	
Balanced mecha If mechanical v If balanced wit	entilation	:		_	or in-use fa	actor (from	n Table 4h)	=				0.5000 76.5000	
Effective ac	0.2609	0.2531	0.2531	0.2493	0.2493	0.2376	0.2415	0.2338	0.2299	0.2376	0.2338	0.2493	(25)
3. Heat losses													
Element  Door to Hall Windows (Uw = 0 New Wall Wall to hall	.84)			Gross m2 34.5500 22.1900	Openings m2 23.0800 1.8600	1. 23. 11.	m2 .8600 .0800 .4700 .3300	U-value W/m2K 1.4000 0.8127 0.1800 0.1705	A x U W/K 2.6040 18.7570 2.0646 3.4660		-value kJ/m2K 9.0000 8.0000	A x K kJ/K 103.2300 365.9400	(26) (27) (29a)
External Roof 1 Total net area Fabric heat los Party Wall 1	of externa			1.0000	1.0000	1. 57.	.0000 .7400	0.1400 80) + (32) 0.0000	0.1400		9.0000	9.0000	(30) (31) (33)
Party Floor 1 Party Ceilings Internal Wall 1	1					52 51	.8000 .8000 .6400			3	0.0000 0.0000 9.0000	1584.0000 1554.0000 248.7600	(32d) (32b)
Heat capacity Continuous Thermal mass parthermal bridges Total fabric he	rameter (TI (Sum(L x	MP = Cm / T						(28)	(30) + (32)		(32e) = + (36) =	12062.1300 224.2032 2.2352 29.2667	(35) (36)
Ventilation hea		culated mon	thly (38)m	= 0.33 x (2	5)m x (5)					(-2)	/		-
(38)m Heat transfer c	Jan 11.8105 oeff 41.0773	Feb 11.4597 40.7264	Mar 11.4597 40.7264	Apr 11.2842 40.5510	May 11.2842 40.5510	Jun 10.7579 40.0247	Jul 10.9334 40.2001	Aug 10.5825 39.8492		Oct 10.7579 40.0247	Nov 10.5825 39.8492	Dec 11.2842 40.5510	
Average = Sum(3			40.7204	40.3310	40.3310	40.0247	40.2001	39.0432	39.0730	40.0247	39.0492	40.3310	
HLP HLP (average) Days in month	Jan 0.7635	Feb 0.7570	Mar 0.7570	Apr 0.7537	May 0.7537	Jun 0.7440	Jul 0.7472	Aug 0.7407	Sep 0.7374	Oct 0.7440	Nov 0.7407	Dec 0.7537 0.7494	
	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heatin													
Assumed occupan Average daily h		se (litres/	day)									1.8021 77.0004	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water	use 84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)



	515, EIVIISS	SIONS AN	D PRIMA	RY ENER	GY 09	Jan 2014					
Energy conte 125.6082 109.85 Energy content (annual) Distribution loss (46)m = 0.15		98.8329	94.8326	81.8333	75.8306	87.0167	88.0559			121.6449 1211.5155	
18.8412 16.47 Water storage loss:		14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(46)
Store volume  a) If manufacturer declared los Temperature factor from Table . Enter (49) or (54) in (55)		nown (kWh/d	ay):							90.0000 1.0700 0.6000 0.6420	(48) (49)
Total storage loss 19.9020 17.97	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	
If cylinder contains dedicated services 19.9020 17.97		19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(57)
Primary loss 0.0000 0.00 Total heat required for water he	ating calculat		month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
145.5102 127.83 Solar input 0.0000 0.00 Output from w/h		118.0929	114.7346	101.0933	95.7326 0.0000	106.9187 0.0000 Solar inpu	0.0000	122.5227 0.0000 months) = S	0.0000	141.5469 0.0000 0.0000	(63)
145.5102 127.83	133.2654	118.0929	114.7346	101.0933	95.7326			122.5227 h/year) = S			
Heat gains from water heating, k 57.6863 50.90		48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	
5. Internal gains (see Table 5 a	nd 5a)										
Metabolic gains (Table 5), Watts Jan Feb		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m 108.1272 108.12 Lighting gains (calculated in App	72 108.1272	108.1272	108.1272	108.1272	108.1272		108.1272	108.1272	108.1272		(66)
35.0113 31.09 Appliances gains (calculated in 1	57 25.2895	19.1458	14.3117	12.0825	13.0556	16.9702	22.7773	28.9211	33.7552	35.9843	(67)
234.4595 236.89. Cooking gains (calculated in App	25 230.7615	217.7094	201.2335	185.7484	175.4034	172.9705	179.1014	192.1536	208.6295	224.1146	(68)
47.6148 47.61 Pumps, fans 0.0000 0.00	18 47.6148	47.6148 0.0000		47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	47.6148 0.0000	
Losses e.g. evaporation (negative -72.0848 -72.08			-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5) 77.5354 75.75	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal gains 430.6635 427.40	411.7714	387.5541	362.9839	340.6793	327.4056	333.8864	347.6008	371.9940	399.1727	419.5203	(73)
6. Solar gains											
[Jan]		m2	Solar flux Table 6a W/m2	Speci or	Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	or	Gains W	
[Jan] North East West	5.9 14.1 3.0	m2 	Table 6a W/m2 11.9672 22.3142 22.3142	Speci or	fic data Table 6b  0.6300 0.6300 0.6300	Specific or Tab	data	fact	or 6d 00		(76)
North East West	5.9 14.3 3.0 22 393.7062	m2 	Table 6a W/m2 11.9672 22.3142 22.3142	Speci or 	fic data Table 6b 	Specific or Tab: 0 0 0	data le 6c .7000 .7000 .7000	fact. Table 0.77 0.77 0.77	or 6d 00 00 00 00	21.8343 96.2231 20.4585	(76) (80)
North East West	5.1 14.1 3.0 22 393.7062 4 805.4775	m2 	Table 6a W/m2 	797.3978 1138.0771	fic data Table 6b 0.6300 0.6300 0.6300 754.9220 1082.3277	Specific or Tab:  0 0 0 0 0 653.1849 987.0713	data le 6c .7000 .7000 .7000	fact. Table 0.77 0.77 0.77	or 6d 00 00 00 00	21.8343 96.2231 20.4585	(76) (80)
North East West Solar gains 138.5159 234.54 Total gains 569.1794 661.94	5.5. 14.1 3.6 22 393.7062 4 805.4775 ating season) is in the livi	m2  7700  100  100  595.1852  982.7392	Table 6a W/m2 11.9672 22.3142 22.3142 27.3142 724.4903 1087.4742	797.3978 1138.0771	fic data Table 6b 0.6300 0.6300 0.6300 754.9220 1082.3277	Specific or Tab:  0 0 0 0 0 653.1849 987.0713	data le 6c .7000 .7000 .7000	fact. Table 0.77 0.77 0.77	or 6d 00 00 00 00	21.8343 96.2231 20.4585	(76) (80) (83) (84)
North East West  Solar gains 138.5159 234.54 Total gains 569.1794 661.94  7. Mean internal temperature (he- Temperature during heating perio Utilisation factor for gains for Jan Feb tau 81.5680 82.27 alpha 6.4379 6.48	5.1 14.1 3.6 22 393.7062 24 805.4775 ating season) ating season) is in the liviliving area, Mar 8 82.2708	m2  7700  1100  0000  595.1852  982.7392  ing area fro nil,m (see Apr 82.6267	Table 6a W/m2 11.9672 22.3142 22.3142 22.3142 724.4903 1087.4742 m Table 9, Table 9a) May 82.6267	797.3978 1138.0771	fic data Table 6b 0.6300 0.6300 0.6300 754.9220 1082.3277	Specific or Tab:  0 0 0 0 0 653.1849 987.0713	data le 6c .7000 .7000 .7000	fact. Table 0.77 0.77 0.77	or 6d 00 00 00 00	W 21.8343 96.2231 20.4585 113.0005 532.5208	(76) (80) (83) (84)
North East West  Solar gains 138.5159 234.54. Total gains 569.1794 661.94  7. Mean internal temperature (hence the second of the	5.1 14.1 3.0 22 393.7062 4 805.4775 24 805.4775 25 20 20 20 20 20 20 20 20 20 20 20 20 20	m2  7700  595.1852  982.7392  ing area fro nil,m (see Apr 82.6267 6.5084	Table 6a W/m2  11.9672 22.3142  724.4903 1087.4742  m Table 9, Table 9a) May 82.6267 6.5084	797.3978 1138.0771  Th1 (C)  Jun 83.7132	fic data Table 6b 0.6300 0.6300 0.6300 754.9220 1082.3277	Specific or Tab:  0 0 0 0 0 653.1849 987.0713  Aug 84.0817 6.6054	data le 6c 77000 77000 496.0487 843.6495	fact. Table 0.77 0.77 0.77 308.4008 680.3948	or 6d 00 00 00 172.1866 571.3593	11.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267	(76) (80) (83) (84)
North East West	5.5 14.1 3.6 22 393.7062 44 805.4775 24 805.4775 25 20 8 805.4775 26 8 82.2708 27 6.4847 28 82.2708 29 0.6462 31 20.2908	m2  7700  5700  595.1852  982.7392  ing area fro ni1,m (see Apr 82.6267  6.5084  0.4363  20.9977  20.2936	Table 6a W/m2 11.9672 22.3142 22.3142 724.4903 1087.4742  m Table 9a) May 82.6267 6.5084 0.2796 20.9999 20.2936	797.3978 1138.0771  Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000 20.3022	Jul 83.3478 6.5565 0.0929 21.0000 20.2993	Aug 84.0817 6.6054 0.1130 21.0000 20.3050	Sep 84.4535 6.6302 0.2586 21.0000 20.3079	fact. Table 0.77 0.77 0.77 308.4008 680.3948 Oct 83.7132 6.5809 0.5256 20.9946 20.3022	Nov 84.0817 6.6054 0.8063 20.9143 20.3050	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936	(86) (87) (88)
North North East West	5.5. 14.1 3.0 22 393.7062 64 805.4775  atting season) ds in the livilitying area, Mar 188 82.2708 17 6.4847 69 0.6462 61 20.9731 18 20.2908 10 0.6149	m2 7700 1100 0000 595.1852 982.7392  ing area fro nil,m (see Apr 82.6267 6.5084 0.4363 20.9977 20.2936 0.4075	Table 6a W/m2 11.9672 22.3142 22.3142 22.3142 724.4903 1087.4742 m Table 9a) May 82.6267 6.5084 0.2796 20.9999	797.3978 1138.0771  Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000	fic data Table 6b 0.6300 0.6300 0.6300 1082.3277  Jul 83.3478 6.5565 0.0929 21.0000	Specific or Tab:  0 0 0  653.1849 987.0713  Aug 84.0817 6.6054 0.1130 21.0000	Sep 84.4535 6.6302 0.2586 21.0000 20.3079 0.2261 20.3079	Gact. Table 0.77 0.77 0.77 308.4008 680.3948  Oct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975	Nov 84.0817 6.6054 0.8063 20.9143 20.3050 0.7758 20.2107	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493	(86) (87) (88) (89) (90)
North North East West	22 393.7062 64 805.4775 25 393.7062 64 805.4775 26 805.4775 27 393.7062 28 305.4775 28 82.2708 29 0.6462 30 0.6462 31 20.9731 32 20.2908 32 0.2908 33 20.2908	m2  7700  7700  595.1852  982.7392  1019 area fro nil,m (see Apr 82.6267 6.5084  0.4363  20.9977 20.2936  0.4075 20.2915	Table 6a W/m2 11.9672 22.3142 22.3142 22.3142 724.4903 1087.4742 m Table 9, Table 9a) May 82.6267 6.5084 0.2796 20.9999 20.2936 0.2533	797.3978 1138.0771  Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000 20.3022 0.1337	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 0.0668	Specific or Tab:	Sep 84.4535 6.6302 0.2586 21.0000 20.3079 0.2261 20.3079	Cot 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975 Living are.	Nov 84.0817 6.6054 0.8063 20.9143 20.3050 0.7758 20.2107 a / (4) =	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088	(86) (87) (88) (89) (90) (91)
North East West	5.9 14.1 3.0 22 393.7062 44 805.4775 24 805.4775 25 39 39 39 39 39 39 39 39 39 39 39 39 39	m2  7700  595.1852 982.7392  101  102  103  104  105  105  105  105  105  105  105	Table 6a W/m2 22.3142 22.3142 22.3142 22.3142 724.4903 1087.4742 74.4903 1087.4742 75.60 76.5084 0.2796 20.9999 20.2936 0.2533 20.2935 20.7137	797.3978 1138.0771  Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000 20.3022 0.1337 20.3022	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 0.0668 20.2993	Specific or Tab:  0 0 0  653.1849 987.0713  Aug 84.0817 6.6054 0.1130 21.0000 20.3050 0.0850 20.3050	data de 6c 7000 7000 7000 496.0487 843.6495 Sep 84.4535 6.6302 0.2586 21.0000 20.3079 0.2261 20.3079 fla =	Oct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975 Living are 20.7122	Nov 84.0817 6.6054 0.8063 20.9143 20.3758 20.2107 a / (4) = 20.6292	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088	(86) (87) (88) (89) (90) (91) (92)
North East West	15.5.22 393.7062 393.	m2  7700  7700  595.1852  982.7392  1ing area fro nil,m (see Apr 82.6267 6.5084  0.4363  20.9977 20.2936  0.4075 20.2915 20.7115	Table 6a W/m2 11.9672 22.3142	797.3978 1138.0771  Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000 20.3022 0.1337 20.3022 20.7172 20.7172	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 20.7161 20.7161	Aug 84.0817 6.6054 0.1130 21.0000 20.3050 20.7184 20.7184	Sep 84.4535 6.6302 0.2586 21.0000 20.3079 0.2261 20.3079 20.7195	Oct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975 Living are 20.7122	Nov 84.0817 6.6054 0.8063 20.9143 20.3758 20.2107 a / (4) = 20.6292	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088	(86) (87) (88) (89) (90) (91) (92)
North East West	5.5. 14.1 3.6 22 393.7062 64 805.4775  atting season) 1s in the livi 1iving area, 18 82.2708 6.4847 6.4847 6.9 0.6462 6.1 20.9731 8.2 20.2908 8.0 0.6149 6.8 20.2625 9.6 20.6851  Mar	m2  7700  7700  595.1852  982.7392  2019 area fro nil,m (see Apr 82.6267 6.5084  0.4363  20.9977 20.2936  0.4075 20.2915  20.7115	Table 6a W/m2 11.9672 22.3142	Speci or 797.3978 1138.0771   Th1 (C)   Jun 83.7132 6.5809   0.1583   21.0000 20.3022   0.1337 20.3022   20.7172   20.7172   Jun 83.7132    3.7132   3.7132   3.7132   3.7132   3.7132   3.7132   3.7132    3.7132   3.7132   3.7132   3.7132   3.7132   3.7132   3.7132    3.7132   3.7132   3.7132   3.7132   3.7132   3.7132   3.7132    3.7132   3.7132   3.7132   3.7132   3.7132   3.7132   3.7132    3.7132   3.7132   3.7132   3.7132   3.7132   3.7132   3.7132    3.7132   3.7132   3.7132   3.7132   3.7132   3.7132   3.7132    3.7132   3.7132   3.7132   3.7132   3.7132   3.7132   3.7132    3.7132   3.7132    3.7132	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 20.7161 20.7161	Specific or Tab:	Sep 84.4535 6.6302 0.2586 21.0000 20.3079 0.2261 20.7195 Sep	fact Table 0.77 0.77 0.77 308.4008 680.3948 0ct 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975 Living are- 20.7122	Nov 84.0817 6.6054 0.8063 20.9143 20.3050 0.7758 20.2107 a / (4) = 20.6292	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088 0.0000 20.4088	(86) (87) (88) (89) (90) (91) (92)
North North East West	15. 5.4. 3.0 2.2 393.7062 64 805.4775 2.2 393.7062 64 805.4775 2.2 393.7062 64 805.4775 2.2 393.7062 64 805.4775 2.2 393.7062 65 2.2 393.7062 2.2 39	m2  7700  7700  595.1852  982.7392  101, m (see Apr 82.6267 6.5084 0.4363 20.9977 20.2936 20.7115 20.7115  Apr 0.4245	Table 6a M/m2 11.9672 22.3142 22.3142 22.3142 724.4903 1087.4742  m Table 9a) May 82.6267 6.5084 0.2796 20.9999 20.2936 0.2533 20.2935 20.7137 20.7137	Speci or 797.3978 1138.0771 Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000 20.3022 20.7172 20.7172 20.7172 Jun 0.1483	fic data Table 6b	Specific or Tab:  0 0 0  653.1849 987.0713  Aug 84.0817 6.6054 0.1130 21.0000 20.3050 0.0850 20.3050 20.7184 20.7184	Sep 84.4535 6.6302 0.2586 21.0000 20.3079 fLA = 20.7195 20.7195	Cot 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.7122 20.7122 20.7122	Nov 84.0817 6.6054 0.8063 20.9143 20.3050 0.7758 20.2107 a / (4) = 20.6292 20.6292	21.8343 96.2231 20.4585 113.0005 532.5208 21.0000 Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088 0.0000 20.4088	(76) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
North East West	5.5. 14.1 3.6 22 393.7062 64 805.4775  atting season) ds in the livi living area, Mar 88 82.2708 17 6.4847 69 0.6462 51 20.9731 88 20.2908 10 0.6149 88 20.2625 10 20.6851 10 20.6851 10 20.6851 10 20.6851 10 20.6851	m2  7700  7700  595.1852  982.7392  1ing area fro nil,m (see Apr 82.6267 6.5084  0.4363  20.9977 20.2936  0.4075 20.2915  20.7115  20.7115  Apr 0.4245 417.2185 10.4000  418.1431	Table 6a W/m2 11.9672 22.3142	Speci or 797.3978 1138.0771 Th1 (C)  Jun 83.7132 6.5809 0.1583 21.0000 20.3022 0.1337 20.3022 20.7172 20.7172 Jun 0.1483 168.7929 16.5000	Jul 83.3478 6.5565 0.0929 21.0000 20.2993 20.7161 20.7161 Jul 0.0823 89.0866 18.5000	Specific or Tab:	Aata Le 6c .7000 .	Cot 83.7132 6.5809 0.5256 20.9946 20.3022 0.4861 20.2975 Living are 20.7122 20.7122 0.5094 346.5991 12.0000 348.7014	Nov 84.0817 6.6054 0.8063 20.9143 20.3050 0.7758 20.2107 a / (4) = 20.6292 20.6292 Nov 0.7904 451.6143 8.4000	21.8343 96.2231 20.4585  113.0005 532.5208  21.0000  Dec 82.6267 6.5084 0.9271 20.7218 20.2936 0.9125 19.9493 0.5948 20.4088 0.0000 20.4088	(85) (86) (87) (88) (89) (90) (91) (92) (93)



## CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space heating per m2								(98)	/ (4) =	4.3910	(99)
8c. Space cooling requirement											
Not applicable											
O. Tarana and an analysis and a state of the											
9a. Energy requirements - Individua 										0.0000	(201)
Fraction of space heat from main sy. Efficiency of main space heating sy. Efficiency of secondary/supplemental Space heating requirement	stem(s) stem 1 (in <sup>s</sup>	k)	. (							1.0000 100.0000 0.0000 236.2342	(202) (206) (208)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement 77.2779 35.3198 Space heating efficiency (main heat.	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(98)
100.0000 100.0000 Space heating fuel (main heating sy	100.0000		100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
77.2779 35.3198 Water heating requirement	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(211)
0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating Water heating requirement											
145.5102 127.8338 Efficiency of water heater		118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(216)
(217)m 100.0000 100.0000 Fuel for water heating, kWh/month	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	
145.5102 127.8338 Water heating fuel used Annual totals kWh/year	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469 1445.8455	
Space heating fuel - main system Space heating fuel - secondary										236.2342	
Electricity for pumps and fans:										0.0000	(215)
(BalancedWithHeatRecovery, Datal mechanical ventilation fans (SFP Total electricity for the above, kW Electricity for lighting (calculate	= 0.7 h/year	7875)	1.2500, SFP	= 0.7875)						131.8053 131.8053 247.3239	(231)
Energy saving/generation technologic	es (Appendio	ces M ,N and	i Q)								
Total delivered energy for all uses										2061.2089	(238)
10a. Fuel costs - using BEDF prices											
						Fuel kWh/year		Fuel price p/kWh		Fuel cost £/year	
Space heating - main system 1 Space heating - secondary						236.2342 0.0000		18.7000 0.0000		44.1758 0.0000	(242)
Water heating (other fuel) Mechanical ventilation fans						1445.8455 131.8053		18.7000 18.7000		270.3731 24.6476	(249)
Pumps and fans for heating Energy for lighting						0.0000		0.0000			(249)
Additional standing charges						247.3239		18.7000		46.2496	
Energy saving/generation technolog. PV Unit								18.7000			
Total energy cost	ies							18.7000		46.2496 0.0000 0.0000	(251)
Total energy cost	ies					247.3239				46.2496 0.0000	(251)
Total energy cost	ies					247.3239				46.2496 0.0000 0.0000	(251)
Total energy cost  12a. Carbon dioxide emissions - Ind.				micro-CHP		0.0000				46.2496 0.0000 0.0000	(251)
						0.0000 0.0000 Energy		18.7000		46.2496 0.0000 0.0000 385.4461	(251) (252) (255)
12a. Carbon dioxide emissions - Ind Space heating - main system 1						0.0000 0.0000 Energy kWh/year 236.2342		18.7000 ion factor kg CO2/kWh 0.5190		46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056	(251) (252) (255) (261)
12a. Carbon dioxide emissions - Ind.  Space heating - main system 1 Space heating - secondary Water heating (other fuel)						0.0000 0.0000 Energy kWh/year		18.7000 ion factor kg CO2/kWh		46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056 0.0000 750.3938	(251) (252) (255) (255)
12a. Carbon dioxide emissions - Ind  Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans						247.3239 0.0000 0.0000 Energy kWh/year 236.2342 0.0000 1445.8455 131.8053		18.7000  ion factor kg CO2/kWh		46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056 0.0000 750.3938 872.9994 68.4069	(251) (252) (255) (261) (263) (264) (265) (267)
Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans Energy for lighting	ividual heat					247.3239 0.0000 Energy kWh/year 236.2342 0.0000 1445.8455		18.7000 ion factor kg CC2/kWn 0.5190 0.0000 0.5190		46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056 0.0000 750.3938 872.9994	(251) (252) (255) (261) (263) (264) (265) (267)
12a. Carbon dioxide emissions - Ind  Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans	ividual heat					247.3239 0.0000 0.0000 Energy kWh/year 236.2342 0.0000 1445.8455 131.8053		18.7000  ion factor kg CO2/kWh		46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056 0.0000 750.3938 872.9994 68.4069	(251) (252) (255) (261) (263) (264) (265) (267) (268)
Space heating - main system 1 Space heating - secondary Water heating (other fuel) Space and water heating Pumps and fans Energy for lighting Energy saving/generation technolog PV Unit	ividual hear	ing system:	s including	micro-CHP		247.3239  0.0000  0.0000  Energy kWh/year 236.2342 0.0000 1445.8455  131.8053 247.3239  -800.0000		18.7000  ion factor kg CO2/kWh		46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056 0.0000 750.3938 872.9994 68.4069 128.3611	(251) (252) (255) (261) (263) (264) (265) (267) (268)
Space heating - main system 1 Space heating - secondary Water heating - secondary Water heating (other fuel) Space and water heating Pumps and fans Energy for lighting Energy saving/generation technolog PV Unit Total kg/year	ividual hear	ing system:	s including	micro-CHP		247.3239  0.0000  Energy kWh/year 236.2342 0.0000 1445.8455 131.8053 247.3239  -800.0000	Primary ene	18.7000  ion factor kg Co2/kWh		46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056 0.0000 750.3938 872.9994 68.4069 128.3611 -415.2000 654.5674	(251) (252) (255) (261) (263) (264) (265) (267) (268) (269) (272)
Space heating - main system 1 Space heating - secondary Water heating - secondary Water heating (other fuel) Space and water heating Pumps and fans Energy for lighting Energy saving/generation technolog EV Unit Total kg/year  13a. Primary energy - Individual he	ividual hear	ing system:	s including	micro-CHP		247.3239  0.0000  Energy kWh/year 236.2342 0.0000 1445.8455 131.8053 247.3239  -800.0000	Primary ene	18.7000  ion factor kg C02/kWh 0.5190 0.0000 0.5190 0.5190 0.5190 0.5190  rgy factor kg C02/kWh 3.0700	Prim	46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056 0.0000 750.3938 872.9994 68.4069 128.3611 -415.2000 654.5674	(251) (252) (255) (261) (263) (264) (265) (267) (268) (269) (272)
Space heating - main system 1 Space heating - secondary Water heating - secondary Water heating (other fuel) Space and water heating Pumps and fans Energy for lighting Energy saving/generation technolog PV Unit Total kg/year  13a. Primary energy - Individual he.  Space heating - main system 1 Space heating - secondary Water heating (other fuel)	ividual hear	ing system:	s including	micro-CHP		247.3239  0.0000  Energy kWh/year 236.2342 0.0000 1445.8455 131.8053 247.3239  -800.0000	?rimary ene	18.7000  ion factor kg CO2/kWh	Prim	46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056 0.0000 750.3938 872.9994 68.4069 128.3611 -415.2000 654.5674 ary energy kWh/year 725.2391 0.0000 438.7457	(251) (252) (255) (261) (263) (264) (268) (269) (272) (261) (263) (263) (264)
Space heating - main system 1 Space heating - secondary Water heating - secondary Water heating (other fuel) Space and water heating Pumps and fans Energy for lighting Energy saving/generation technolog PV Unit Total kg/year  13a. Primary energy - Individual he- Space heating - main system 1 Space heating - secondary	ividual hear	ing system:	s including	micro-CHP		247.3239  0.0000  Energy kWh/year 236.2342 0.0000 1445.8455 131.8053 247.3239  -800.0000  Energy kWh/year 236.2342 0.0000	?rimary ene	18.7000  ion factor kg CO2/kWh	Prim	46.2496 0.0000 0.0000 385.4461 Emissions g CO2/year 122.6056 0.0000 750.3938 872.9994 68.4069 128.3611 -415.2000 654.5674	(251) (252) (255) (261) (263) (264) (267) (268) (269) (272) (261) (263) (264) (263) (264) (265) (265)



**CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY** 

#### Energy saving/generation technologies PV Unit -2456.0000 (269) 3871.9113 (272) 71.9686 (273) -800.0000 3.0700 Primary energy kWh/year Primary energy kWh/m2/year SAP 2012 EPC IMPROVEMENTS Current energy efficiency rating: Current environmental impact rating: B 82 B 90 (For testing purposes): Not considered Not considered Not considered Already installed Not considered Not considered Low energy lighting Not considered Not considered Not considered Not considered Not considered Not considered Not applicable Not considered Not considered Not considered Solar water heating Not considered Not considered Not considered Not considered Not considered Not considered Solar photovoltaic panels A3 T2 W X Y J2 Not considered V2 Wind turbine Not applicable L2 Q3 03 Not considered Not considered Not considered Recommended measures: SAP change Cost change (none) Energy Environmental efficiency impact Typical annual savings Recommended measures (none) Total Savings £0 $0.00 \text{ kg/m}^2$ Potential energy efficiency rating: в 82 Potential environmental impact rating: Fuel prices for cost data on this page from database revision number 467 TEST (29 Oct 2020) Recommendation texts revision number 4.9c (22 Feb 2014) £O Space heating £69 £69 Water heating £270 £270 £385 £385 Total cost of fuels Total cost of uses Delivered energy Carbon dioxide emissions CO2 emissions per m<sup>2</sup> £0 0 kWh/m<sup>2</sup> 0.0 tonnes 0 kg/m<sup>2</sup> £385 £385 38 kWh/m<sup>2</sup> 0.7 tonnes 12 kg/m<sup>2</sup> 72 kWh/m<sup>2</sup> 38 kWh/m<sup>2</sup> 0.7 tonnes 12 kg/m<sup>2</sup> 72 kWh/m<sup>2</sup> Primary energy 0 kWh/m²

09 Jan 2014



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

## CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, 3 CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2	
No improvements selected / applicable	



#### CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING No improvements selected / applicable SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) Overheating Calculation Input Data Dwelling type Number of storeys Cross ventilation possible MidTerrace Flat Yes SAP Region Front of dwelling faces Overshading Thermal mass parameter Thames Valley West
Average or unknown
224.2 (calculated from construction elements) Night ventilation Ventilation rate during hot weather (ach) 6.00 (Windows fully open) Overheating Calculation 271.64 (P1) Summer ventilation heat loss coefficient Transmission heat loss coefficient Summer heat loss coefficient 29.27 (37) 300.90 (P2) Overhangs Orientation Ratio Z overhangs Overhang type North 0 000 None None 1.000 East 0.000 West None Solar shading Orientation Z overhangs Z blinds 0.900 (P8) 0.900 (P8) 0.900 (P8) 0.90 North 1.000 Solar flux Table 6a W/m2 [Jul] Shading Gains W Specific data Specific data or Table 6c 0.6300 0.7000 81.1852 173.1309 0.9000 North 5.9700 East West 14.1100 117.5071 117.5071 0.6300 0.9000 592.2630 125.9241 891.3180 total: Internal gains Total summer gains 1290 1219 1106 (P5) Summer gain/loss ratio
Summer external temperature
Thermal mass temperature increment (TMP = 224.2) 4.29 16.00 0.43 20.72 4.05 17.90 0.43 22.38 3.68 17.80 0.43 21.91 Threshold temperature (P7) Likelihood of high internal temperature Medium Assessment of likelihood of high internal temperature: Medium



## **BASIC COMPLIANCE REPORT**

**Calculation Type: New Build (As Designed)** 

Property Reference	016859				Issued on Date	30/11/2020
Assessment	003 - Green		Pro	p Type Ref		
Reference						
Property	Flat 2:01, 9-10 George Str	eet, Richmon	d, London, TW9 1JY	′		
SAP Rating		82 B	DER	16.68	TER	26.10
Environmental		90 B	% DER <ter< th=""><th></th><th>36.10</th><th></th></ter<>		36.10	
CO <sub>2</sub> Emissions (t/ye	ear)	0.65	DFEE	32.95	TFEE	42.89
General Requireme	ents Compliance	Pass	% DFEE <tfee< th=""><th></th><th>23.18</th><th></th></tfee<>		23.18	
Assessor Details	Mr. Matthew Carter, Energy C mcarter@energycalculations.		imited, Tel: 01754 7	'61035,	Assessor ID	7869-0001
Client	Carlford Properties					
SUMARY FOR INPU	T DATA FOR New Build (As Des	igned)				
0:: 4 4 1:	to substitute and TEEE make					

## Criterion 1 – Achieving the TER and TFEE rate

#### 1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	26.10	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	16.68	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-9.42 (-36.1%)	kgCO <sub>2</sub> /m <sup>2</sup>	
1b TFEE and DFEE			
Target Fabric Energy Efficiency (TFEE)	42.89	kWh/m²/yr	
Dwelling Fabric Energy Efficiency (DFEE)	32.95	kWh/m²/yr	

-10.0 (-23.3%)

## Criterion 2 – Limits on design flexibility

## **Limiting Fabric Standards**

## 2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	0.88 (max. 2.00)	1.40 (max. 3.30)	Pass

## 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

## 3 Air permeability

Air permeability at 50 pascals	4.00 (design value)		
Maximum	10.0	Pass	

## **Limiting System Efficiencies**

## 4 Heating efficiency

ricating emelency		
Main heating system	Room heaters - Electric	
	Panel, convector or radiant heaters	
Secondary heating system	None	

### **5 Cylinder insulation**



kWh/m²/yr

Pass

# BASIC COMPLIANCE REPORT Calculation Type: New Build (As Designed)

Hot water storage	Measured cylinder loss: 1.07 kWh/day	Pass	
	Permitted by DBSCG 1.41		
Primary pipework insulated	No primary pipework		
<u>6 Controls</u>			
Space heating controls	Programmer and appliance thermostats		Pass
Hot water controls	Cylinderstat		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power	0.63		
Maximum	1.5		Pass
MVHR efficiency	90	%	
Minimum	70	%	Pass
Criterion 3 – Limiting the effects of heat gains in su	mmer		
9 Summertime temperature			
Overheating risk (Thames Valley)	Medium		Pass
Based on:			
Overshading	Average		
Windows facing North	5.97 m <sup>2</sup> , No overhang		
Windows facing East	14.11 m², No overhang		
Windows facing West	3.00 m², No overhang		=
Air change rate	8.00 ach		=
Blinds/curtains	None		
Criterion 4 – Building performance consistent with	DER and DEEE rate		
Party Walls			
Туре	U-value		
Solid Wall	0.00	W/m²K	Pass
Air permeability and pressure testing			
3 Air permeability	[		_
Air permeability at 50 pascals	4.00 (design value)		
Maximum	10.0		Pass
10 Key features			
Party wall U-value	0.00	W/m²K	
Window U-value	0.84	W/m²K	
Thermal bridging y-value	0.039	W/m²K	
Photovoltaic array	800.00	kWh/Year	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.



## **SUMMARY FOR INPUT DATA**Calculation Type: New Build (As Designed)

016859 **Issued on Date** 30/11/2020 **Property Reference** Prop Type Ref **Assessment** 003 - Green Reference Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY **Property SAP Rating** 82 B **DER** 16.68 **TER** 26.10 **Environmental** 90 B % DER<TER 36.10 CO<sub>2</sub> Emissions (t/year) **DFEE** 32.95 TFEE 0.65 42.89 **General Requirements Compliance** Pass % DFEE<TFEE 23.18 **Assessor Details** Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, Assessor ID 7869-0001 mcarter@energycalculations.co.uk Client **Carlford Properties** SUMMARY FOR INPUT DATA FOR: New Build (As Designed) West Orientation **Property Tenure** Unknown New dwelling **Transaction Type** Urban **Terrain Type** 1.0 Property Type Flat, Mid-Terrace 2.0 Number of Storeys 2020 3.0 Date Built 4.0 Sheltered Sides 5.0 Sunlight/Shade Average or unknown 6.0 Measurements **Heat Loss Perimeter Internal Floor Area Average Storey Height Ground Floor:** 53.80 m<sup>2</sup> 22.25 m 2.55 m 7.0 Living Area 32.00 m<sup>2</sup> 8.0 Thermal Mass Parameter Precise calculation Thermal Mass 224.2 kJ/m<sup>2</sup>K 9.0 External Walls Description Construction **U-Value Gross Area Nett Area** Kappa Type  $(W/m^2K)$  $(kJ/m^2K)$ (m<sup>2</sup>) (m<sup>2</sup>) New Wall **Timber Frame** Timber framed wall (one layer of plasterboard) 0.18 9.00 34.55 11.47 Wall to hall **Timber Frame** Timber framed wall (two layers of plasterboard) 0.18 18.00 22.19 20.33 9.1 Party Walls Construction **U-Value** Description Type Kappa Area  $(W/m^2K)$  $(kJ/m^2K)$ (m<sup>2</sup>)0.00 180.00 Party Wall 1 Solid Wall 45.54 Dense plaster both sides, dense blocks, cavity or cavity fill 9.2 Internal Walls Description Construction Area Kappa (kJ/m<sup>2</sup>K) (m<sup>2</sup>)Internal Wall 1 Plasterboard on timber frame 9.00 27.64 10.0 External Roofs Description Construction **U-Value** Карра Gross Area **Nett Area** Type  $(W/m^2K)$  $(kJ/m^2K)$ (m<sup>2</sup>)(m<sup>2</sup>)External Roof 1 External Flat Roof Plasterboard, insulated flat roof 0.14 9.00 1.00 1.00



10.1 Party Ceilings

# **SUMMARY FOR INPUT DATA Calculation Type: New Build (As Designed)**

Description			Construction								Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1			Timber I-joists, carp	eted							20.00	51.80
11.1 Party Floors Description			Construction								Kappa (kJ/m²K)	Area (m²)
Party Floor 1			Timber I-joists, carp	eted							30.00	52.80
12.0 Opening Type Description	Data	Source		Glazing		Glazing Gap	g Argon Filled	G-val	ue	Frame Type	Frame Factor	U Value (W/m²K)
Door to Hall Windows		table ufacture	Door to Corridor Window	Double Low-E	Soft 0.05			0.63	3		0.70	1.40 0.84
13.0 Openings												
Name	Opening Ty	pe	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	t Count	Area (m²)	Curtain Closed
Door to Hall	Door to Cor	ridor	[2] Wall to hall	North							1.86	
Front Windows	Window		[1] New Wall	West	None	0.00					3.00	
Rear Windows	Window		[1] New Wall	East	None	0.00					14.11	
Side Windows	Window		[1] New Wall	North	None	0.00					5.97	
14.0 Conservatory	,		None									
15.0 Draught Prod	fing		100				%					
16.0 Draught Lobb	у		Yes									
17.0 Thermal Brid	ging		Calculate Br	idges								
17.1 List of Bridge	S											
Source Type		Bridge	Туре			Length	Psi	Imported	I			
Independently a	ssessed	E2 Oth	er lintels (including o	other steel lintels	<b>(</b> )	9.83	0.056	No				
Table K1 - Appro	ved	E3 Sill				1.80	0.040	No				
Table K1 - Appro		E4 Jam				16.86	0.050	No				
Independently a	ssessed	E7 Part flats)	ty floor between dw	ellings (in blocks	of	22.25	0.000	No				
Table K1 - Defau	lt	E14 Fla	at roof			4.84	0.080	No				
Table K1 - Appro	ved	E16 Co	rner (normal)			2.55	0.090	No				
Table K1 - Appro	ved		rner (inverted – inte al area)	rnal area greater	than	5.10	-0.090	No				
Table K1 - Appro	ved		rty wall between dw	ellings		10.20	0.060	No				
Y-value			0.039				W/m²K					
18.0 Pressure Test	ing		Yes									
Designed AP₅o			4.00				m³/(h.m²	) @ 50 Pa	a			
Property Teste							-					
As Built AP <sub>50</sub>							m³/(h.m²	) @ 50 Pa	а			
19.0 Mechanical V	/ontilation											
Summer Over												
	open in hot	weatho	or Window	s fully open								
	ilation noss		.i villuov	73 Tully Open			_					

Windows open in hot weather Cross ventilation possible Night Ventilation Air change rate

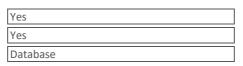
Yes
No
8.00

#### **Mechanical Ventilation**

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type





# **SUMMARY FOR INPUT DATA**Calculation Type: New Build (As Designed)

Туре	1	chanical vent	ilation with heat	
MV Reference Number	recovery 500625			$\dashv$
				=
Configuration	1			=
MVHR Duct Insulated	Yes			$\dashv$
Manufacturer SFP	0.63			<u> </u>
Duct Type	Rigid			
MVHR Efficiency	90.00			<u>_</u>
Wet Rooms	1			
20.0 Fans, Open Fireplaces, Flues				
	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues Number of intermittent fans	0		0	0
Number of Intermittent rans  Number of passive vents				0
Number of flueless gas fires				0
	Гъ.		1	
21.0 Fixed Cooling System	No			
22.0 Lighting				
Internal				
Total number of light fittings	9			
Total number of L.E.L. fittings	9			
Percentage of L.E.L. fittings	100.00			%
External				
External lights fitted	No			
	Standard			
23.0 Electricity Tariff				
24.0 Main Heating 1	SAP table			
Percentage of Heat	100			%
Main Heating	REA			
SAP Code	691			
Efficiency (SAP Table)	100.0			%
Controls	CRC Programmer	r and applian	ce thermostats	
Sap Code	2603			
25.0 Main Heating 2	None			
ESTO Main ricatilis 2	INOTIE			
Community Hooting	None			
Community Heating				
28.0 Water Heating	HEI Immersion			
Water Heating	Independent			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery	No			
Storage System				
Solar Panel	No			



Water use <= 125 litres/person/day

Yes

# **SUMMARY FOR INPUT DATA Calculation Type: New Build (As Designed)**

Energy Calculations Ltd

SAP Code	903	
Immersion Heater	Dual	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder In Heated Space	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	90.00	] L
Loss	1.07	kWh/day
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	800.00	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None



## Appendix 2

SAP Calculations (conversion) Flat 1.01

**SAP ◆ CODE ◆ SBEM ◆ DESIGN** 

01754-761035



# SAP Report Submission for Building Regulations Compliance

Client: Carlford Properties Limited

Project: Flat 1:01, 9-10 George Street

Richmond, London, TW9 1JY

Contact: Matthew Carter

**Energy Calculations Limited** 

mcarter@energycalculations.co.uk

Report Issue Date: 30/11/2020

EXCELLENCE IN ENERGY ASSESSMENT

## PREDICTED ENERGY ASSESSMENT

**TW9 1JY** 

Flat 1:01, 9-10 George Street,

Dwelling type:

Flat, Mid-Terrace

Richmond.

Date of assessment: 30/11/2020

Richmond, Date of assessment: 30/11/2020 London.

Produced by: Energy Calculations Limited

Total floor area: 59.03 m<sup>2</sup>

DRRN: 9270-0193-0975

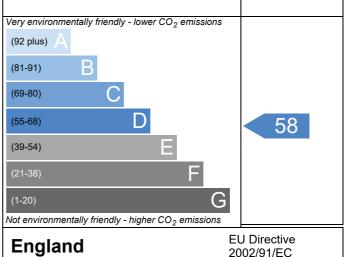
This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.

# Very energy efficient - lower running costs (92 plus) A (81-91) B (69-80) C (55-68) D (39-54) E (1-20) G Not energy efficient - higher running costs Eu Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

# Environmental Impact (CO<sub>2</sub>) Rating Very environmentally friendly - lower CO<sub>2</sub> emissions



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.





Property Re	ferenc <u>e</u>	0168	861							Issue	ed on Da	ite 3	0/11/2020	
Assessment		001						Pr	op Type Re	ype Ref				
Reference														
Property		Flat	1:01, 9-1	10 George	Street, Ri	chmond	, London	, TW9 1.	ΙΥ					
SAP Rating					5	3 E	DER		N/A	TE	ER		N/A	
Environmen	ital				58	8 D	% DER<	TER			N/A			
CO₂ Emissio	ns (t/ye	ar)			2.	69	DFEE		N/A	TI	EE		N/A	
General Rec	uireme	nts Com	pliance		N	/A	% DFEE	<tfee< th=""><th></th><th></th><th>N/A</th><th></th><th></th></tfee<>			N/A			
Assessor De	tails	1		rter, Energ ycalculatio		tions Lir	nited, Te	l: 01754	761035,	A	ssessor l	D	7869-0001	
Client		Carlford	l Propert	ies										
CALCULATIO	ON OF H	EAT DEM	MAND	09 Jan 20	14									
SAP 2012 WORKSHE CALCULATION OF H			s Designed an 2014	) (Version	9.92, Janua	ry 2014)								
1. Overall dwell	ing dimen	sions								,				
Ground floor First floor Total floor area Dwelling volume	TFA = (1	a)+(1b)+(1c	)+(1d)+(1e	)(1n)	5	9.0300		Area (m2) 47.0000 12.0300	(1b) x	height (m) 2.5500 (2.3300 (3d)+(3e).	2c) =		(1b) - (3b) (1c) - (3c) (4)	
,														
2. Ventilation r	ate													
Number of chimne					main heating		condary heating		other	tota	1 m 0 * 40 =	3 per hour		
Number of chimne Number of open f Number of interm Number of passiv Number of fluele	lues littent far e vents				0	+ +	0	+ +	0 = 0 =	:	0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 20.0000 0.0000 0.0000	(6b) (7a) (7b)	
Infiltration due Pressure test Measured/design Infiltration rat Number of sides	AP50	eys, flues	and fans	= (6a)+(6b)+	(7a)+(7b)+(	7c) =				20.0000	Air change / (5) =	0.1352 No 15.0000 0.8852	(8)	
Shelter factor		المسامسة معام	a abaltan	Footon					(20) = 1 -	[0.075 x = (18) x		0.7750	(20)	
Infiltration rat	e adjuste	a to includ	e sneiter	Iactor					(21)	= (18) X	(20) =	0.6861	(21)	
Wind speed Wind factor	Jan 3.7000 0.9250	Feb 3.5000 0.8750	Mar 3.5000 0.8750	Apr 3.4000 0.8500	May 3.4000 0.8500	Jun 3.1000 0.7750	Jul 3.2000 0.8000	Aug 3.0000 0.7500	Sep 2.9000 0.7250	Oct 3.1000 0.7750	Nov 3.0000 0.7500	Dec 3.4000 0.8500		
Adj infilt rate	0.6346 0.7014	0.6003	0.6003	0.5832 0.6700	0.5832	0.5317	0.5489	0.5145		0.5317	0.5145 0.6324	0.5832 0.6700	(22b)	
3. Heat losses a	ind heat l	oss paramet	er											
Element				Gross m2	Openings m2		Area m2	U-value W/m2K	A x U W/K		value J/m2K	A x K kJ/K		
Door to Hall Windows (Uw = 1. Heat Loss Floor Existing wall				31.7700	11.4500	11. 47. 20.	8600 4500 0000 3200	1.4000 1.5038 0.1250 0.3000	2.6040 17.2180 5.8750 6.0960	20 190	.0000	940.0000 3860.8000	(26) (27) (28b) (29a)	
Dwarf Wall Wall to Void Wall to hall Roof Slope Roof plane Roof Void Flat roof				10.8700 15.2000 20.1200 4.6600 4.3000 33.9200 6.1200	1.8600	15. 18. 4. 4. 33.	8700 2000 2600 6600 3000 9200	0.2800 0.2800 0.2745 0.1800 0.1600 0.1600	3.0436 4.2560 5.0119 0.8388 0.6880 5.4272	9 190 9 9	.0000 .0000 .0000 .0000 .0000	97.8300 136.8000 3469.4000 41.9400 38.7000 305.2800	(29a) (29a) (30) (30) (30)	
Flat roof Total net area of Fabric heat loss Party Wall 1 Internal Wall 1	, W/K = S		Aum(A, m2)	6.1200		173. 36. 40.	7500 8500	0.1800 30) + (32) 0.0000	1.1016 = 52.1601 0.0000	180 9	.0000	55.0800 6615.0000 367.6500	(31) (33) (32) (32c)	
Internal Floor 1 Internal Ceiling							0300 0300				.0000	216.5400 108.2700		



CALCULAT	ION OF H	HEAT DEN	MAND	09 Jan 2	014								
Heat capacity Thermal mass por Thermal bridge: Total fabric he	arameter (' s (Default	TMP = Cm /			ì)			(28).	(30) + (3	32) + (32a).	(32e) = + (36) =	16253.2900 275.3395 26.0940 78.2541	(35) (36)
Ventilation he	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer		33.1932 111.4474	33.1932	32.6979 110.9521	32.6979 110.9521	31.2982 109.5524	31.7505	30.8604	30.4369 108.6910	31.2982 109.5524	30.8604	32.6979 110.9521	
Average = Sum(			111.4474	110.9321	110.9321	109.3324	110.0040	109.1145	100.0910	109.3324	109.1143	110.3551	
HLP HLP (average)	Jan 1.9055	Feb 1.8880	Mar 1.8880	Apr 1.8796	May 1.8796	Jun 1.8559	Jul 1.8635	Aug 1.8485	Sep 1.8413	Oct 1.8559	Nov 1.8485	Dec 1.8796 1.8695	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)
4. Water heati	ng energy :	requirement	s (kWh/year	:)									
Assumed occupa: Average daily	ncy											1.9541 80.6094	
Average daily	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec Dec	(43)
Daily hot water	88.6703 131.4955	85.4460 115.0068	82.2216 118.6767	78.9972 103.4653	75.7728 99.2774	72.5484 85.6688	72.5484 79.3848	75.7728 91.0952	78.9972 92.1831	82.2216 107.4306	85.4460 117.2689	88.6703 127.3464	(45)
Energy content Distribution 1		= 0.15 x (	45) m 17.8015	15.5198	14.8916	12.8503	11.9077	13.6643	13.8275	Total = S	um(45)m = 17.5903	1268.2995	
Water storage : Store volume	loss:											90.0000	(47)
a) If manufac Temperature Enter (49) or Total storage	factor from (54) in (5	n Table 2b	actor is kn	own (kWh/c	lay):							1.0700 0.6000 0.6420	(49)
If cylinder co	19.9020	17.9760 icated sola	19.9020 r storage	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
Primary loss Total heat req						19.2600 0.0000	19.9020 0.0000	19.9020 0.0000	19.2600 0.0000	19.9020 0.0000	19.2600 0.0000	19.9020 0.0000	(59)
Solar input	151.3975	132.9828	138.5787	122.7253	119.1794 0.0000	104.9288 0.0000	99.2868 0.0000	110.9972 0.0000	111.4431 0.0000	127.3326 0.0000 months) = S	136.5289	147.2484 0.0000 0.0000	(63)
Output from w/	h 151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326 Th/year) = S	136.5289	147.2484	(64)
RHI water heat Heat gains from		ating, kWh/ 52.6206	month 55.3816	49.8102	48.9313	43.8929	42.3170	46.2107	46.0589	51.6423	54.3999	1503 58.2643	(64) (65)
5. Internal ga			5a) 										
Metabolic gain: (66)m	Jan	Feb	Mar 117.2448	Apr 117.2448	May 117.2448	Jun 117.2448	Jul 117.2448	Aug 117.2448	Sep 117.2448	Oct 117.2448	Nov 117.2448	Dec 117.2448	(66)
Lighting gains	(calculate 38.4004	ed in Appen 34.1069	dix L, equa 27.7376	tion L9 or 20.9991	L9a), also s 15.6971	see Table 5 13.2522	14.3194	18.6129	24.9822	31.7207	37.0227	39.4676	
Appliances gain	254.4688	257.1094	250.4552	236.2892	218.4071	201.6005	190.3727	187.7321	194.3863	208.5523	226.4344	243.2410	(68)
Cooking gains Pumps, fans	48.6786	48.6786	48.6786	48.6786	48.6786	48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	
Losses e.g. ev	aporation	(negative v	alues) (Tab	le 5)	-78.1632								
Water heating	gains (Tab	le 5)					56.8777			69.4116			
Total internal		457.2808	440.3906	414.2293	387.6323	363.5752	349.3300	356.2164	371.0994	397.4448	426.7726	448.7810	(73)
6. Solar gains													
[Jan]			A	rea	Solar flux Table 6a W/m2		a		FF data	Acce fact	or	Gains W	
East										Table 0.77		41.3943	(76)
West					22.3142 22.3142				.7000	0.77		36.6889	
Solar gains Total gains	78.0832 538.8790	132.4978 589.7786	220.8647 661.2553	328.0745 742.3038	392.4398 780.0721	428.2894 791.8646	406.9836 756.3136	357.3993 713.6157	276.5837 647.6831	173.9967 571.4415	97.1854 523.9580	63.5882 512.3691	(83) (84)
7. Mean intern	al temperat	ture (heati	ng season)										
Temperature du Utilisation fac	ring heating	ng periods ains for li	in the livi ving area,	ng area fro	om Table 9, T	Th1 (C)			San	Oct	Nov	21.0000 Dec	(85)
tau	40.1384	40.5106	40.5106	40.6915	40.6915	41.2114	41.0419	41.3767	41.5380	41.2114	41.3767		



	IION OF	HEAT DE	VIAND	09 Jan 20	014								
lpha til living a	3.6759	3.7007	3.7007	3.7128	3.7128	3.7474	3.7361	3.7584	3.7692	3.7474	3.7584	3.7128	
icii iiving a	0.9907	0.9859	0.9701	0.9246	0.8125	0.5781	0.3583	0.4179	0.7575	0.9411	0.9833	0.9921	(86)
1IT	19.4197	19.5864	19.9278	20.3576	20.7399	20.9536	20.9947	20.9903	20.8586	20.4101	19.8672	19.4111	
h 2	19.3971	19.4091	19.4091	19.4148	19.4148	19.4311	19.4259	19.4363	19.4412	19.4311	19.4363	19.4148	(88)
til rest of													
	0.9868	0.9799	0.9563	0.8871	0.7151	0.3972	0.1346	0.1887	0.6066	0.9028	0.9748	0.9888	
IIT 2	17.4235	17.6721	18.1614	18.7584	19.2258	19.4185	19.4258	19.4359	19.3727	18.8562	18.0978	17.4222	
iving area f										Living are		0.4720	
MIT emperature a	18.3656 diustment	18.5756	18.9951	19.5131	19.9404	20.1430	20.1662	20.1695	20.0740	19.5896	18.9329	18.3609	(92)
			10 0051	10 5131	19.9404	20.1430	20.1662	20.1695	20.0740	19.5896	10 0000		(02)
djusted MIT	18.3656	18.5756	18.9951	19.5131	19.9404	20.1430	20.1662	20.1093	20.0740	19.3890	18.9329	18.3609	(93)
djusted MIT			18.9951	19.5131	19.9404	20.1430	20.1662	20.1693	20.0740	19.3090	18.9329	18.3609	(93)
3. Space heat	ing require	ement Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
3. Space heat	ing require	Feb	Mar 0.9516	Apr 0.8900	May 0.7520	Jun 0.4841	Jul 0.2414	Aug 0.2988	Sep 0.6757	Oct 0.9077	Nov 0.9709	Dec 0.9856	(94)
3. Space heat	Jan 0.9832 529.8327	Feb 0.9755 575.3092	Mar 0.9516 629.2223	Apr 0.8900 660.6204	May 0.7520 586.5994	Jun 0.4841 383.3041	Jul 0.2414 182.5976	Aug 0.2988 213.2473	Sep 0.6757 437.6700	Oct 0.9077 518.7216	Nov 0.9709 508.7068	Dec 0.9856 504.9840	(94) (95)
3. Space heat Utilisation Seful gains	Jan 0.9832 529.8327 5.5000	Feb	Mar 0.9516	Apr 0.8900	May 0.7520	Jun 0.4841	Jul 0.2414	Aug 0.2988	Sep 0.6757	Oct 0.9077	Nov 0.9709	Dec 0.9856	(94) (95)
3. Space heat	Jan 0.9832 529.8327 5.5000	Feb 0.9755 575.3092 6.1000	Mar 0.9516 629.2223 7.9000	Apr 0.8900 660.6204 10.4000	May 0.7520 586.5994 13.5000	Jun 0.4841 383.3041 16.5000	Jul 0.2414 182.5976 18.5000	Aug 0.2988 213.2473 18.2000	Sep 0.6757 437.6700 15.5000	Oct 0.9077 518.7216 12.0000	Nov 0.9709 508.7068 8.4000	Dec 0.9856 504.9840 5.5000	(94) (95) (96)
Utilisation Seful gains Ext temp.	Jan 0.9832 529.8327 5.5000 e W	Feb 0.9755 575.3092 6.1000 1390.3703	Mar 0.9516 629.2223 7.9000	Apr 0.8900 660.6204 10.4000	May 0.7520 586.5994 13.5000 714.5709	Jun 0.4841 383.3041 16.5000 399.1011	Jul 0.2414 182.5976 18.5000	Aug 0.2988 213.2473 18.2000 214.9034	Sep 0.6757 437.6700 15.5000	Oct 0.9077 518.7216 12.0000 831.4559	Nov 0.9709 508.7068 8.4000	Dec 0.9856 504.9840 5.5000	(94) (95) (96) (97)
3. Space heat Utilisation Seful gains	Jan 0.9832 529.8327 5.5000	Feb 0.9755 575.3092 6.1000	Mar 0.9516 629.2223 7.9000	Apr 0.8900 660.6204 10.4000	May 0.7520 586.5994 13.5000	Jun 0.4841 383.3041 16.5000	Jul 0.2414 182.5976 18.5000	Aug 0.2988 213.2473 18.2000	Sep 0.6757 437.6700 15.5000	Oct 0.9077 518.7216 12.0000	Nov 0.9709 508.7068 8.4000	Dec 0.9856 504.9840 5.5000	(94) (95) (96) (97)
Utilisation Seful gains Ext temp.	Jan 0.9832 529.8327 5.5000 e W 1447.1363 1.0000	Feb 0.9755 575.3092 6.1000 1390.3703 1.0000	Mar 0.9516 629.2223 7.9000 1236.5212 1.0000	Apr 0.8900 660.6204 10.4000 1011.1224 1.0000	May 0.7520 586.5994 13.5000 714.5709 1.0000	Jun 0.4841 383.3041 16.5000 399.1011 0.0000	Jul 0.2414 182.5976 18.5000 183.2948 0.0000	Aug 0.2988 213.2473 18.2000 214.9034 0.0000	Sep 0.6757 437.6700 15.5000 497.1542 0.0000	Oct 0.9077 518.7216 12.0000 831.4559 1.0000	Nov 0.9709 508.7068 8.4000 1149.2949 1.0000	Dec 0.9856 504.9840 5.5000 1426.9457 1.0000	(94) (95) (96) (97) (97a)
S. Space heat Utilisation Seful gains Suxt temp. Heat loss rat	Jan 0.9832 529.8327 5.5000 e W 1447.1363 1.0000	Feb 0.9755 575.3092 6.1000 1390.3703	Mar 0.9516 629.2223 7.9000	Apr 0.8900 660.6204 10.4000	May 0.7520 586.5994 13.5000 714.5709	Jun 0.4841 383.3041 16.5000 399.1011	Jul 0.2414 182.5976 18.5000	Aug 0.2988 213.2473 18.2000 214.9034	Sep 0.6757 437.6700 15.5000	Oct 0.9077 518.7216 12.0000 831.4559	Nov 0.9709 508.7068 8.4000	Dec 0.9856 504.9840 5.5000 1426.9457 1.0000 685.9396	(94) (95) (96) (97) (97a)
S. Space heat Utilisation Seful gains Suxt temp. Heat loss rat	Jan 0.9832 529.8327 5.5000 e W 1447.1363 1.0000 kWh 682.4739	Feb 0.9755 575.3092 6.1000 1390.3703 1.0000 547.7211	Mar 0.9516 629.2223 7.9000 1236.5212 1.0000	Apr 0.8900 660.6204 10.4000 1011.1224 1.0000	May 0.7520 586.5994 13.5000 714.5709 1.0000	Jun 0.4841 383.3041 16.5000 399.1011 0.0000	Jul 0.2414 182.5976 18.5000 183.2948 0.0000	Aug 0.2988 213.2473 18.2000 214.9034 0.0000	Sep 0.6757 437.6700 15.5000 497.1542 0.0000	Oct 0.9077 518.7216 12.0000 831.4559 1.0000	Nov 0.9709 508.7068 8.4000 1149.2949 1.0000	Dec 0.9856 504.9840 5.5000 1426.9457 1.0000	(94) (95) (96) (97) (97a) (98) (98)

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09 Jan 2014

**CALCULATION OF ENERGY RATINGS** 

#### SAP 2012 WORKSHEET FOR Conversion (As Designed) (Version 9.92, January 2014) CALCULATION OF ENERGY RATINGS 09 Jan 2014 1. Overall dwelling dimensions Volume (m3) 119.8500 (1b) - (3b) 28.0299 (1c) - (3c) (m) 2.5500 (2b) 47.0000 (1b) Ground floor First floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) Dwelling volume 12.0300 (1c) 2.3300 (2c) 59.0300 2. Ventilation rate secondary m3 per hour heating Number of chimneys Number of open flues Number of intermittent fans Number of passive vents Number of flueless gas fires 0 \* 40 = 0 \* 20 = 2 \* 10 = 0 \* 10 = 0.0000 (6a) 0.0000 (6b) 20.0000 (7a) 0.0000 (7b) Air changes per hour 20.0000 / (5) = 0.1352 Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 1352 (8) No 15.0000 0.8852 (18) Pressure test Measured/design AP50 Infiltration rate Number of sides sheltered 3 (19) $(20) = 1 - [0.075 \times (19)] = (21) = (18) \times (20) =$ 0.7750 (20) Infiltration rate adjusted to include shelter factor 0.6861 (21) May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Dec 4.7000 (22) 1.1750 (22a) 4.5000 1.1250 Wind speed Wind factor 5.1000 1.2750 5.0000 4.9000 1.2250 1.1000 0.9500 0.9500 1.0750 Adj infilt rate Effective ac 3. Heat losses and heat loss parameter A x U W/K 2.6040 17.2180 Openings m2 II-value K-value W/m2K 1.4000 1.5038 Door to Hall Windows (Uw = 1.60) Heat Loss Floor 1 Existing wall Dwarf Wall (26) (27) 11.4500 47.0000 20.3200 10.8700

TOTAL HET ALCA	OI CACCING	II CICIICIICS	ricini (ri, inz.)			110	. 5000						( O T )
Fabric heat los	ss, $W/K = S$	Sum (A x U)					(26) (	30) + (32) =	52.160	1			(33)
Party Wall 1						36	.7500	0.0000	0.000	0 18	0.0000	6615.0000	(32)
Internal Wall 1						40	.8500				9.0000	367.6500	(32c)
Internal Floor	1					12	.0300			1	8.0000	216.5400	(32d)
Internal Ceilin	ng 1					12	.0300			1	8.0000	216.5400	(32e)
Heat capacity C Thermal mass pa Thermal bridges	rameter (1	MP = Cm /			)			(28)	(30) + (32	) + (32a).	(32e) =	16361.5600 277.1736 26.0940	(35)
Total fabric he	eat loss			•						(33)	+ (36) =	78.2541	(37)
Ventilation hea	at loss cal	Lculated mo	nthly (38) m	= 0.33 x (	25)m x (5)								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.0702	42.3452	41.6346	38.2968	37.6723	34.7652	34.7652	34.2269	35.8850	37.6723	38.9356	40.2564	(38)
Heat transfer c													
	121.3243	120.5993	119.8887	116.5509	115.9264	113.0194	113.0194	112.4810	114.1391	115.9264	117.1898	118.5105	(39)
Average = Sum(3	39)m / 12 =	=										116.5479	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.0553	2.0430	2.0310	1.9744	1.9639	1.9146	1.9146	1.9055	1.9336	1.9639	1.9853	2.0076 1.9744	
Days in month												1.9/44	(30)
-	31	28	31	30	31	30	31	31	30	31	30	31	(41)

15.2000

18.2600

4.6600 4.3000 33.9200 6.1200

173.9600

0.1250 0.3000 0.2800

0.2800

0.2745

0.1800 0.1600 0.1600

0.1800

5.8750

4.2560

5.0119

0.8388 0.6880 5.4272

1.1016

20.0000

190.0000

190.0000 9.0000 9.0000 9.0000

9.0000

9.0000



31.7700 10.8700 15.2000 20.1200

4.6600 4.3000

6.1200

11.4500

1.8600

Assumed occupancy Average daily hot water use (litres/day) 1.9541 (42) 80.6094 (43)



Wall to Void Wall to hall

Roof Slope Roof plane Roof Void

Flat roof

Total net area of external elements Aum(A, m2)

940.0000 (28b) 3860.8000 (29a) 97.8300 (29a)

97.8300 (29a) 136.8000 (29a) 3469.4000 (29a) 41.9400 (30) 38.7000 (30) 305.2800 (30) 55.0800 (30)

CALCULAT	ION OF I	ENERGY I	RATINGS	09 Jar	n 2014								
Balla hat out	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte Energy content	88.6703 131.4955 t (annual)	115.0068	82.2216 118.6767	78.9972 103.4653	75.7728 99.2774	72.5484 85.6688	72.5484 79.3848	75.7728 91.0952	78.9972 92.1831		85.4460 117.2689 um(45)m =	88.6703 127.3464 1268.2995	(45)
Distribution :	19.7243	= 0.15 x ( 17.2510		15.5198	14.8916	12.8503	11.9077	13.6643	13.8275	16.1146	17.5903	19.1020	(46)
Store volume a) If manufac Temperature Enter (49) or	cturer decl factor fro	m Table 2b	actor is kn	own (kWh/c	day):							90.0000 1.0700 0.6000 0.6420	(48) (49)
Total storage	19.9020	17.9760		19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder co	19.9020 0.0000	17.9760 0.0000	19.9020 0.0000	19.2600 0.0000	0.0000	19.2600 0.0000	19.9020 0.0000	19.9020 0.0000	19.2600 0.0000	19.9020 0.0000	19.2600 0.0000	19.9020 0.0000	
Total heat red Solar input			138.5787 0.0000			104.9288	99.2868 0.0000	110.9972 0.0000 Solar inp	111.4431 0.0000 ut (sum of 1	127.3326 0.0000 months) = S	0.0000	147.2484 0.0000 0.0000	(63)
Output from w		132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431 er year (kW	127.3326	136.5289	147.2484	(64)
Heat gains fro			month 55.3816	49.8102	48.9313	43.8929	42.3170	46.2107	46.0589	51.6423	54.3999	58.2643	
5. Internal ga	ains (see T	able 5 and	5a)										
Metabolic gair		), Watts							Co	0=+	No	D	
(66)m Lighting gains	117.2448	117.2448			May 117.2448 L9a), also			Aug 117.2448	Sep 117.2448	Oct 117.2448	Nov 117.2448	Dec 117.2448	(66)
Appliances ga	38.4004 ins (calcul	34.1069 ated in App	27.7376 endix L, eq	20.9991 uation L13	15.6971 or L13a), a	13.2522 lso see Tab	14.3194 le 5	18.6129	24.9822	31.7207	37.0227	39.4676	
Cooking gains	(calculate	d in Append	lix L, equat	ion L15 or		see Table !	5	187.7321	194.3863	208.5523	226.4344	243.2410	
Pumps, fans Losses e.g. ev	48.6786 0.0000	0.0000	48.6786 0.0000	48.6786 0.0000		48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	48.6786 0.0000	
Water heating	-78.1632	-78.1632	-78.1632		-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	(71)
Total internal	80.1665	78.3044	74.4377	69.1808	65.7679	60.9623	56.8777	62.1112	63.9707	69.4116	75.5554	78.3122	(72)
	460.7958	457.2808	440.3906	414.2293	387.6323	363.5752	349.3300	356.2164	371.0994	397.4448	426.7726	448.7810	(73)
6. Solar gains	s												
6. Solar gains	S 		A	rea m2	Solar flux Table 6a W/m2	Speci:	g fic data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
6. Solar gains	3		A 6.0 5.3	rea m2	Solar flux Table 6a W/m2 19.6403 19.6403	Speci: or '	g fic data Table 6b	Specific or Tab	data le 6c	fact	or 6d 00		
[Jan]  East West	68.7266	134.4437	A 6.0 5.3	rea m2	Solar flux Table 6a W/m2 19.6403 19.6403	Speci: or '	g fic data Table 6b	Specific or Tab	data le 6c .7000 .7000	fact Table 0.77	or 6d 00 00 85.6939	36.4341 32.2925 56.5174	(80)
6. Solar gains [Jan]  East West  Solar gains Total gains	68.7266	134.4437 591.7246	6.0 5.3 221.4097 661.8003	rea m2700 800322.9128 737.1421	Solar flux Table 6a W/m2  19.6403 19.6403 395.7418 783.3741	Speci: or ! 405.1121 768.6873	fic data Table 6b  0.6300 0.6300 385.6833 735.0133	Specific or Tab 0 0 0 0 331.2962 687.5126	data le 6c .7000 .7000	fact Table 0.77 0.77	or 6d 00 00 85.6939	36.4341 32.2925 56.5174	(80)
6. Solar gains [Jan]  East West  Solar gains Total gains	68.7266 529.5224	134.4437 591.7246 ture (heati	6.0 5.3 221.4097 661.8003	rea m2	Solar flux Table 6a W/m2 19.6403 19.6403 395.7418 783.3741	Speci: or: 405.1121 768.6873	gfic data Table 6b 0.6300 0.6300 385.6833 735.0133	Specific or Tab 0 0 331.2962 687.5126	data le 6c .7000 .7000	fact Table 0.77 0.77	or 6d 00 00 85.6939	W 36.4341 32.2925 56.5174 505.2983	(80) (83) (84)
6. Solar gains [Jan]  East West  Solar gains Total gains  7. Mean inter Temperature di Utilisation fa	68.7266 529.5224 anal tempera arring heati actor for g Jan 37.4606	134.4437 591.7246 ture (heati- ng periods ains for li Feb 37.6858	221.4097 661.8003 in the livi ving area, Mar 37.9091	rea m2 700 800 322.9128 737.1421	Solar flux Table 6a W/m2 19.6403 19.6403 395.7418 783.3741  om Table 9a) May 39.2048	Speci: or: 405.1121 768.6873	gfic data Table 6b  0.6300 0.6300 385.6833 735.0133	Specific or Tab or Tab 331.2962 687.5126	data le 6c .7000 .7000 257.5086 628.6080	fact Table 0.77 0.77 159.5288 556.9736	or 6d 00 00 85.6939 512.4666	W 36.4341 32.2925 56.5174 505.2983 21.0000 Dec 38.3500	(80) (83) (84)
6. Solar gains [Jan]  East West  Solar gains Total gains  7. Mean inter Temperature di Utilisation fa	68.7266 529.5224 mal tempera uring heati actor for g Jan 37.4606 3.4974	134.4437 591.7246 ture (heati- ng periods ains for li Feb	221.4097 661.8003 in the liviving area,	rea m2 700 800 322.9128 737.1421	Solar flux Table 6a W/m2 19,6403 19.6403 395.7418 783.3741  om Table 9, 7 Table 9a) May	Speci: or: 405.1121 768.6873	gfic data Table 6b 0.6300 0.6300 385.6833 735.0133	Specific or Tab 0 0 331.2962 687.5126	data le 6c .7000 .7000 257.5086 628.6080	fact Table 0.77 0.77 159.5288 556.9736	or 6d 00 00 85.6939 512.4666	W 36.4341 32.2925 56.5174 505.2983 21.0000 Dec	(80) (83) (84) (85)
6. Solar gains [Jan]  East West  Total gains  7. Mean intern  Temperature du Utilisation fa tau alpha util living an	68.7266 529.5224 mal tempera 	134.4437 591.7246 ture (heati- ng periods ains fer li Feb 37.6858 3.5124	221.4097 661.8003 221.4097 661.8003 in the livi ving area, Mar 37,9091 3.5273	rea m2  700 800  322.9128 737.1421  ng area fronii,m (see Apr 38.9948 3.5997	Solar flux Table 6a W/m2  19.6403 19.6403 395.7418 783.3741  om Table 9, 17 Table 9a) May 39.2048 3.6137	Speci: or 9 405.1121 768.6873 Th1 (C) Jun 40.2133 3.6809	gfic data Table 6b 0.6300 0.6300 385.6833 735.0133  Jul 40.2133 3.6809	Specific or Tab  0 0 331.2962 687.5126  Aug 40.4057 3.6937	data le 6c .7000 .7000 257.5086 628.6080  Sep 39.8188 3.6546	fact Table 0.77 0.77 159.5288 556.9736	or 6d 00 00 00 85.6939 512.4666 Nov 38.7822 3.5855	W 36.4341 32.2925 56.5174 505.2983 21.0000 Dec 38.3500 3.5567	(80) (83) (84) (85)
6. Solar gains [Jan]  East West  Total gains  7. Mean interr  Temperature du tutilisation fa tau alpha util living au  MIT Th 2 util rest of l	68.7266 529.5224 mal tempera auring heati actor for g Jan 37.4606 3.4974 rea 0.9932 19.0918 19.2967 nouse 0.9905	134.4437 591.7246 ture (heating periods ains for lifeb 37.6858 3.5124 0.9892 19.2718 19.3048	221.4097 661.8003 221.4097 661.8003 in the livi ving area, Mar 37.9091 3.5273 0.9792 19.6082 19.3128	rea m2 700 800	Solar flux Table 6a W/m2  19.6403 19.6403 395.7418 783.3741  om Table 9, Table 9a) May 39.2048 3.6137 0.8882 20.5071 19.3575 0.8293	Speci:	gfic data Table 6b  0.6300 0.6300 385.6833 735.0133  Jul 40.2133 3.6809 0.6147 20.9409 19.3909 0.4180	Specific or Tab  0 0 331.2962 687.5126  Aug 40.4057 3.6937 0.6641 20.9209 19.3971 0.4717	data le 6c .7000 .7000 257.5086 628.6080  Sep 39.8188 3.6546 0.8637 20.6833 19.3780 0.7682	fact Table 0.77 0.77 159.5288 556.9736 Oct 39.2048 3.6137 0.9660 20.1394 19.3575	Nov 38.7822 3.5855 0.9891 19.5581 19.3432 0.9838	W 36.4341 32.2925 56.5174 505.2983  21.0000 Dec 38.3500 3.5567 0.9943 19.0934 19.3283 0.9920	(80) (83) (84) (85) (86) (87) (88) (89)
6. Solar gains [Jan]  East West  Total gains  7. Mean intern  Temperature du Utilisation fa tau alpha util living an	68.7266 529.5224 mal tempera aring heati actor for g Jan 37.4606 3.4974 rea 0.9932 19.0918 19.2967 nouse 0.9905 16.8842	134.4437 591.7246 ture (heati- ng periods ains for li Feb 37.6858 3.5124 0.9892 19.2718 19.3048	221.4097 661.8003 221.4097 661.8003 in the livi ving area, Mar 37.9091 3.5273 0.9792 19.6082 19.3128	rea m2  700 800  322.9128 737.1421  ng area frc nil,m (see Apr 38.9948 3.5997 0.9513 20.0874 19.3504	Solar flux Table 6a W/m2 19.6403 395.7418 783.3741  om Table 9, 7 Table 9a) May 39.2048 3.6137 0.8882 20.5071 19.3575	Speci: or 9 405.1121 768.6873 Th1 (C) Jun 40.2133 3.6809 0.7618 20.8212 19.3909	Jul 40.2133 3.6809 0.6147 20.9409 19.3909	Specific or Tab  0 0  331.2962 687.5126  Aug 40.4057 3.6937 0.6641 20.9209 19.3971	data le 6c .7000 .7000 257.5086 628.6080  Sep 39.8188 3.6546 0.8637 20.6833 19.3780 0.7682 19.1512	fact Table 0.77 0.77 159.5288 556.9736 Oct 39.2048 3.6137 0.9660 20.1394 19.3575	Nov 38.7822 3.5855 0.9891 19.5581 19.3432 0.9838 17.5916	W 36.4341 32.2925 56.5174 505.2983 21.0000 Dec 38.3500 3.5567 0.9943 19.0934 19.3283	(85) (86) (87) (88) (89) (90)
6. Solar gains [Jan]  East West  Solar gains Total gains  7. Mean interr  Temperature du Utilisation for the second secon	68.7266 529.5224 mal tempera actor for garder of a 37.4606 3.4974 rea 0.9932 19.0918 19.2967 nouse 0.9905 16.8842 raction 17.9261	134.4437 591.7246 ture (heati- ng periods ains for li Feb 37.6858 3.5124 0.9892 19.2718 19.3048 0.9849 17.1503	221.4097 661.8003 221.4097 661.8003 in the liviving area, Mar 37.9091 3.5273 0.9792 19.6082 19.3128 0.9701 17.6412	rea m2 700 800	Solar flux Table 6a W/m2  19.6403 19.6403 395.7418 783.3741  om Table 9a, May 39.2048 3.6137 0.8882 20.5071 19.3575 0.8293 18.9081	Speci:	Jul 40.2133 3.6809 0.6147 20.9409 19.3754	Specific or Tab 0 0 331.2962 687.5126  Aug 40.4057 3.6937 0.6641 20.9209 19.3971 0.4717 19.3727	data le 6c .7000 .7000 .257.5086 628.6080  Sep 39.8188 3.6546 0.8637 20.6833 19.3780 0.7682 19.1512 fLA =	fact Table 0.77 0.77 159.5288 556.9736 Oct 39.2048 3.6137 0.9660 20.1394 19.3575 0.9450 18.4344 Living are	Nov 38.7822 3.5855 0.9891 19.5581 19.3432 0.9838 17.5916 a / (4) =	W 36.4341 32.2925 56.5174 505.2983 21.0000 Dec 38.3500 3.5567 0.9943 19.0934 19.3283 0.9920 16.9052 0.4720	(86) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
6. Solar gains  [Jan]  East West  Total gains  7. Mean inter  Temperature di Utilisation fa tau alpha util living an  MIT Th 2 util rest of h  MIT 2 Living area fi MIT Temperature ac	68.7266 529.5224 mal tempera aring heati actor for g Jan 37.4606 3.4974 rea 0.9932 19.2967 house 0.9905 16.8842 caction 17.9261 djustment 17.9261	134.4437 591.7246 ture (heati ng periods ains for li Feb 37.6858 3.5124 0.9892 19.2718 19.3048 0.9849 17.1503 18.1515	221.4097 661.8003  221.4097 661.8003  in the livi ving area, Mar 37.9091 3.5273 0.9792 19.6082 19.3128 0.9701 17.6412 18.5696	rea m2  700 800  322.9128 737.1421  ng area frc nil,m (see Apr 38.9948 3.5997 0.9513 20.0874 19.3504 0.9281 18.3440 19.1669	Solar flux Table 6a W/m2 19.6403 19.6403 395.7418 783.3741  Dom Table 9, Table 9a) May 39.2048 3.6137 0.8882 20.5071 19.3575 0.8293 18.9081 19.6628	Speciment of the state of the s	Jul 40.2133 3.6809 0.6147 20.9409 19.3754 20.1143	Aug 40.4057 3.6937 0.6641 20.9209 19.3971 0.4717 19.3727 20.1034	data le 6c .7000 .7000 .7000  257.5086 628.6080  Sep 39.8188 3.6546 0.8637 20.6833 19.3780 0.7682 19.1512 fLA = 19.8743	fact Table 0.77 0.77 159.5288 556.9736 Oct 39.2048 3.6137 0.9660 20.1394 19.3575 0.9450 18.4344 Living are	Nov 38.7822 3.5855 0.9891 19.5581 19.3432 0.9838 17.5916 a / (4) = 18.5197	36.4341 32.2925 56.5174 505.2983 21.0000 Dec 38.3500 3.5567 0.9943 19.0934 19.3283 0.9920 16.9052 0.4720 17.9380 0.0000	(86) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
6. Solar gains  [Jan]  East West  7. Mean intern  Temperature du Utilisation fa tau alpha util living an  MIT Th 2 util rest of 1  MIT 2 Living area fn MIT Temperature ac adjusted MIT	68.7266 529.5224  al tempera uring heati actor for g Jan 37.4606 3.4974 rea 0.9932 19.2967 nouse 0.9905 16.8842 raction 17.9261 17.9261	134.4437 591.7246  ture (heating periods ains for lifeb 37.6858 3.5124 0.9892 19.2718 19.3048 0.9849 17.1503 18.1515 18.1515	221.4097 661.8003 221.4097 661.8003 in the livi ving area, Mar 37.9091 3.5273 0.9792 19.6082 19.3128 0.9701 17.6412 18.5696	rea m2 700 800 322.9128 737.1421  ng area frc nil,m (see Apr 38.9948 3.5997 0.9513 20.0874 19.3504 0.9281 18.3440 19.1669	Solar flux Table 6a W/m2  19.6403 19.6403 395.7418 783.3741  om Table 9a, May 39.2048 3.6137 0.8882 20.5071 19.3575 0.8293 18.9081 19.6628	Speci:	Jul 40.2133 3.6809 0.6147 20.9409 19.3754 20.1143	Specific or Tab or Tab 331.2962 687.5126  Aug 40.4057 3.6937 0.6641 20.9209 19.3971 0.4717 19.3727 20.1034 20.1034	data le 6c .7000 .7000 .7000 257.5086 628.6080  Sep 39.8188 3.6546 0.8637 20.6833 19.3780 0.7682 19.1512 fLA = 19.8743 19.8743	fact Table 0.77 0.77 159.5288 556.9736 Oct 39.2048 3.6137 0.9660 20.1394 19.3575 0.9450 18.4344 Living are 19.2391	Nov 38.7822 3.5855 0.9891 19.5581 19.3432 0.9838 47.5916 a / (4) = 18.5197	W 36.4341 32.2925 56.5174 505.2983  21.0000 Dec 38.3500 3.5567 0.9943 19.0934 19.3283 0.9920 16.9052 0.4720 17.9380	(86) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
6. Solar gains  [Jan]  East West  Solar gains Total gains  7. Mean interr  Temperature du Utilisation fe tau alpha util living an  MIT Th 2 util rest of l  MIT 2 Living area fr MIT Temperature ac adjusted MIT  8. Space heat:	68.7266 529.5224  all tempera arring heati actor for g Jan 37.4606 3.4974 rea 0.9932 19.0918 19.2967 nouse 0.9905 16.8842 reaction 17.9261 djustment 17.9261 djustment 17.9261	134.4437 591.7246 ture (heating periods ains for lifeb 37.6858 3.5124 0.9892 19.2718 19.3048 0.9849 17.1503 18.1515 18.1515	A  6.0 5.3  221.4097 661.8003  in the livi ving area, Mar 37.9091 3.5273 0.9792 19.6082 19.3128 0.9701 17.6412 18.5696	rea m2 700 800	Solar flux Table 6a W/m2  19.6403 19.6403 395.7418 783.3741  Dom Table 9, 'Table 9a) May 39.2048 3.6137 0.8882 20.5071 19.3575 0.8293 18.9081 19.6628	Speci:	gfic data Table 6b  0.6300 0.6300 385.6833 735.0133  Jul 40.2133 3.6809 0.6147 20.9409 19.3909 0.4180 19.3754 20.1143	Specific or Tab or Tab 331.2962 687.5126  Aug 40.4057 3.6937 0.6641 20.9209 19.3971 0.4717 19.3727 20.1034 20.1034	data le 6c .7000 .7000 .7000  257.5086 628.6080  Sep 39.8188 3.6546 0.8637 20.6833 19.3780 0.7682 19.1512 fLA = 19.8743	fact Table 0.77 0.77 159.5288 556.9736 Oct 39.2048 3.6137 0.9660 20.1394 19.3575 0.9450 18.4344 Living are	Nov 38.7822 3.5855 0.9891 19.5581 19.3432 0.9838 17.5916 a / (4) = 18.5197	36.4341 32.2925 56.5174 505.2983 21.0000 Dec 38.3500 3.5567 0.9943 19.0934 19.3283 0.9920 16.9052 0.4720 17.9380 0.0000	(85) (86) (87) (88) (89) (90) (91) (92) (93)
6. Solar gains  [Jan]  East West  Total gains  7. Mean interr  Temperature du Utilisation fa tau alpha util living an  MIT Th 2 util rest of l MIT 2 Living area for MIT Temperature act adjusted MIT  8. Space heat: Utilisation Useful gains	68.7266 529.5224	134.4437 591.7246  ture (heating periods ains for lifeb 37.6858 3.5124 0.9892 19.2718 19.3048 0.9849 17.1503 18.1515 18.1515	A  6.0 5.3  221.4097 661.8003  in the livi ving area, Mar 37.9091 3.5273 0.9792 19.6082 19.3128 0.9701 17.6412 18.5696 18.5696	rea m2 700 800	Solar flux Table 6a W/m2  19.6403 19.6403 395.7418 783.3741  Dom Table 9, Table 9a) May 39.2048 3.6137 0.8882 20.5071 19.3575 0.8293 18.9081 19.6628 19.6628	Speci:	Jul 40.2133 3.6809 0.6147 20.9409 19.3754 20.1143 20.1143 Jul 0.5131 377.1102	Aug 40.4057 3.6937 0.6641 20.9209 19.3971 0.4717 19.3727 20.1034 20.1034 38.0529	data le 6c .7000 .7000 .7000 257.5086 628.6080  Sep 39.8188 3.6546 0.8637 20.6833 19.3780 0.7682 19.1512 fLA = 19.8743 19.8743  Sep 0.8033 504.9832 14.1000	fact Table 0.77 0.77 159.5288 556.9736 Oct 39.2048 3.6137 0.9660 20.1394 19.3575 0.9450 18.4344 Living are 19.2391 19.2391	Nov 38.7822 3.5855 0.9891 19.5581 19.3432 0.9838 17.5916 a / (4) = 18.5197 18.5197	W 36.4341 32.2925 56.5174 505.2983  21.0000 Dec 38.3500 3.5567 0.9943 19.0934 19.3283 0.9920 16.9952 0.4720 17.9380  Dec 0.9892 499.8405 4.2000	(80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97)



CALCULAT	TION OF E	NERGY R	RATINGS	09 Jan	2014								
Space heating Space heating	841.0275 per m2	684.0298	601.6183	370.7480	195.7597	0.0000	0.0000	0.0000	0.0000	354.3791 (98)	601.9611	839.4206 4488.9441 76.0451	(98)
8c. Space cool	ling require	ement											
9a. Energy red	quirements -	- Individual	l heating sy	ystems, inc	luding micr	o-CHP							
Fraction of sp Fraction of sp Efficiency of Efficiency of Space heating	pace heat fr pace heat fr main space secondary/s	com secondar com main sys heating sys supplementar	ry/supplemer stem(s) stem 1 (in %	ntary system 8)								0.0000 1.0000 100.0000 0.0000 4488.9441	(202) (206) (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	841.0275	684.0298	601.6183		195.7597	0.0000	0.0000	0.0000	0.0000	354.3791	601.9611	839.4206	(98)
Space heating	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating	841.0275	684.0298		370.7480	195.7597	0.0000	0.0000	0.0000	0.0000	354.3791	601.9611	839.4206	(211)
Water heating	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	151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	
Efficiency of (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	
Fuel for water	151.3975 fuel used	Wh/month 132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484 1502.6295	
Annual totals Space heating Space heating	fuel - mair											4488.9441 0.0000	
Electricity for Total electricity for Total delivered	city for the or lighting	above, kWh (calculated		ix L)								0.0000 271.2651 6262.8387	(232)
10a. Fuel cost	ts - using T	able 12 pri	ices						,	Fuel price		Fuel cost	
Space heating Space heating Water heating Pumps and fans Energy for lic Additional sta Total energy of	- secondary (other fuel s for heatir ghting anding chard	/ -) ng						Fuel kWh/year 4488.9441 0.0000 1502.6295 0.0000 271.2651		p/kWh 13.1900 0.0000 13.1900 0.0000 13.1900		fuel cost f/year 592.0917 0.0000 198.1968 0.0000 35.7799 0.0000 826.0684	(240) (242) (247) (249) (250) (251)
11a. SAP ratin	ng - Individ	dual heating	g systems										
Energy cost de Energy cost fa SAP value SAP rating (Se SAP band	eflator (Tak actor (ECF)								(255) <b>x</b> (256)	] / [(4) +	45.0] =	0.4200 3.3351 53.4756 53 E	(257)
12a. Carbon d	ioxide emiss	sions - Indi	ividual heat	ting systems	s including	micro-CHP			Emiss	ion factor		Emissions	
Space heating Space heating	- secondary	7						kWh/year 4488.9441 0.0000		0.5190 0.0000	]	cg CO2/year 2329.7620 0.0000	(261) (263)
Water heating Space and water	er heating	- )						1502.6295		0.5190		779.8647 3109.6267	(265)
Pumps and fan: Energy for lig Total kg/year CO2 emissions EI value EI rating EI band	ghting							0.0000 271.2651		0.0000 0.5190		0.0000 140.7866 3250.4133 55.0600 57.9959 58	(268) (272) (273) (274)
Calculation or													
Calculation of									00) / 1.0000	- 12 100	***** = 1		
Main heating e Water heating	environmenta	al impact						0.29 × 0.0	00) / 1.0000 10) / 1.0000 19 / 1.0000	= 0.5190, s	stars = 2		



				Т															0:	

Water heating environmental	impact	0.519 /	1.0000 =	0.5190,	stars :	=



## CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHE	EPC COSTS,	EMISSIONS	AND PRIMAR	RY ENERGY	09 Jan 20	14							
1. Overall dwell													
Ground floor First floor Total floor area Dwelling volume	a TFA = (1	a)+(lb)+(lc	c)+(1d)+(1e	e)(1n)		59.0300		Area (m2) 47.0000 12.0300	(1b) x	rey height (m) 2.5500 2.3300 ++(3d)+(3e)	(2c) =	Volume (m3) 119.8500 28.0299 147.8799	(1b) - (1c) - (4)
2. Ventilation													
Number of object					main heating		econdary heating		other	tota		n3 per hour	
Number of chimne Number of open in Number of intern Number of passiv Number of fluele	flues mittent fa ve vents				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	AP50	eys, flues	and fans	= (6a)+(6b	)+(7a)+(7b)+	(7c) =				20.0000	Air change / (5) =	0.1352 No 15.0000 0.8852	(8)
Number of sides		l							(00)		47.01.7	3	(19)
Shelter factor Infiltration rat	te adjuste	d to include	de shelter	factor					(20) = 1 -	- [0.075 x 21) = (18) :		0.7750 0.6861	
Wind speed Wind factor Adj infilt rate	Jan 3.7000 0.9250	Feb 3.5000 0.8750	Mar 3.5000 0.8750	Apr 3.4000 0.8500	May 3.4000 0.8500	Jun 3.1000 0.7750	Jul 3.2000 0.8000	Aug 3.0000 0.7500		Oct 3.1000 0.7750	Nov 3.0000 0.7500	Dec 3.4000 0.8500	
Effective ac	0.6346 0.7014	0.6003 0.6802	0.6003 0.6802	0.5832 0.6700	0.5832 0.6700	0.5317 0.6414	0.5489 0.6506	0.5145 0.6324		0.5317 0.6414	0.5145 0.6324	0.5832 0.6700	
3. Heat losses a	and heat 1	oss paramet	ter										
Element  Door to Hall Windows (Uw = 1. Heat Loss Floor Existing wall Dwarf Wall Wall to Void Wall to hall Roof Slope				Gross m2 31.7700 10.8700 15.2000 20.1200 4.6600	Openings m2 11.4500	1 11 47 20 10 15	m2 .8600 .4500 .0000 .3200 .8700 .2000 .2600	U-value W/m2K 1.4000 1.5038 0.1250 0.3000 0.2800 0.2800 0.2745 0.1800	A x W, 2.604 17.218 5.875 6.096 3.044 4.256 5.011 0.838	/K 1 40 30 50 20 60 190 36 50	-value kJ/m2K 0.0000 0.0000 9.0000 9.0000 0.0000 9.0000	A x K kJ/K 940.0000 3860.8000 97.8300 136.8000 3469.4000 41.9400	(26) (27) (28b) (29a) (29a) (29a) (29a)
Roof plane Roof Void Flat roof Total net area o	of externa	ıl elements	Aum(A, m2)	4.3000 33.9200 6.1200		4 33 6	.3000 .9200 .1200 .9600	0.1600 0.1600 0.1800	0.688 5.427 1.101	30 72	9.0000 9.0000 9.0000	38.7000 305.2800 55.0800	(30) (30)
Fabric heat loss Party Wall 1 Internal Wall 1 Internal Floor 1 Internal Ceiling	1	Sum (A × U)				40 12	(26)( .7500 .8500 .0300	30) + (32) 0.0000	= 52.160 0.000	00 180 :	0.0000 9.0000 B.0000	6615.0000 367.6500 216.5400 216.5400	(32c) (32d)
Heat capacity Cr Thermal mass par Thermal bridges Total fabric hea	rameter (T (Default	MP = Cm / r			.)			(28)	(30) + (32		(32e) = + (36) =	16361.5600 277.1736 26.0940 78.2541	(35) (36)
Ventilation heat	t loss cal Jan	culated mon	nthly (38)m Mar	Apr	25)m x (5) May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer co	34.2269	33.1932	33.1932 111.4474	32.6979 110.9521	32.6979 110.9521	31.2982 109.5524	31.7505 110.0046	30.8604	30.4369 108.6910	31.2982 109.5524	30.8604 109.1145	32.6979 110.9521	
Average = Sum(39			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	110.3551 Dec	
HLP HLP (average) Days in month	1.9055	1.8880	1.8880	1.8796	1.8796	1.8559	1.8635	1.8485	1.8413	1.8559	1.8485	1.8796 1.8695	
Days III MONCH	31	28	31	30	31	30	31	31	30	31	30	2.5	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9541 (42)
Average daily hot water use (litres/day) 80.6094 (43)



CALCULAT	TON OF E	PC COST	rs, emiss	IONS AN	D PRIMA	RY ENER	GY 09	Jan 2014					
Daily hot wate	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte Energy content	88.6703 131.4955 t (annual)		118.6767	78.9972 103.4653	75.7728 99.2774	72.5484 85.6688	72.5484 79.3848	75.7728 91.0952	78.9972 92.1831		85.4460 117.2689 um(45)m =		(45)
Distribution : Water storage	19.7243		17.8015	15.5198	14.8916	12.8503	11.9077	13.6643	13.8275	16.1146	17.5903	19.1020	(46)
tore volume  i) If manufac  Temperature  inter (49) or	cturer decla factor from (54) in (5	n Table 2b	Factor is kno	own (kWh/d	lay):							90.0000 1.0700 0.6000 0.6420	(48) (49)
Potal storage If cylinder co	19.9020	17.9760		19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
rimary loss	19.9020 0.0000	17.9760 0.0000	19.9020 0.0000	19.2600	19.9020	19.2600 0.0000	19.9020 0.0000	19.9020 0.0000	19.2600 0.0000	19.9020 0.0000	19.2600 0.0000	19.9020 0.0000	
otal heat red				122.7253 0.0000		104.9288	99.2868 0.0000	110.9972 0.0000 Solar inpu	111.4431 0.0000 at (sum of	127.3326 0.0000 months) = Si	136.5289 0.0000 um(63)m =	147.2484 0.0000 0.0000	(63)
utput from w,	151.3975	132.9828		122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326 h/year) = Si	136.5289		
eat gains fro		ating, kWh/ 52.6206		49.8102	48.9313	43.8929	42.3170	46.2107	46.0589	51.6423	54.3999	58.2643	(65)
5. Internal ga	ains (see Ta	able 5 and	5a)										
Metabolic gair		, Watts	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gains	117.2448 s (calculate	117.2448 ed in Appen	117.2448 ndix L, equat	117.2448 tion L9 or	117.2448 L9a), also	117.2448 see Table 5	117.2448	117.2448	117.2448	117.2448	117.2448	117.2448	
ppliances ga	ins (calcula	ated in App	27.7376 pendix L, equ 250.4552	uation L13	or L13a), a	lso see Tab		18.6129 187.7321	24.9822 194.3863	31.7207 208.5523	37.0227 226.4344	39.4676 243.2410	
ooking gains			dix L, equat:					48.6786	48.6786	48.6786	48.6786	48.6786	
umps, fans osses e.g. ev	0.0000 vaporation	0.0000 (negative v	0.0000 values) (Tab	0.0000 le 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
ater heating	gains (Tab	le 5)	-78.1632			-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	-78.1632	
otal internal	l gains	78.3044 457.2808		69.1808 414.2293	65.7679 387.6323	60.9623 363.5752	56.8777 349.3300	62.1112 356.2164	63.9707 371.0994	69.4116 397.4448	75.5554 426.7726	78.3122 448.7810	
	400.7938	437.2000	440.3300	414.2233	307.0323	303.3732	349.3300	330.2104	371.0994	397.4440	420.7720	440.7010	(73)
. Solar gains	3												
. Solar gains	S 		A:		Solar flux Table 6a W/m2	Speci:	g fic data Table 6b	Specific or Tab		Acce: facto Table	or	Gains W	
. Solar gains	3		A: 6.0° 5.38	rea m2 700 800	Solar flux Table 6a W/m2 22.3142 22.3142	Speci:	g fic data Table 6b	Specific or Tab	data le 6c	facto	or 6d		(76)
Jan]  ast lest olar gains	3		6.0° 5.38	rea m2 700 800	Solar flux Table 6a W/m2 22.3142 22.3142	Speci: or '	fic data Table 6b 0.6300 0.6300	Specific or Tab:	data le 6c .7000 .7000	facto Table	or 6d	W 41.3943	(76) (80)
Jan]  Jan]  Jast	78.0832	132.4978 589.7786	6.0° 5.31 220.8647 661.2553	rea m2	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721	Speci: or: 428.2894 791.8646	fic data Table 6b  0.6300 0.6300 406.9836 756.3136	Specific or Tab:  0 0 357.3993 713.6157	data le 6c .7000 .7000	factor Table 0.770 0.770 173.9967	or 6d 00 00 97.1854	W 41.3943 36.6889 63.5882	(76) (80)
. Solar gains ast est olar gains otal gains	78.0832 538.8790	132.4978 589.7786 Lure (heati	6.0° 5.30 220.8647 661.2553	rea m2 700 800 328.0745 742.3038	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721	Speci: or: 428.2894 791.8646	gfic data Table 6b 0.6300 0.6300 406.9836 756.3136	Specific or Tab: 0 0 0 357.3993 713.6157	data le 6c .7000 .7000	factor Table 0.770 0.770 173.9967	or 6d 00 00 97.1854	W 41.3943 36.6889 63.5882	(76) (80) (83) (84)
Jan]  Jan]  Sast  Solar gains  Dolar gains  Dolar gains  Dolar gains  Dolar gains  Dolar gains  Dolar gains	78.0832 538.8790 	132.4978 589.7786 cure (heati	220.8647 661.2553 in the living area, 1 Mar 40.7805	rea m2 700 800 328.0745 742.3038  ng area fronil,m (see Apr 40.9625	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721  mm Table 9, Table 9a) May 40.9625	Speci: or: 428.2894 791.8646	gfic data Table 6b  0.6300 0.6300 406.9836 756.3136	Specific or Tab: 0 0 357.3993 713.6157	data Le 6c .7000 .7000 .7000 .706.5837 .647.6831	factor Table (0.77) 0.77) 173.9967 571.4415	97.1854 523.9580 Nov 41.6524	W 41.3943 36.6889 63.5882 512.3691 21.0000 Dec 40.9625	(76) (80) (83) (84)
Solar gains  ast est  olar gains  otal gains  mean intern  emperature ditation fa	78.0832 538.8790 mal temperaturing heating actor for grade Jan 40.4057 3.6937	132.4978 589.7786 ture (heati	220.8647 661.2553 ing season) in the living area, 1	rea m2 700 800 328.0745 742.3038 ng area fro nil,m (see Apr	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721 mm Table 9, Table 9a) May	Speci: or: 428.2894 791.8646	gfic data Table 6b 0.6300 0.6300 406.9836 756.3136	Specific or Tab: 0 0 357.3993 713.6157	data le 6c .7000 .7000 276.5837 647.6831	factor Table (0.77) 0.77(0.77) 173.9967 571.4415	97.1854 523.9580	W 41.3943 36.6889 63.5882 512.3691 21.0000 Dec	(76) (80) (83) (84)
Solar gains  Jan]  ast est  olar gains  otal gains  . Mean inter  emperature ditilisation for au  lipha  til living an	78.0832 538.8790 and temperal actor for gr Jan 40.4057 3.6937	132.4978 589.7786 Ture (heating periods ains for life of the control of the cont	220.8647 661.2553 ing season) in the living area, 1 Mar 40.7805 3.7187 0.9705	rea m2  700 800  328.0745 742.3038  ng area fro nil,m (see Apr 40.9625 3.7308	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721  m Table 9, Table 9a) May 40.9625 3.7308	Speci: or 9 428.2894 791.8646 Th1 (C) Jun 41.4859 3.7657	gfic data Table 6b 0.6300 0.6300 406.9836 756.3136	Specific or Tab:  0 0 357.3993 713.6157  Aug 41.6524 3.7768	data Le 6c .7000 .70	factor Table (0.77) (0.77) (173.9967) (571.4415) (0ct 41.4859) (3.7657)	97.1854 523.9580 Nov 41.6524 3.7768	W 41.3943 36.6889 63.5882 512.3691 21.0000 Dec 40.9625 3.7308 0.9923 19.4188	(76) (80) (83) (84) (85)
Solar gains  Jan]  ast est  clar gains  otal gains  tilisation fa  au lpha cil living au  IT  n 2  til rest of l	78.0832 538.8790 	132.4978 589.7786 cure (heating periods sins for life Feb 40.7805 3.7187 0.9862	A:  6.0° 5.38  220.8647 661.2553  in the living area, 19 40.7805 3.7187 0.9705 19.9333 19.4091 0.9569	rea m2  700 800  328.0745 742.3038  ng area fronil,m (see Apr 4) 9625 3.7308 0.9253 20.3613	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721  mm Table 9a) May 40.9625 3.7308 0.8133 20.7419	Speci:	gfic data Table 6b  0.6300 0.6300 406.9836 756.3136  Jul 41.3153 3.7544 0.3584 20.9948	Specific or Tab: 0 0 357.3993 713.6157  Aug 41.6524 3.7768 0.4180 20.9905	data Le 6c .70000 .70000 .70000 .70000 .70000 .70000 .70000 .70000 .7	factor Table (0.77) (0.77) (173.9967) (571.4415) (173.9967) (173.9	97.1854 523.9580 Nov 41.6524 3.7768 0.9836	W 41.3943 36.6889 63.5882 512.3691 21.0000 Dec 40.9625 3.7308 0.9923 19.4188	(76) (80) (83) (84) (85) (86) (87) (88) (89)
Solar gains Jan]  ast est  olar gains otal gains  . Mean inter  emperature ditilisation for au lipha til living an  IT h 2 til rest of h  IT 2 iving area for	78.0832 538.8790 mal temperal uring heating actor for gr Jan 40.4057 3.6937 rea 0.9909 19.4273 19.3971 house 0.9871 17.4331	132.4978 589.7786 Ture (heating periods ains for li Feb 40.7805 3.7187 0.9862 19.5934 19.4091 0.9802	A:  6.0° 5.38  220.8647 661.2553  in the living area, 19 40.7805 3.7187 0.9705 19.9333 19.4091 0.9569	rea m2  700 800  328.0745 742.3038  ng area fro nil,m (see Apr 40.9625 3.7308  0.9253 20.3613 19.4148 0.8879	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721  mm Table 9a, Table 9a) May 40.9625 3.7308 0.8133 20.7419 19.4148 0.7158	Speci:	gfic data Table 6b  0.6300 0.6300 406.9836 756.3136  Jul 41.3153 3.7544 0.3584 20.9948 19.4259 0.1346	Specific or Tab:  0 0  357.3993 713.6157  Aug 41.6524 3.7768 0.4180 20.9905 19.4363 0.1887	data le 6c .7000 .7000 .7000 .7000 .706.5837 .647.6831 .7876 .7583 .20.8600 .19.4412 .0.6071 .19.3736	factor Table (0.77) (0.77) (173.9967) (571.4415) (173.9967) (173.9	Nov 41.6524 3.7768 0.9836 19.8729 19.4363 0.9752 18.1046	41.3943 36.6889 63.5882 512.3691 21.0000 Dec 40.9625 3.7308 0.9923 19.4188 19.4148 0.9890	(76) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91)
Solar gains  Jan]  ast est  Olar gains otal gains  Mean inter  emperature ditilisation for all gains  IT had been for all gains  IT 2  iving area for IT  IT 2  iving area for IT  uning	78.0832 538.8790 	132.4978 589.7786 ture (heating periods ains for life Feb 40.7805 3.7187 0.9862 19.5934 19.4091 0.9802 17.6807	A:  6.0° 5.38  220.8647 661.2553  in the living area, 1 Mar 40.7805 3.7187 0.9705 19.9333 19.4091 0.9569 18.1681	rea m2  700 800  328.0745 742.3038  ng area fro nil,m (see Apr 4).9625 3.7308 0.9253 20.3613 19.4148 0.8879 18.7626	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721  mm Table 9a) May 40.9625 3.7308 0.8133 20.7419 19.4148 0.7158 19.2277	Speci:	gfic data Table 6b  0.6300 0.6300 406.9836 756.3136  Jul 41.3153 3.7544 0.3584 20.9948 19.4259 0.1346 19.4258	Specific or Tab:  0 0 357.3993 713.6157  Aug 41.6524 3.7768 0.4180 20.9905 19.4363 0.1887 19.4359	data Le 6c .7000 .7000 .7000 276.5837 647.6831 Sep 41.8147 3.7876 0.7583 20.8600 19.4412 0.6071 19.3736 fLA =	factor Table (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	Nov 41.6524 3.7768 0.9836 19.8729 19.4363 0.9752 18.1046 a / (4) =	41.3943 36.6889 63.5882 512.3691 21.0000 Dec 40.9625 3.7308 0.9923 19.4188 19.4148 0.9890 17.4319 0.4720	(76) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Solar gains Jan]  ast est  olar gains otal gains  tillisation fa  au lpha til living au liti rest of l  IIT 2 iving area fi IIT emperature a djusted MIT  Space heat:	78.0832 538.8790 all temperal actor for gr Jan 40.4057 3.6937 rea 0.9909 19.4273 19.3971 nouse 0.9871 17.4331 raction 18.3743 dijustment 18.3743	132.4978 589.7786  Ture (heating periods ains for lifeb 40.7805 3.7187 0.9862 19.5934 19.4091 0.9802 17.6807 18.5834	A:  6.0° 5.38  220.8647 661.2553  ing season) in the living area, 19 40.7805 3.7187 0.9705 19.9333 19.4091 0.9569 18.1681 19.0012	rea m2  700 800  328.0745 742.3038  ng area fro ni1,m (see Apr 40.9625 3.7308  0.9253 20.3613 19.4148  0.8879 18.7626 19.5172	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721  mm Table 9a, May 40.9625 3.7308 0.8133 20.7419 19.4148 0.7158 19.2277 19.9424	Speci:	Jul 41.3153 3.7544 0.3584 20.9948 19.4259 0.1346 20.1663 20.1663	Specific or Tab:  0 0  357.3993 713.6157  Aug 41.6524 3.7768 0.4180 20.9905 19.4363 0.1887 19.4359 20.1696	data le 6c .7000 .7000 .7000 .7000  276.5837 647.6831  Sep 41.8147 3.7876 0.7583 20.8600 19.4412 0.6071 19.3736 £LA = 20.0751	Oct 41.4859 3.7657 0.9418 20.4134 19.4311 0.9035 18.8598 Living area 19.5930	Nov 41.6524 3.7768 0.9836 19.8729 19.4363 0.9752 18.1046 a / (4) = 18.9392	41.3943 36.6889 63.5882 512.3691 21.0000 Dec 40.9625 3.7308 0.9923 19.4188 19.4148 0.9890 17.4319 0.4720 18.3697 0.0000	(76) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Jan]  Jan  Jan	78.0832 538.8790  mal temperal action for gradient for gr	132.4978 589.7786  Ture (heating periods ains for lifeb 40.7805 3.7187 0.9862 19.5934 19.4091 0.9802 17.6807 18.5834	A:  6.0° 5.38  220.8647 661.2553  Ing season) in the liviniving area, 1 40.7805 3.7187 0.9705 19.9333 19.4091 0.9569 18.1681 19.0012 19.0012  Mar 0.9522 629.6497	rea m2  700 800  328.0745 742.3038  ng area fro ni1,m (see Apr 40.9625 3.7308  0.9253 20.3613 19.4148  0.8879 18.7626 19.5172	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721  mm Table 9a, May 40.9625 3.7308 0.8133 20.7419 19.4148 0.7158 19.2277 19.9424	Specii or ' 428.2894 791.8646  Th1 (C) Jun 41.4859 3.7657 0.5785 20.9543 19.4311 0.3974 19.4187 20.1435 20.1435	Jul 41.3153 3.7544 0.3584 20.9948 19.4259 0.1346 20.1663 20.1663	Specific or Tab:  0 0  357.3993 713.6157  Aug 41.6524 3.7768 0.4180 20.9905 19.4363 0.1887 19.4359 20.1696	data le 6c .7000 .7000 .7000 .7000  276.5837 647.6831  Sep 41.8147 3.7876 0.7583 20.8600 19.4412 0.6071 19.3736 £LA = 20.0751	Oct 41.4859 3.7657 0.9418 20.4134 19.4311 0.9035 18.8598 Living area 19.5930	Nov 41.6524 3.7768 0.9836 19.8729 19.4363 0.9752 18.1046 a / (4) = 18.9392	41.3943 36.6889 63.5882 512.3691 21.0000 Dec 40.9625 3.7308 0.9923 19.4188 19.4148 0.9890 17.4319 0.4720 18.3697 0.0000	(76) (80) (83) (84) (85) (86) (87) (88) (90) (91) (92) (93)
Cast lest Colar gains Colar ga	78.0832 538.8790  al temperal actor for gr Jan 40.4057 3.6937 rea 0.9909  19.4273 19.3971 nouse 0.9871 17.4331 raction 18.3743 djustment 18.3743  ing requirer Jan 0.9835 530.0110 5.5000	132.4978 589.7786  Ture (heating periods ains for lifeb 40.7805 3.7187 0.9862 19.5934 19.4091 0.9802 17.6807 18.5834 18.5834 18.5834	A:  6.0° 5.38  220.8647 661.2553  ing season) in the livir living area, 1 Mar 40.7805 3.7187 0.9705 19.9333 19.4091 0.9569 18.1681 19.0012 19.0012  Mar 0.9522 629.6497 7.9000 1237.1980	rea m2 700 800 328.0745 742.3038 328.0745 742.3038 0.9253 20.3613 19.4148 0.8879 18.7626 19.5172 19.5172 Apr 0.8909 661.2982 10.4000	Solar flux Table 6a W/m2 22.3142 22.3142 392.4398 780.0721  mm Table 9a, Table 9a) May 40.9625 3.7308 0.8133 20.7419 19.4148 0.7158 19.2277 19.9424 19.9424	Speci:	Jul 40.6384 20.1663 20.1663 20.1663 Jul 0.2415 182.6218	Specific or Tab:  0 0  357.3993 713.6157  Aug 41.6524 3.7768 0.4180 20.9905 19.4363 0.1887 19.4359 20.1696 20.1696	data Le 6c .7000 .	factor Table (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	Nov 41.6524 3.7768 0.9836 19.8729 19.4363 0.9752 18.1046 a / (4) = 18.9392 18.9392	W 41.3943 36.6889 63.5882 512.3691 21.0000 Dec 40.9625 3.7308 0.9923 19.4188 19.4148 0.9890 17.4319 0.4720 18.3697 Dec 0.9859 505.1363 5.5000	(85) (86) (87) (88) (89) (90) (91) (92) (93)



CALCULAT	TION OF I	EPC COST	S, EMISS	IONS ANI	O PRIMA	RY ENERO	SY 09	Jan 2014	ļ				
Space heating Space heating		548.1372	452.0159	252.1942	94.8563	0.0000	0.0000	0.0000	0.0000	232.5886	461.5329	686.5480 3410.9403 57.7832	(98)
8c. Space coo	ling requir	ement											
Not applicable													
9a. Energy re	quirements	- Individua	l heating sy	stems, incl	uding micro	o-CHP							
Fraction of sp Fraction of sp Efficiency of Efficiency of Space heating	pace heat f pace heat f main space secondary/	rom seconda: rom main sys heating sys supplementa:	ry/supplemer stem(s) stem 1 (in 9	ntary system								0.0000 1.0000 100.0000 0.0000 3410.9403	(202) (206) (208)
Space heating	Jan reguiremen	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	683.0671	548.1372		252.1942 L)	94.8563	0.0000	0.0000	0.0000	0.0000	232.5886	461.5329	686.5480	(98)
Space heating	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Water heating	683.0671	548.1372		252.1942	94.8563	0.0000	0.0000	0.0000	0.0000	232.5886	461.5329	686.5480	(211)
Water heating	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	requiremen 151.3975	132.9828	138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	(64)
Efficiency of (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	
Fuel for wate	151.3975		138.5787	122.7253	119.1794	104.9288	99.2868	110.9972	111.4431	127.3326	136.5289	147.2484	
Water heating Annual totals Space heating Space heating	kWh/year fuel - mai											1502.6295 3410.9403 0.0000	(211)
Electricity for Total electricity for Total deliver	city for th or lighting	e above, kWl (calculated		ix L)								0.0000 271.2651 5184.8349	(232)
10a. Fuel cos  Space heating Space heating Water heating	ts - using - main sys - secondar (other fue	BEDF prices tem 1 Y 1)	(467)					Fuel kWh/year 3410.9403 0.0000 1502.6295		Fuel price p/kWh 18.7000 0.0000 18.7000		Fuel cost f/year 637.8458 0.0000 280.9917	(240) (242) (247)
Pumps and fan Energy for li Additional st Total energy	ghting anding char cost	ges						0.0000 271.2651		0.0000 18.7000		0.0000 50.7266 0.0000 969.5641	(250) (251)
12a. Carbon d				ing systems	including								
Space heating Space heating Water heating Space and wat	- secondar (other fue	У						Energy kWh/year 3410.9403 0.0000 1502.6295		ion factor kg CO2/kWh 0.5190 0.0000 0.5190		Emissions 19 CO2/year 1770.2780 0.0000 779.8647 2550.1427	(261) (263) (264)
Pumps and fan. Energy for li Total kg/year	ghting							0.0000 271.2651		0.0000 0.5190		0.0000 140.7866 2690.9293	(268)
13a. Primary	energy - In	dividual hea	ating system	ns including	micro-CHP								
Space heating Space heating Water heating	- secondar (other fue	У										kWh/year 10471.5866 0.0000 4613.0727	(261) (263) (264)
Space and wat Pumps and fan Energy for li Primary energy Primary energy	s ghting y kWh/year	ar						0.0000 271.2651		0.0000 3.0700		15084.6593 0.0000 832.7838 15917.4431 269.6501	(267) (268) (272)
SAP 2012 EPC	IMPROVEMENT	S											



## CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: Current environmental impact rating:			E 53 D 58
(For testing purposes): A B			Not considered Not considered
C D E Low energy lighting F G H I J			Not considered Not considered Already installed Not considered Not considered Not considered Not considered Not considered
K M N Solar water heating O P R S			Not considered Not considered Not applicable Not considered Not considered Not considered Not considered
T U Solar photovoltaic panels A2 A3 T2 W X Y J2 Q2 Z1 Z3 Z4 Z5 V2 Wind turbine			Not considered Not applicable Not considered
L2 Q3 O3			Not considered Not considered Not considered
Recommended measures: (none)	SAP change	Cost change	CO2 change
Recommended measures	Typical an	nual savings	Energy Environmental efficiency impact
Total Savi	ngs £0	0.00 kg/s	n²
Potential energy efficiency rating: Potential environmental impact rating	:		E 53 D 58
Fuel prices for cost data on this pag Recommendation texts revision number	e from database 4.9c (22 Feb 20	revision numbe:	r 467 TEST (29 Oct 2020)
Typical heating and lighting costs of	Current	Potential	Saving
Electricity	£970	£970 £	)
Space heating Water heating Lighting	£638 £281 £51	£638 £1 £281 £1 £51 £1	0
Total cost of fuels Total cost of uses Delivered energy Carbon dioxide emissions CO2 emissions per m <sup>2</sup> Primary energy	£970 £970 88 kWh/m <sup>2</sup> 2.7 tonnes 46 kg/m <sup>2</sup> 270 kWh/m <sup>2</sup>	£970 £970 88 kWh/m <sup>2</sup> 2.7 tonnes 46 kg/m <sup>2</sup> 270 kWh/m <sup>2</sup>	£0 £0 0 kWh/m <sup>2</sup> 0.0 tonnes 0 kg/m <sup>2</sup> 0 kWh/m <sup>2</sup>



# **FULL SAP CALCULATION PRINTOUT Calculation Type: Conversion (As Designed)**

## CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR Conversion (As Designed) (Version 9.92, January 2014) CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014	
No improvements selected / applicable	



## **FULL SAP CALCULATION PRINTOUT Calculation Type: Conversion (As Designed)**

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR Conversion (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable



## **SUMMARY FOR INPUT DATA**Calculation Type: Conversion (As Designed)

016861 **Issued on Date** 30/11/2020 **Property Reference** 001 Prop Type Ref Assessment Reference Flat 1:01, 9-10 George Street, Richmond, London, TW9 1JY **Property SAP Rating** 53 E **DER** N/A **TER** N/A **Environmental** 58 D % DER<TER N/A TFEE CO<sub>2</sub> Emissions (t/year) 2.69 **DFEE** N/A N/A **General Requirements Compliance** N/A % DFEE<TFEE N/A Assessor ID **Assessor Details** Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, 7869-0001 mcarter@energycalculations.co.uk Client **Carlford Properties SUMMARY FOR INPUT DATA FOR: Conversion (As Designed)** West Orientation **Property Tenure** Unknown New dwelling **Transaction Type Terrain Type** Urban 1.0 Property Type Flat, Mid-Terrace 2.0 Number of Storeys 2020 3.0 Date Built 4.0 Sheltered Sides 5.0 Sunlight/Shade Average or unknown 6.0 Measurements **Heat Loss Perimeter Internal Floor Area Average Storey Height Ground Floor:** 47.00 m<sup>2</sup> 20.35 m 2.55 m 1st Storey: 11.10 m 12.03 m<sup>2</sup> 2.33 m 7.0 Living Area 27.86  $m^2$ 8.0 Thermal Mass Parameter Precise calculation Thermal Mass 277.17 kJ/m<sup>2</sup>K 9.0 External Walls Description Construction **U-Value Gross Area Nett Area** Type Kappa  $(W/m^2K)$  $(kJ/m^2K)$ (m<sup>2</sup>)(m<sup>2</sup>) Existing wall Solid Wall Solid wall: dense plaster, 200 mm dense block, 0.30 190.00 31.77 20.32 insulated externally Dwarf Wall Timber Frame Timber framed wall (one layer of plasterboard) 0.28 9.00 10.87 10.87 Wall to Void Timber Frame Timber framed wall (one layer of plasterboard) 0.28 9.00 15.20 15.20 Wall to hall Solid Wall Solid wall: dense plaster, 200 mm dense block, 0.30 190.00 20.12 18.26 insulated externally 9.1 Party Walls Description Construction **U-Value** Type Kappa Area  $(W/m^2K)$ (kJ/m<sup>2</sup>K) (m<sup>2</sup>)Party Wall 1 Solid Wall Dense plaster both sides, dense blocks, cavity or cavity fill 0.00 180.00 36.75 9.2 Internal Walls Description Construction Kappa Area (kJ/m<sup>2</sup>K) (m<sup>2</sup>)Internal Wall 1 Plasterboard on timber frame 9.00 40.85



10.0 External Roofs

# SUMMARY FOR INPUT DATA Calculation Type: Conversion (As Designed)

Description	Туре		Construction				U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Are
Roof Slope	Exterr	nal Slope Roof	Plasterboard, insula	ted slope			0.18	9.00	4.66	4.66
Roof plane	Exterr	nal Plane Roof	Plasterboard, insula	ted at ceilin	g level		0.16	9.00	4.30	4.30
Roof Void		nal Plane Roof	Plasterboard, insula				0.16	9.00	33.92	33.92
Flat roof	Exterr	nal Flat Roof	Plasterboard, insula	ted flat roo	f 		0.18	9.00	6.12	6.12
LO.2 Internal Ceilings Description		Construction							Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1		Plasterboard c	eiling, carpeted chipb	oard floor					9.00	12.03
1.0 Heat Loss Floor	s									
Description	Туре		Construction					U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Expos Timbe	ed Floor - er	Timber exposed floo	or, insulatio	n between jo	oists		0.25	20.00	47.00
11.2 Internal Floors Description		Construction							Карра	Area
									(kJ/m²K)	(m²)
Internal Floor 1		Plasterboard c	eiling, carpeted chipb	oard floor					18.00	12.03
12.0 Opening Types Description	Data Source		Glazing		Glazing Gap	Argon Filled	G-value	e Frame Type	Frame Factor	U Value (W/m²k
Door to Hall Windows	SAP table Manufacture r	Door to Corr	idor Double Low-I	E Soft 0.05			0.63		0.70	1.40
13.0 Openings										
Name O	pening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang		leight Cou (m)	unt Area (m²)	Curtain Closed
Door to Hall D	oor to Corridor	[4] Wall to hall	West				. ,	. ,	1.86	
		[1] Existing wa		None	0.00				5.38	
Rear Windows W	Vindow	[1] Existing wa	II East	None	0.00				6.07	
4.0 Conservatory		None								
.5.0 Draught Proofir	ng	100				%				
16.0 Draught Lobby		Yes								
7.0 Thermal Bridgir	ng	Default	t							
Y-value		0.150				W/m²K				
18.0 Pressure Testing	g	No								
19.0 Mechanical Ver	ntilation									
Summer Overhe	ating									
Windows ope	en in hot weathe	r Wii	ndows fully open							
Cross ventila	tion possible	Yes	5							
Night Ventila	tion	No								
Air change ra	ite	8.0	0							
Mechanical Vent	tilation					_				
Mechanical Ve	ntilation System Pr	resent No								
20.0 Fans, Open Fire	places, Flues									
			HS SHS	(	Other	Total				
Number of Chimi	neys	(	0		0	0				
Number of consis	*Io.c		1.1		(1)	0				



Number of open flues

0

0

# SUMMARY FOR INPUT DATA Calculation Type: Conversion (As Designed)

Number of Intermittent fans Number of passive vents Number of flueless gas fires		2 0 0
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	] %
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	SAP table	
Percentage of Heat	100	] %
Main Heating	REA	
SAP Code	691	
Efficiency (SAP Table)	100.0	] %
Controls	CRC Programmer and appliance thermostats	
Sap Code	2603	
25.0 Main Heating 2	None	
Community Heating	None	1
28.0 Water Heating	HEI Immersion	]
		I .

Lord Water Heating	TIETHIHICISION	l
Water Heating	Independent	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	903	
Immersion Heater	Dual	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder In Heated Space	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	90.00	] L
Loss	1.07	kWh/day

#### Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None



## Appendix 3

Water Calculation – Flat 2.01

## Part G Compliance Report

## PROJECT DETAILS

Project Reference:

Client:

Property: Flay 2:01

Water Lane

Thurnham ME14 3LU

Local Authority:

Agent:

Assessor: Energy Calculations Limited
Address: 7 Marine Avenue, Skegness

Contact: 01754 -761035

Software: G-Calc 2015 version 3.0.2

Prepared on: 02-Dec-20

## **RESULT SUMMARY**

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 1 bed dwelling, as designed, achieves a water consumption of 109.9 litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Wa	ater Calculator	for New	Dwellings	6	
Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)		4.42	0.00	0
WC(dual flush)	Full flush vol.	4	1.46	0.00	5.84
	Part flush vol.	2.6	2.96	0.00	7.7
WC(multiple fittings)	Average effective Flush vol. (litres)	0	4.42	0.00	0
Taps(excl. Kitchen)	Flow rate (litres/min)	5	1.58	1.58	9.48
Bath (shower also present)	Capacity to overflow (litres)	170	0.11	0.00	18.7
Shower (bath also present)	Flow rate (litres/min)	9	4.37	0.00	39.33
Bath only Shower only	Capacity to overflow (litres) Flow rate		0.50	0.00	0
Kitchen sink taps	(litres/minute) Flow rate		5.6	0.00	0
Washing Machine	(litres/minute)	5	0.44	10.36	12.56
Dishwasher	dry load litres/place	8.17	2.1	0.0	17.16
	setting	1.25	3.6	0.0	4.5
Waste disposal Water softener	litres/use litres/person/day	0	3.08	0.0	0
water sortener	iides/person/day	0 Total calc	1.0 ulated use	0.0	0
		(litres/per		wator	115.27
		(litres/per			-
		(litres/per		watei	-
			ition factor er Consumpt	ion Codo	0.91
			nable Homes		104.9
		External v	vater use		5.0
		Total Wat (litres/per	er Consumpt son/day)	ion. (36(1))	109.9

Summary of fitting types "As Designed"											
Type	Description	Flow rates, volumes etc.	Qty								
Taps	Taps	5 litres/min	1								
Baths	Bath	170 litres to overflow	1								
Dishwashers		1.25 litres/place	1								
Washing Machines		8.17 litres/kg	1								
Showers	Showers	9 litres/min	1								
WC's	WC	4 / 2.6 litres flush vols.	1								
Kitchen/Utility taps	Taps	5 litres/min	1								

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer (). The completed table should be returned to the assessor: Energy Calculations Limited (Contact: 01754 -761035).

Declaration of fitting types "As Built"				
Type	Make and Model	Flow rates, volumes etc.	Qty	
Taps				
Baths				
Dishwashers				
Washing Machines				
Showers				
WC's				
Kitchen/Utility taps				

Project ref: - Flay 2:01

The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

Name:	Signature:	Date:
	End of Report	