

ST JOHN'S WOOD ENERGY AND SUSTAINABILITY STATEMENT

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1. EXECUTIVE SUMMARY

1.1 Overview

This report has been produced by Ridge & Partners LLP on behalf of Indigo Planning to outline the initial energy and sustainability strategy for the proposed St John's Wood Park development, London.

The scheme is a new residential development comprising of 9no. apartments across 7 floor levels.

The report aims to demonstrate how the proposed strategy is in accordance with the requirements of Part L of the Building Regulations, local planning policy and the Greater London Authority (GLA) planning policy.

1.2 Key Energy Efficiency Design Measures

The method taken in developing the energy strategy for the scheme has followed a sequential approach in line with the principles outlined in the energy hierarchy - assessing in turn:

- The feasibility of the integration of passive design measures and energy efficient building services strategies;
- Determining the viability of a decentralised energy network; and
- An assessment of the feasibility of a number of Low or Zero Carbon (LZC) Technologies for application to the site.

Key energy efficient design measures are proposed for inclusion in the development as detailed below:

- U-values exceeding the minimum requirements of Part L1a of the Building Regulations;
- Air leakage rate is to be 70% lower than the maximum permissible under the Building Regulations. i.e. a target of 3.0m³/m².h at 50Pa;
- Enhanced thermal bridging details;
- Solar control glazing to mitigate overheating risk;
- Centralised continuous mechanical ventilation with heat recovery (MVHR) in each of the dwellings, in accordance with SAP Appendix Q;
- Reduction in hot water demand, in part due to higher insulation standards but also due to lower water consumption;
- Maximise daylighting and consequently passive solar heating;
- Reduce energy requirements for lighting by utilising daylighting and by incorporating fixed energy efficient lamps to 100% of luminaires throughout;
- Community heating scheme with centralised heating and cooling generation plant;
- High efficiency air source heat pumps (ASHPs);
- Energy display devices; and
- Recommendations to building users regarding energy efficient appliances and operation of systems and equipment.

Preliminary calculations undertaken for this development demonstrate that implementing these measures will significantly reduce the CO₂ emissions associated with the scheme. The carbon savings associated with each stage of the energy hierarchy are illustrated graphically in Figure 1.1.



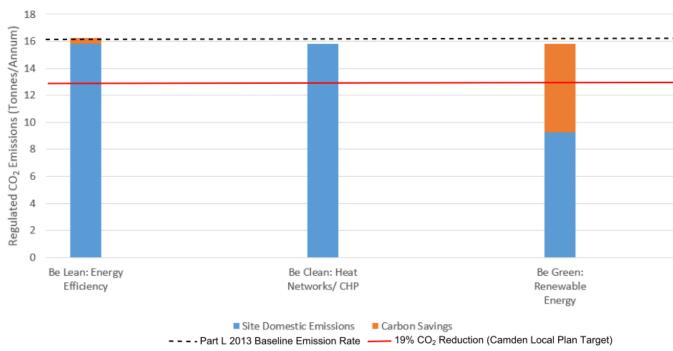


Figure 1.1 – The Energy Hierarchy

Tables 1.1 and 1.2 further illustrate the breakdown of energy savings achieved through the implementation of the energy hierarchy.

Table 1.1 – Carbon Dioxide Emissions after Each Stage of the Energy Hierarchy for Domestic Buildings

	Carbon Dioxide Emissions for Domestic Buildings (Tonnes CO ₂ per Annum)				
	Regulated Unregulated				
Baseline: Part L 2013 of the Building					
Regulations Compliant Development	16.24	18.22			
After Energy Demand Reduction	15.78	18.22			
After Heat Network/ CHP	15.78	18.22			
After Renewable Energy	9.26	18.22			

Table 1.2 – Regulated Carbon Dioxide Savings from Each Stage of the Energy Hierarchy for Domestic Buildings

	Regulated Domestic Carbon Dioxide Savings			
	(Tonnes CO ₂ per Annum) %			
Savings from Energy Demand				
Reduction	0.45	2.80		
Savings from Heat Network/ CHP	0.00	0.00		
Savings from Renewable Energy	6.52	40.14		
Cumulative on Site Savings	6.97	42.94		



The Camden Local Plan dictates that schemes will be required to demonstrate a 19% reduction in CO₂ emissions below the Part L 2013 baseline- Figure 1.1 demonstrates how this target has been met for the proposed St John's Wood Park development.

The Camden local authority also sets an additional renewable energy target applicable to the scheme– a requirement for a 20% reduction in carbon dioxide emissions to be met by on-site renewable technologies. It is shown in Table 1.2 that a 40.14% reduction is achievable via the implementation of high efficiency ASHP technology, exceeding this planning requirement.

In summary, it has been demonstrated that the application of passive design measures, provision of energy efficient servicing systems and specification of LZC energy sources would result in a significant reduction in regulated carbon dioxide emissions for the St John's Wood Park development.

1.3 Additional Sustainability Measures

The wider sustainability of the St John's Wood Park development has also been addressed in this study – including resource efficiency, waste mitigation and water efficiency.

A strategy has been developed for the St John's Wood Park scheme to maximise the efficient use of resources, both through the construction process and during future occupation. The waste hierarchy has been referenced throughout this assessment process to prioritise measures that would have the most significant resource saving impacts.

A summary of the key resource efficiency and waste mitigation proposals for the site are detailed below:

- The production of a Site Waste Management Plan (SWMP) to set good practice target waste benchmarks, set procedures for minimising, measuring, monitoring & reporting various waste streams and identifying potential for reuse to divert potential waste from landfill;
- Reduce the resource intensity of the detailed design architectural proposals where feasible and maximise end of life potential:
- Encourage the use of recycling and composting facilities. Provide guidance to future occupants via Home User Guides detailing Local Authority collection schemes, information on local recycling facilities & tips, guidance on procedures to discard potentially hazardous waste (i.e. batteries, fridges/ freezers etc.) and WRAP sustainable waste disposal principles.

A water efficiency strategy has been developed for the scheme to meet a water consumption target of 110 litres per person per day (including external water usage). The feasibility of a number of measures have been explored – including water butts, rainwater harvesting, greywater harvesting and the installation of water conservation appliances.

An analysis has been undertaken of various routes to meet the targeted performance level. A standard approach is proposed for the scheme utilising water conservation appliances such as dual flush toilets, low flow taps and baths with a low capacity to overflow. A Water Efficiency Calculator for New Dwellings tool has been utilised to demonstrate that this approach could meet the target of 110 l/p/day.



2. INTRODUCTION

2.1 Overview

This report has been compiled to set out the key sustainability and energy efficiency measures for the St John's Wood Park development, in support of the full planning application for the scheme.

In order to demonstrate that energy objectives defined by national, regional and local policies are met-energy performance analysis has been undertaken to identify the most appropriate, commercially viable strategies to meet the site low carbon targets. This report has been written in line with the guidance document published by the Greater London Authority (GLA), "Energy Planning – Greater London Authority guidance on preparing energy assessments (March 2016)" and aims to clearly outline how the energy strategy for the scheme has been developed in accordance with the energy hierarchy.

Waste, resource and water use efficiency will also be addressed in line with the requirements of the Camden Core Strategy.

2.2 Project Description

The development site is currently occupied by a row of garages and a gated access road that leads to St John's Wood Park. It is proposed to demolish the garages and redevelop the site to provide a new apartment building comprising of 9no. dwellings across 7no. floor levels, including a new basement.

The development site is shown in the Existing Site Plan drawing in Figure 2.1, below.

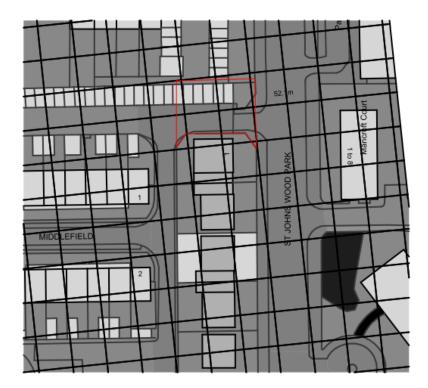




Figure 2.1 – Typical Elevation and Floorplan (Image Source: Existing Site Plans drawing by Creative Architecture)

The architectural proposals for the development are shown illustratively in Figure 2.2, below.



Figure 2.2 – 3D Visual of Proposed Development (Image Source: Maccreanor Lavington)



3. POLICY CONTEXT

3.1 Overview

The energy strategy for the St John's Wood Park scheme has been developed in accordance with the requirements set out in the London Plan and Camden Council Planning Policy.

These compliance requirements are above and beyond the performance standards outlined within the 2013 revision of Part L of the Building Regulations (Conservation of Fuel and Power).

3.2 The London Plan

The London Plan sets out the overall strategic plan for London- it integrates the economic, environmental, transport and social framework for the development of London over the next 20-25 years.

The key policies outlining London's approach to sustainable development include the following:

Policy 5.1 Climate Change Mitigation

Policy 5.2 Minimising Carbon Dioxide Emissions

Policy 5.3 Sustainable Design and Construction

Policy 5.5 Decentralised Energy Networks

Policy 5.6 Decentralised Energy in Development Proposals

Policy 5.7 Renewable Energy

Policy 5.8 Innovative Energy Technologies

Policy 5.9 Overheating and Cooling

Policy 5.2 dictates that development proposals should make the fullest contribution to minimising CO₂ emissions in accordance with the energy hierarchy:

1. Be Lean: Use Less Energy

2. Be Clean: Supply Energy Efficiently

3. Be Green: Use Renewable Energy

Additionally, this policy sets out defined targets for both 'Major' residential and non-domestic buildings. Due to the size of the St John's Wood Park scheme it is noted that it will not fall under the GLA definition of 'Major Development' - which is defined for residential schemes as development comprising 10 or more dwellings.

Policy 5.6 outlines a hierarchy for the adoption of clean energy systems, below:

- 1. Connection to existing heating or cooling networks
- 2. Site wide CHP network
- 3. Communal heating and cooling

A guidance document published by the GLA, "Energy Planning – Greater London Authority guidance on preparing energy assessments (March 2016)", defines an energy assessment process to develop energy strategies in accordance with the energy and clean energy hierarchies.

3.3 Camden Local Plan

The Camden Local Plan was adopted on the 3rd of July 2017 and has replaced the Core Strategy and Camden Development Policies documents.

Policy CC1 of the Camden Local Plan relates to the climate change mitigation measures that the council will expect to be considered for new schemes. This policy aligns with the principles of the energy hierarchy set out by the GLA. This is policy is detailed, in full, below:

Policy CC1 – Climate Change Mitigation

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

We will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met; c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;

d. support and encourage sensitive energy efficiency improvements to existing buildings;

e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and

f. expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;

h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and

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

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

Although the St John's Wood Park development is not defined as a major development, the Camden Local Plan also sets out the following energy performance targets for schemes comprising 5 or more dwellings:-

- 19% CO2 reduction below Part L; and
- 20% CO₂ reduction from on-site renewable energy generation

3.4 Camden Planning Guidance 3 (CPG 3) - Sustainability

CPG 3 has been developed by Camden Council to support the policies within the Local Development Framework and forms a Supplementary Planning Document (SPD).



3.4.1. The Energy Hierarchy

The key messages with regards to the energy hierarchy are outlined below.

KEY MESSAGES

- All developments are to be design to reduce carbon dioxide emissions
- Energy strategies are to be designed following the steps set out by the energy hierarchy

This guidance reiterates the GLA guidance detailed in Section 3.2.

3.4.2. Energy Efficiency: New Buildings

The key messages with regards to the energy efficiency are outlined below.

KEY MESSAGES

All new developments are to be designed to minimise carbon dioxide emissions

The most cost-effective ways to minimise energy demand are through good design and high levels of insulation and air tightness.

This guidance reiterates the GLA guidance on step 1 of the energy hierarchy: Be Lean.

Additionally, this section of the SPG details how passive overheating mitigation measures should be implemented in the first instance to mitigate overheating risk. Where air conditioning is to be specified, it is necessary to demonstrate that energy efficient ventilation and cooling methods have been considered first, and that they have been assessed for their carbon efficiency.

3.4.3. Decentralised Energy Networks and Combined Heat and Power

The key messages with regards to clean energy are outlined below.

KEY MESSAGES

Decentralised energy could provide 20% of Camden's heating demand by 2020.

Combined heat and power plants can reduce carbon dioxide emissions by 30-40% compared to a conventional gas boiler.

Where feasible and viable your development will be required to connect to a decentralised energy network or include CHP.

This guidance reiterates the GLA guidance on step 2 of the energy hierarchy: Be Clean.

3.4.4. Renewable Energy

The key messages with regards to renewable energy are outlined below.

KEY MESSAGES

There are a variety of renewable energy technologies that can be installed to supplement a development's energy needs

Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies.

This aim for a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies will form an additional energy performance target for this scheme.

3.4.5. Water Efficiency

The key messages with regards to water efficiency are outlined below.

KEY MESSAGES

At least 50% of water consumed in homes and workplaces does not need to be of drinkable quality re-using water

All developments are to be water efficient

Developments over 10 units or 1000sq m should include grey water recycling

Camden Council expects all developments to be designed to be water efficient by minimising water use and maximising the re-use of water.

With regards to greywater recycling, Camden Council will expect developments comprising 10 or more units to include a grey water harvesting system, unless the applicant can demonstrate that this would not be feasible.

3.4.6. Sustainable Use of Materials

The key messages with regards to sustainable materials use are outlined below.

KEY MESSAGES

Reduce waste by firstly re-using your building, where this is not possible you should implement the waste hierarchy

The waste hierarchy prioritises the reduction, re-use and recycling of materials

Source your materials responsibly and ensure they are safe to health.

The SPG outlines 5 key steps that are to be followed for resource efficiency:

- 1. Managing existing resources;
- 2. Specifying materials using the BRE's Green Guide to Specification;
- 3. Ensuring that materials are responsibly sourced;
- 4. Minimising the harmful effects of some materials on human health; and
- 5. Ensuring that specified materials are robust and sensitive to the building type and age.

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4. ENERGY DEMAND REDUCTION (BE LEAN)

4.1 Overview

Passive and energy efficiency measures were addressed in the first instance across this development in order to reduce the energy demand of the scheme and the associated carbon dioxide emissions. This section will provide an overview of the proposed lean measures for the St John's Wood Park scheme.

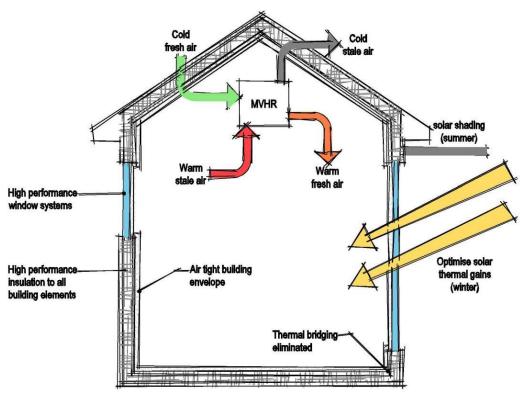


Figure 4.1 - Key Passive Design Measures to be addressed in Section 4

4.2 Sampling

In order to assess the energy performance of the residential units, a sample of representative units have been modelled using Elmhurst Design SAP 2012 (Version 4.05r02). The sample modelled includes the basement duplex apartment, 2 single level apartments from a typical mid floor level and the 2 duplex apartments that are located across floor levels 4 and 5. The sample of units is shown in the mark up included in Appendix 1. The results of these representative sample SAPs have been multiplied by the cumulative floor area for each of the respective dwelling types to inform the site wide CO_2 emission figures.

4.3 Building Fabric

Table 4.1 demonstrates the building fabric improvements that have been incorporated over Part L1a limiting standards.

Table 4.1 – Residential Building Fabric Performance Targets

ELEMENT	PERFORMANCE TARGET	PART L1A LIMITING VALUES
External Wall U Value (W/m²K)	0.16	0.3
Unheated Corridor Walls (W/m²K)	0.25*	0.3
Party Walls between Apartments (W/m²K)	0**	
Façade Glazing U Value (W/m²K)	1	2
Flat Entrance Doors U Value (W/m²K)	1	2
Ground/ Exposed Floor U Value (W/m²K)	0.13	0.25
Roof U Value (W/m²K)	0.13	0.2
Air Permeability (m³/hr.m² @ 50Pa)	3	10

^{*}This U value is prior to the application of a shelter factor afforded by the adjacent unheated space.

Additionally, Table 4.2 sets out additional solar and light transmission properties for the glazed constructions on the scheme.

Table 4.2 – Further Glazing Properties (Residential Units)

ELEMENT	SOLAR TRANSMISSION (G VALUE)	VISIBLE LIGHT TRANSMISSION (LT)
Glazing	0.45*	≥60%

^{*}This G value is proposed in all above ground level rooms – in the basement bedrooms where there will be a significant degree of shading it is proposed for a higher G value to be provided of approximately 0.6. The final glass specification properties will be confirmed at detailed design stage following a design optimisation process.

The inclusion of solar control glazing will aid in significantly reducing the solar gains into the spaces, and therefore reduce the likelihood of overheating risk/ comfort cooling system loads.

Minimising thermal bridging effects is a critical step in achieving Part L1a Target Fabric Energy Efficiency (TFEE) compliance. Therefore in addition to the properties in Table 4.1 and 4.2, enhanced thermal bridging characteristics are also proposed as detailed in Table 4.3, on the next page.

^{**}To meet this U value for the purposes of SAP calculations, it is assumed that the party walls will be solid/fully filled and sealed.



Table 4.3 – Proposed Thermal Bridging Allowances

JUNCTION TYPE	REFERENCE	PSI VALUE (W/MK)	DESCRIPTION
Other Lintels (including other steel lintels)	E2	0.3	ACD
Sill	E3	0.04	ACD
Jamb	E4	0.05	ACD
Ground Floor	E5	0.16	ACD
Intermediate Floor between Dwellings	E6	0.07	ACD
Party Floor between Dwellings	E7	0.07	ACD
Flat Roof	E14	0.08	Default
Flat Roof (with parapet)	E15	0.56	Default
Corner (normal)	E16	0.09	ACD
Corner (inverted)	E17	-0.09	ACD
Party Wall between Dwellings	E18	0.06	ACD
Basement Floor	E22	0.07	Default
Staggered Wall Between Dwellings	E25	0.12	Default
Party Wall and Roof	P4	0.24	Default

4.4 Building Services

It is proposed to incorporate 100% low energy light fittings within the dwellings. Table 4.4, below, illustrates how this exceeds the minimum requirements set in Part L1a.

Table 4.4 – Residential Lighting Performance Targets

ELEMENT	PROPOSED	PART L1A LIMITING VALUE
Internal Lighting	100% Low Energy	75%

Additionally, it is also proposed that where external light fittings are to be installed they will meet the following characteristics:

Either a)

- Lamp capacity not greater than 100 lamp-watts per light fitting, and
- All lamps automatically controlled so as to switch off after the area lit by the fitting becomes unoccupied, and

· All lamps automatically controlled so as to switch off when daylight is sufficient

Or b)

- Lamp efficacy greater than 45 lumens per circuit-watt, and
- · All lamps automatically controlled so as to switch off when daylight is sufficient, and
- Light fittings controllable manually by occupants

Energy efficient external lighting has been assumed within the sample SAP calculations completed. Confirmation of whether this is to be achieved by compliance route a or b (outlined above) will be confirmed as the design for the scheme progresses.

Mechanical ventilation with heat recovery (MVHR) systems are proposed for the dwellings. This system type supplies and extracts air- routing both air streams through a high efficiency heat exchanger where the heat can be transferred from the exhausted air to the incoming fresh air. This system type can facilitate a decrease in winter heating load in a dwelling.



Figure 4.1 - MVHR Diagram (Image Source: www.nfan.co.uk)

It is proposed to provide accessible heat and electricity metering systems to each of the dwellings. The provision of these meters will aid the occupants in better understanding their energy usage, and to assist them in making more informed decisions with regards to their energy usage.

4.5 Results

The results of the integration of these energy usage reduction measures in the domestic scheme is illustrated in Figure 1.1. An example of a full SAP calculation sheet accounting for the implementation of lean measures is also included in Appendix 2.

It should be noted that the extent of improvement over the Part L 2013 Target Emission Rate shown is limited to an extent due to the proposed inclusion of solar control glass in the scheme. The G value of glazing in the notional (target) building is set to 0.63- this exceeds the proposed G value for the non- basement spaces by approximately 28%. A higher G value facilitates greater solar gains and can therefore aid in reducing space heating loads, however, it can also increase overheating risk/ cooling loads. This has informed the selection of a lower G value for the glazing which has been offset by the other energy efficiency measures detailed within this section to still result in an improvement over the Part L 2013 Target Emission Rate through lean measures alone.



5. HEATING INFRASTRUCTURE INCLUDING CHP (BE CLEAN)

5.1 Overview

In line with the Energy Hierarchy, after energy consumption has been reduced through the implementation of passive design and energy efficiency measures, the next step is to consider the connection to a low carbon heat distribution network/ the installation of CHP.

5.2 Connection to Existing Heating or Cooling Networks

In line with the first step of the clean energy hierarchy, the feasibility of a connection to an existing heating or cooling network has been investigated. The London Heat Map has been accessed to assess the infrastructure present in the vicinity of the development site, below.

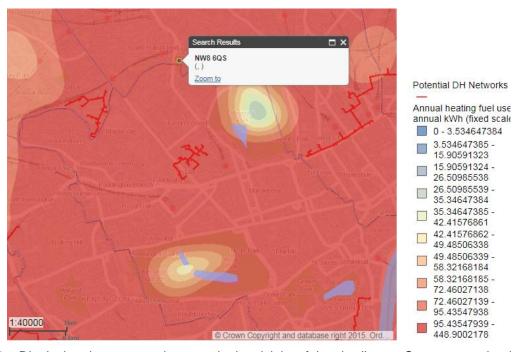


Figure 5.1 – District heating opportunity areas in the vicinity of the site (Image Source: www.london.gov.uk)

The map indicates that the development site (indicated with marker) is not in the close vicinity of an existing district heating network. It is shown, however, that it is located in a relatively high-density area of annual heating fuel usage. This means that it is possible district heating schemes may potentially be developed in the local vicinity of the development site in future. There may, therefore, be the possibility for the St John's Wood Park development to connect to a district heating scheme in the future.

5.3 Site-wide Heating Network

A community heating network is a system where more than one property is heated by a central energy centre. Heat can be supplied to the centralised system from conventional gas fired boilers, renewable fired boilers, CHP plant, ASHPs etc. The supply and demand of heat can be managed efficiently through the sharing of the heat generation plant. A community heating system can therefore provide carbon reduction benefits compared to conventional solutions for the provision of domestic hot water and space heating. A centralised energy centre may also contain centralised cooling plant, should there be a demand for this.

There are also economic benefits associated with the installation of a community heating scheme. A shared plant installation is likely to be less expensive than the combined cost of individual plant installations serving separate buildings.

This form of centralised space conditioning plant configuration has been identified as suitable for the St John's Wood Park development.

5.4 Site-wide CHP Heating Network

A CHP engine generates electricity and heat in a single process from a single fuel (typically natural gas). This cogeneration process facilitates greater fuel efficiencies being achieved and reduces transmission losses. This is illustrated in Figure 5.2, below.

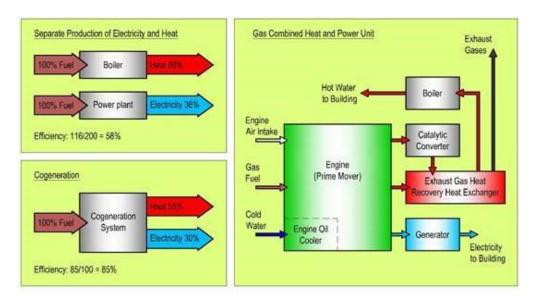


Figure 5.2 – CHP Indicative Schematic

The CHP plant, fuelled by natural gas, is defined as a low carbon technology, with a direct benefit in the better utilisation of fossil fuels for the production of electrical energy.

Design and sizing of CHP installations is usually driven by the presence of a heating base load; selection based on an electrical base load is likely to result in large quantities of heat being dumped due to there being no use for it. The adoption of combined heat and power requires a significant investment, so it is essential that CHP plant is not sat idle – providing no benefits. CHP units are often selected so that they are operating for 17 hours per day, 11 months a year and therefore it is critical that the plant is operating at maximum efficiency, utilising all the heat available.

As most small scale units produce low temperature hot water, i.e. 80°C, they are ideal for integration into 'standard' building heating systems. In such a configuration, it is important that the CHP unit is run as the lead boiler to maximise its running hours. Balancing of water flows through the boilers and CHP unit must be carefully addressed, as the latter has a considerably higher hydraulic resistance compared to standard plant.

Due to the residential nature of this development, there will be a consistent thermal baseload. However, due to the size of the scheme - 9 dwellings - it is not proposed to install this form of technology due to financial viability and the availability of more appropriate forms of renewable technology for a scheme of this size.



6. RENEWABLE ENERGY (BE GREEN)

In line with the Energy Hierarchy, after the feasibility of lean and clean measures have been assessed, the next step is to consider the application of renewable technologies to the scheme. Renewable technologies convert natural resources such as wind, sunlight, tides and geothermal energy into useable energy. These sources of energy are naturally replenished and are therefore considered sustainable.

The renewable technologies listed below have been assessed for their applicability to this development:

- Wave Power
- Tidal Power
- Small Scale Hydropower
- Wind Power
- Air Source Heat Pumps (ASHP's)
- Ground Source Heat Pumps (GSHP's)
- Anaerobic Digestion
- Biomass boilers
- Photovoltaics
- Solar hot water (solar thermal)

A series of assessments have been undertaken to assess the viability of the above technologies from an initial feasibility assessment through to final selection.

6.1 Preliminary Assessment

To aid final renewable technology selection, a number of technologies have been disregarded at a preliminary stage due to technical and practical issues applying them to the St John's Wood Park development. Table 6.1 shows why a number of renewable technologies have been disregarded in the preliminary assessment.



Table 6.1– Preliminary Assessment of Renewable Technologies

	INCIDENT SOLAR ENERGY	COASTAL LOCATION	RIVER/ STREAM ACCESS	WIND ACCESS	ACCESS TO SOLAR WARMED AIR	WARMED	ACCESS TO WASTE ORGANIC MATERIALS	THERMAL LOAD	LIMITED NOISE/ AESTHETIC IMPLICATIONS?	DEPENDENCY ON BIOMASS FUEL SOURCES ACCEPTABLE?	NOTES
Wave Power		×									-Not a coastal location
Tidal Power		×									-Not a coastal location
Small Scale Hydropower			×								-No suitable river/ stream on site
Wind Power				×					*		-RenSMART wind map indicates that a wind speed of 4.9m/s is likely at a height of 10 metres. This is less than the recommended 5m/s for viability. At 45m the wind map indicates that a wind speed of 6.2m/s is likely, however, this will still present aesthetic and noise implications.
Ground Source Heat Pump						×					-Very limited site area
Air Source Heat Pump					✓						-Available access to warmed air -To be considered further
Anaerobic Digestion							*				-Unlikely that organic waste streams will be generated on site in the quantities required for this form of heat generation plant.
Biomass Boilers										*	-Not considered further due potential issues with access to fuels and deliveries
Photovoltaics	✓										-Roof area availableTo be considered further
Solar Thermal	√							√			-Roof area availableTo be considered further



6.2 Secondary Assessment

A secondary renewable assessment was then completed to further investigate the remaining technologies. The remaining and most suitable renewable technologies for the St John's Wood Park development, are:

- Air Source Heat Pumps
- Photovoltaics
- Solar Thermal

6.2.1. Air Source Heat Pumps (ASHP)

Heat pumps use electrical energy to transfer thermal energy from a heat store to a heat sink. ASHPs extract/ reject heat from the air. Typically one unit of electricity will produce >3 units of useful heat – so although this technology is not a fully renewable technology, it can still facilitate carbon savings. An air source heat pump has much smaller space requirements than a ground source heat pump and has lower associated installation costs. The units tend to be located externally, and therefore consideration needs to be given to their placement as they may pose a noise issue when operational.

The heating distribution system for ASHP applications is generally underfloor heating or a convector designed for low temperatures.

The application of ASHPs lends itself to a scheme where cooling is required in addition to heating- as they can provide both heating and cooling. An example of a high efficiency heat pump is shown in Figure 6.1, below. These units can achieve whole system cooling seasonal energy efficiency ratio (SEER) in the range of 7.16-9.02 and complete system heating seasonal coefficient of performance (SCOP) in the range of 4.79-6.41. Reference data has been included in Appendix 3.



Figure 6.1 – Example Heat Pump Unit- Mitsubishi Electric Y Series High COP PUHY (Source: SWAT Engineering)

These units are considered an appropriate form of technology for this scheme due to the high SEER/ SCOP figures achievable, availability of roof space and their ability to meet both heating and cooling demand.

6.2.2. Photovoltaic Panels

Photovoltaics are semiconductor devices that convert sunlight into direct current (DC) electricity. Groups of panels can be electrically configured into arrays which can be used to power a building's electrical load.

A number of photovoltaic systems including monocrystalline, polycrystalline and thin film are available, generally made up into arrays using multiple panels or roof slate "substitutes". Photovoltaic panels can also replace vertical cladding systems.

The orientation and mounting angles of the panels are critical in order to maximise their output. Additionally, overshadowing should always be considered when assessing the feasibility of PV installations as this can significantly reduce the output of the panels.

The St John's Wood Park development does not have a significant area of roof available due to the size of the footprint of the building and the stepped back nature of the uppermost floor. It is also proposed for the ASHPs to be located at roof level. This would limit the size of the array feasible for the scheme.

A solar photovoltaic array has therefore not been proposed as an additional form of low or zero carbon technology on this scheme.

6.2.3. Solar Thermal

Solar thermal technology captures the sun's energy through solar collectors in order to generate hot water. This technology could be adopted to contribute to the domestic hot water loads on the scheme. This technology would require an area of roof to house the solar thermal array. Experience on previous schemes has demonstrated that significant carbon emission savings cannot be demonstrated through the implementation of this form of technology, relative to the impact that can be demonstrated with other forms of LZC technology.

The thermal loads of the development are also already going to be met by the proposed renewable ASHP installation.

A solar thermal array has therefore not been proposed as an additional form of low or zero carbon technology on this scheme.

6.2.4. Proposed Green Technology

It is proposed to utilise high efficiency ASHP technology for the St John's Wood Park residential development.

In line with the guidance set out by the GLA, the Target Emission Rate (TER) that is being used as the baseline Part L compliant emission rate has been generated based on the heating being provided by gas fired boilers. On this basis, it is indicated in Table 1.2 that an approximately 40.14% carbon emission reduction is achievable via the implementation of green technology on the St John's Wood Park scheme.



7. OVERHEATING

7.1 Overview

With the improving thermal efficiency of building envelopes and air tightness, the risk of overheating in the UK has increased. The Cooling Hierarchy has been used to guide the overheating mitigation strategy for the St John's Wood Park development. The design has taken into consideration a passive and active approach to the site and building layout through strategies that mitigate overheating risk and minimise CO₂ emissions associated with comfort cooling systems.

The Cooling Hierarchy is outlined below:

- 1 Minimise internal heat generation through energy efficient design
- 2 Reduce the amount of heat entering a building through orientation, shading, albedo, fenestration, insulation and green roofs and walls
- 3 Manage the heat within the building through exposed internal thermal mass and high ceilings
- 4 Passive ventilation
- 5 Mechanical ventilation
- 6 Active cooling systems (ensuring they are the lowest carbon options)

This section of the report will outline the measures that have been incorporated at each stage of the hierarchy.

7.2 Minimise Internal Heat Generation

The following energy efficient design measures have been incorporated into the scheme design in order to reduce the generation of heat within dwellings:

- 1. Minimising LTHW Distribution Pipework Losses. It is proposed to fully insulate LTHW distribution pipework to ECA standards to reduce the associated heat losses into the apartment ceiling voids.
- 2. Energy Efficient Light Fittings. It is proposed to include LED light fittings throughout the apartments- this will aid in reducing the internal heat gains associated with the operational heat losses of less efficient fittings.
- 3. A/ A+ white goods are proposed to be supplied to the apartments in the fit-out installation. This will aid in reducing the heat emitted into the living areas from the kitchen appliances.

7.3 Reduce the Heat Entering the Building

The following design measures have been incorporated into the scheme in order to reduce the amount of heat entering the dwellings:

- 1. Appropriate Proportion of Façade Glazing to Occupied Spaces. This will aid in preventing excessive solar gains to the occupied spaces.
- 2. Energy Efficient Façade Construction Materials. The properties of the proposed materials are detailed further within Section 4.3.
- 3. Minimal South Facing Glazing. This will aim to reduce excessive solar gains via south facing windows.
- 4. Specification of Solar Control Glass. Solar control glazing is proposed for the apartments to further limit excessive solar gains to the apartments. A G value of 0.45 is proposed for the majority of the glazing systems.

7.4 Manage the Heat within the Building

One form of managing heat within a building can be the incorporation of high thermal mass. Materials with a high thermal mass have the ability to absorb and store thermal energy during the day – facilitating a resistance to sharp temperature rises.

A medium weight construction type is proposed for the external walls on the scheme and it is proposed that floorslabs will be concrete - this will add a degree of thermal mass to each of the dwellings.

The interior finishes have been selected to be easy to maintain, meet the acoustic requirements of Part E and meet the fire safety requirements of Part B. Due to the residential nature of the development, there is also a requirement for the services being run at high level -such as pipework and ductwork - to be concealed. This therefore limits the feasibility of the adoption of an exposed thermal mass at ceiling level within the apartments.

In conclusion, thermal mass has been incorporated within the St John's Wood Park development where feasible. It is envisaged that the overall thermal mass parameter will be medium (i.e. circa 250KJ/m²K).

7.5 Passive Ventilation

All occupied spaces are to have openable windows to facilitate natural ventilation with no associated regulated energy use. These windows can be opened to dissipate internal heat gains in the warmer months of the year. Many of the proposed windows are to be sash windows or doors, which will afford a significant free opening area.

This element of ventilation will be completely within the control of the future occupants of the scheme so they will be able to operate these openings to suit their thermal comfort requirements.

7.6 Mechanical Ventilation

MVHR units are proposed for all dwellings to provide background ventilation, whilst minimising winter heat losses. The proposed MVHR systems consist of a fresh air intake and extract discharge from/to the façade of the building, supplying fresh air to all habitable rooms and extract from 'wet areas' such as bathroom, kitchens and utility cupboards. The heat exchanger in the unit can recover high percentages of heat using it to increase the temperature of incoming fresh air in the winter months. During winter months the quantity of fresh air provided is calculated to balance minimum extract volumes from each space and the apartment overall, typically achieving around 0.75 air changes per hour (ACH). The MVHR system is sized to provide the correct quantity of fresh air and extract without the need to open windows in the winter.

The MVHR heat exchanger has a summertime by-pass to avoid heating incoming summer fresh air further with hot air being extracted. During a large part of the summer months and nearly always at night, the outside air temperature in the UK would provide beneficial 'free-cooling' to the space.

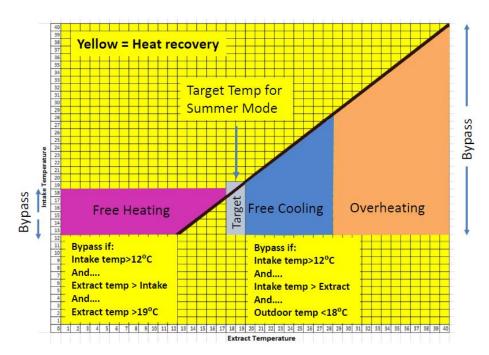


Figure 7.1 – Summertime Free-Cooling Opportunity (Image Source: Nuaire)

7.7 Active Cooling Systems

In the first instance, overheating risk has been mitigated through the adoption of passive measures outlined in the Cooling Hierarchy.

Comfort cooling systems are proposed in the primary occupied spaces within the development. These cooling loads will be served by high efficiency heat pumps to reduce the associated emissions.

An overheating study will be developed at detailed design stage to determine if comfort cooling systems are required in the remaining occupied spaces to demonstrate that the thermal comfort criteria outlined in TM59: 2017 will be met.



8. WATER EFFICIENCY

8.1 Overview

The World Economic Forum's Global Risks 2014 report listed water security as one of the top three global risks, with water supplies in Southern England coming under increasing pressure due to population growth and urbanisation. Thames Water have anticipated the number of households in their catchment area will increase by 200,000 and the population will grow by 800,000 over the next 10 years. Therefore, the importance of reducing water consumption is becoming an increasingly critical priority.

8.2 Maximising Re-use of Water

8.2.1. Water Butts

Camden Council expects buildings with gardens or landscaped areas that require regular maintenance to be fitted with water butts. In the case of this development, it should be noted that these area types are not included within the site design proposals.

8.2.2. Rainwater Harvesting

Rainwater harvesting is a simple and effective method of reducing the consumption of mains water on a site. It is usually put to use where water of drinking water quality is unnecessary. For instance, rainwater can be utilised to provide supplies for the following:

- Irrigation systems;
- WC flushing;
- · Laundry facilities, i.e. washing machines; and
- Vehicle washing.

A rainwater harvesting system would normally consist of the following:

- Pre-filters located in the downpipes or integrated into the below ground pipework;
- Underground storage tank with calmed, filtered inlet and overflow;
- Submersible pump with integral filter;
- Control panel with pump pressure regulator;
- · Mains water make-up (into main or header tank);
- Fine Filter(s) in main distribution pipework (optional); and
- Ultra-violet disinfection unit (optional).

It is recommended that sanitary appliances are selected to be as efficient as possible, so that the use of rainwater can be maximised.

Rainwater can be filtered and disinfected to provide water of drinking quality, but this is rare in the United Kingdom given the availability and quality of mains water.

Management of storm water is increasingly becoming an issue and rainwater harvesting can be utilised as part of an attenuation strategy.

Particular factors that need to be addressed when considering a rainwater harvesting system include:

- The supply of rainwater may not meet the demand and therefore large volumes of storage may be necessary to compensate;
- Compliance with the Water Regulations, including avoidance of backflow and cross connection into the mains water supply:
- The additional expense of a centralised system and also of maintenance, although the works necessary are relatively straightforward; and
- The relatively low impact of WC use on overall dwelling regulated water usage.

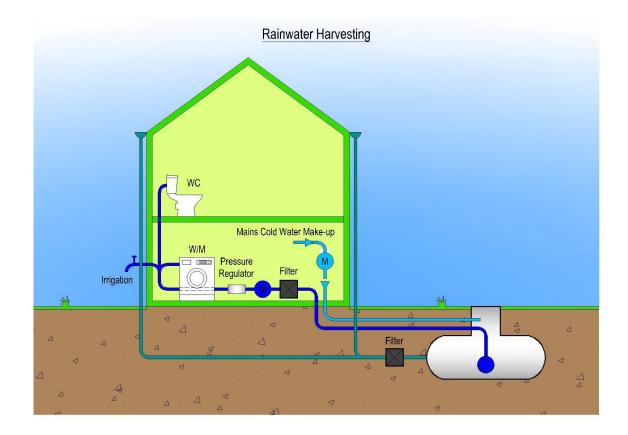


Figure 8.1 – Typical Rainwater Harvesting System Illustration

There is limited roof area available on the St John's Wood Park development for the collection of rainwater, and there is no scope for a large buried storage tank to compensate due to the restricted space of the construction site. The financial viability of a centralised rainwater harvesting systems is also facilitated by a large scale residential scheme-the St John's Wood Park is going to include 9no. dwellings.

Due to the scale of the development, limited roof collection area and limited area for the siting of a rainwater harvesting tank this system type is not proposed for the St John's Wood Park scheme.



8.2.3. Greywater Recycling

Grey water is defined as waste water collected from sources with relatively low levels of contaminants, i.e. basins, baths, sinks, showers and, in some cases, washing machines. When filtered and disinfected it is primarily used in WC flushing. Grey water is collected via a dedicated waste water pipework system and stored in tanks. Screen filtering and settlement takes place in the tank, after which the water is filtered and disinfected.

Packaged systems are now available, but filtration and disinfection methods vary between manufacturers. Reverse osmosis, sand and cartridge filters may be utilised; ultra-violet lamps, bromine and chlorination may be used for disinfection purposes.

Storage of 'raw' grey water for long periods is not recommended and a grey water installation should address all the possible health and safety issues, i.e. labelling of outlets and pipework, avoidance of cross contamination with mains water, regular maintenance.

Camden Council require developments over 10 units in size to include a greywater harvesting system, unless it can be demonstrated that this is not a feasible option for a development. It should be noted that the size of this scheme is below the 10 unit threshold, however, the feasibility of this system type has still been addressed in this section of the report.

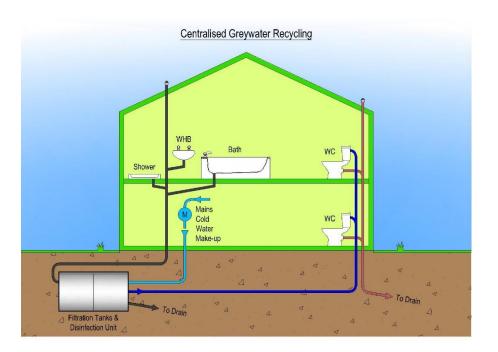


Figure 8.2 – Typical Greywater Harvesting System Illustration

Factors that need to be addressed when considering a grey water system include:

- Compliance with the Water Regulations, including avoidance of backflow and cross connection into the mains water supply;
- The additional capital expense of a centralised system;

- Ongoing maintenance, which is invariably expensive;
- The relatively low impact of WC use on overall dwelling regulated water usage; and
- Possibility of more concentrated effluent returned to the sewerage system.

The financial viability of a centralised greywater harvesting systems is facilitated by a large scale residential schemethe St John's Wood Park is going to include 9no. dwellings.

8.3 Minimising Water Use

The Code for Sustainable Homes (CfSH) has been wound down by the government, however it still provides an applicable assessment methodology for the assessment of water usage in dwellings. The average person in the UK currently uses around 150 l/p/day. CfSH sets mandatory minimum requirements for water consumption with the entry level for achieving a Code Level 1 or 2 set at \leq 120 l/p/day and to achieve a Code Level 3 or 4 water usage must be further reduced to \leq 105 l/p/day.

For residential developments achieving this required reduction in the consumption of potable water can be addressed in several different ways. This calculation methodology takes a whole dwelling approach; manufacturer's data for each appliance is inputted and the theoretical amount of water that the average person would use in a dwelling fitted with those appliances is calculated.

Therefore one of the most straight forward approaches to reducing water consumption would be to specify water conservation appliances such as dual flush toilets, low flow taps and baths with a low capacity to overflow although this has the potential to conflict with user preferences.

In line with the Camden Council CPG 3, it is expected that developments are to be water efficient by installing dual flush toilets, low flow taps & shower heads and low water consumption washing machines & dishwashers.

The following strategy is proposed to achieve ≤105 l/p/d:

- WCs to have an effective flush volume of ≤3.06 litres (e.g. 4/2.6 litre dual flush);
- Wash hand basins to have a flow rate of ≤6 litres/min;
- Baths to have a capacity of ≤170 litres;
- Showers to have a flow rate of ≤8 litres/min;
- Kitchen taps to have a flow rate of ≤6 litres/min;
- Dishwashers to have a water usage of ≤1.25 litres/place setting; and
- Washing machines to have a water usage of ≤8.17 litres/dry kg load.

The above sanitaryware specification has been entered in the BRE's Water Efficiency Calculator for New Dwellings and this confirms that the overall water consumption would be 102.8 litres / person / day. The results of this are included as Figure 8.3.

Installation Type	Unit of measure	Capacity/ flow rate	Litres/ person/ day		
Is a dual or	single flush WC specified?	Du	ıal		
wc	Full flush volume	4	5.84		
VVC	Part flush volume	2.6	7.70		
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	6	11.06		
Are both a Bath & SI	nower Present?	Bath & S	Shower		
Bath	Capacity to overflow	170	18.70		
Shower	Flow rate (litres / minute)	8	34.96		
Kitchen sink taps	Flow rate (litres / minute)	6	13.00		
Has a washin	Has a washing machine been specified?				
Washing Machine	Litres / kg	8.17	17.16		
Has a dishwasher l	been specified?	Yes			
Dishwasher	Litres / place setting	1.25	4.50		
Has a waste dis	posal unit been specified?	No	0.00		
Water Softener	Litres / person / day		0.00		
	Calcul	ated Use	112.9		
	Normalisat	ion factor	0.91		
Code for	nption	102.8			
Sustainable Homes	level	Level 3/4			
D	External u	ise	5.0		
Building Regulations 17.K	Total Consur	107.8			
Regulations 17.K	17.K Compli	Yes			

Figure 8.3 – Water Efficiency Calculator for New Dwellings

It should be noted that instructions/labelling should be specified on WC dual flush cistern system to encourage reduced water consumption.

It is also proposed to provide water meters to each of the dwellings. These meters will be located in an accessible location to allow occupiers to monitor their water usage.

8.4 Summary

In conclusion, the limiting of water flow rates and appliance capacity has been identified as the most appropriate route to achieve regulated water usage on the St John's Wood Park development of <105l/p/day.



9. RESOURCE EFFICIENCY

9.1 Overview

Resource efficiency means utilising the earth's limited natural resources in a sustainable manner and in turn mitigating negative environmental impacts. The management of waste is increasingly recognised by local authorities as an area that should be addressed in the development of design proposals. The Camden Sustainability SPG dictates that efforts should be demonstrated to minimise waste and maximise recycling & reuse of materials through both the construction process and future occupation. This section of the report will outline a strategy for a resource efficient development at St John's Wood Park.

9.2 Waste Hierarchy

The Waste Hierarchy aids in identifying actions that can improve resource efficiency by prioritising waste management options in line with their relative impact.



Figure 9.1 – The Waste Hierarchy (Image Source: BRE Website)

The Building Research Establishment (BRE) outline the following steps in identifying a route to resource efficiency:

- Where is waste being produced?
- What is the cause of this and is it avoidable?
- If not avoidable, what opportunities are there for this material to be used internally, or by another business through recycling or refurbishing?
- Can improvements be made to the way waste is currently handled?

9.3 Construction Waste

Construction waste can be minimised during the construction process via the effective and appropriate management of construction site waste.

It is proposed that this is implemented on the St John's Wood Park site through the production of a Site Waste Management Plan (SWMP) outlining procedures and good practice measures that can be adopted on site.

It is proposed that a SWMP will be developed for the site in accordance with guidance from:

- DEFRA (Department for Environment, Food and Rural Affairs);
- BRE (Building Research Establishment);
- Envirowise;
- WRAP (Waste & Resources Action Programme); and
- Environmental performance indicators and / or key performance indicators (KPI) from Envirowise or Constructing Excellence.

The SWMP will outline the following:

- Target benchmarks for resource efficiency, i.e. m³ of waste per 100m² or tonnes of waste per 100m² set in accordance with best practice;
- Procedures and commitments to minimize non-hazardous construction waste at design stage. Specify waste minimisation actions relating to at least 3 waste groups and support them by appropriate monitoring of waste;
- Procedures for minimising hazardous waste;
- Monitoring, measuring and reporting of hazardous and non-hazardous site waste production according to the defined waste groups; and
- Procedures to divert waste from landfill through re-use on site, re-use on other sites, reclaim for re-use, return to the supplier via a 'take-back' scheme, recovery and recycling using an approved waste management contractor or composting according the defined waste groups.

The defined waste groups referenced in the SWMP will include the following materials as defined in the European Waste Catalogue: bricks, concrete, insulation, packaging, timber, electrical and electronic equipment, canteen / office / ad hoc, asphalt & tar, tiles and ceramics, inert materials, metals, gypsum, plastics, floor coverings, soils, hazardous materials, architectural features and other / mixed materials.

The target benchmarks for resource efficiency will be set using best practice and will be reviewed throughout the construction process.

9.4 Built Fabric Resource Efficiency

The resource intensity of the building fabric of the proposed dwellings can be addressed through the specification of 'resource light' construction and consideration of the end of life of the building.

Resource-light construction refers to the appropriate use of construction materials and building techniques to provide the most efficient response to the particular building requirements. 'Eco' materials will be considered for their applicability to the scheme as the architectural design progresses. Eco-materials are less resource intensive than alternative materials, and have a lower level of embodied carbon as a result of their sourcing, production process, delivery requirements etc. Examples of these materials are locally sourced eco-cement, wood, straw, clay etc. The application of these materials in the final site proposals will be within the site, economic and thermal performance constraints of the scheme.

The design of the scheme will also consider the end of life of the future dwellings. The following options will be explored as the scheme develops to maximise the end of life potential for the dwellings:



- The use of prefabricated components may make them easier to dismantle on demolition and therefore more appropriate for re-use;
- Utilising simple connections and avoiding non-standard connection details will allow for efficient deconstruction and will reduce the need for multiple tools;
- Designing with reusable and adaptable materials. Materials such as bricks, steel beams / columns and wood can be easily re-used / repurposed to avoid them going to landfill on demolition; and
- Resilience to climate change may extend the lifetime of the dwellings and therefore the economic life of the dwellings.

9.5 Recycling and Composting In-use

Encouraging the occupants of the development to recycle and compost biodegradable waste will aid in reducing the amount of waste being sent to landfill through the lifetime of the St John's Wood Park development. It is proposed that the Homes User Guides will include a section on Recycling and Waste to provide guidance on good practices to the future occupants.

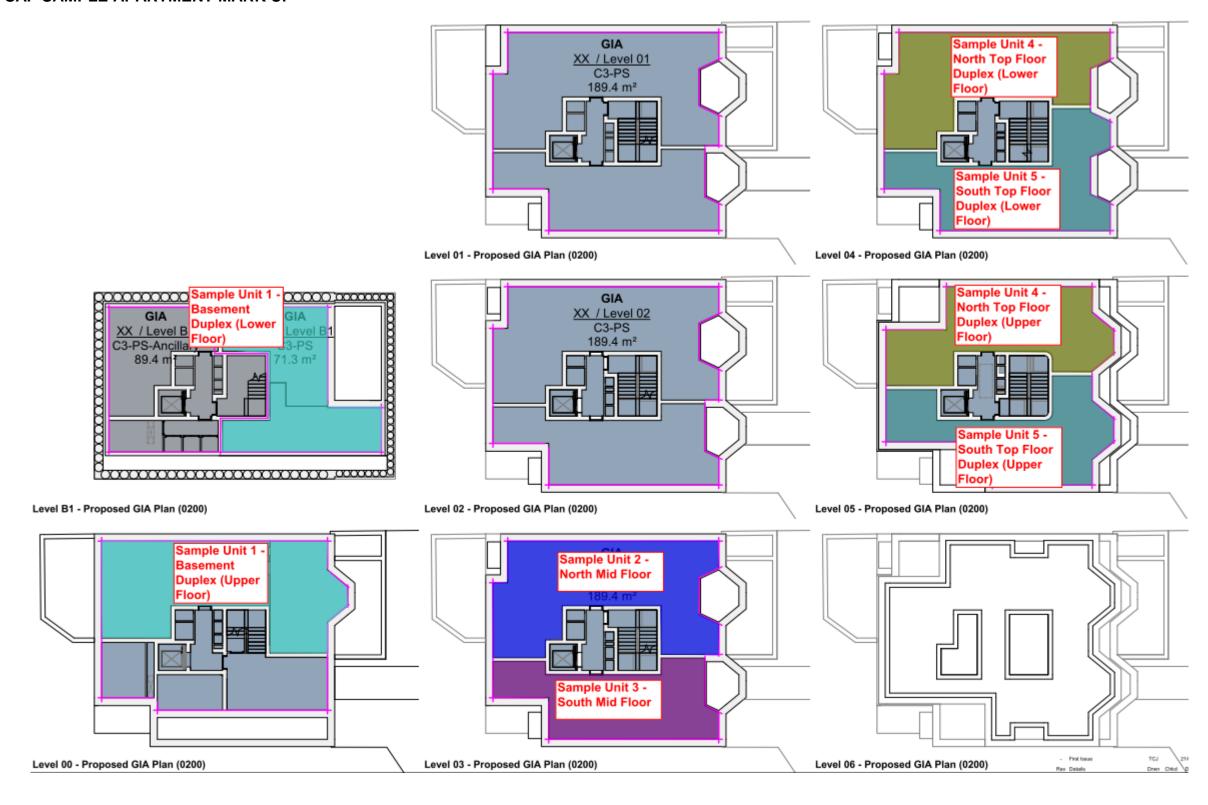
The Waste Hierarchy aids in identifying actions that can improve resource efficiency by prioritising waste management options in line with their relative impact.

It is proposed that this section of the Home User Guide will include the following:

- Information about the Local Authority collection scheme;
- Information on the Waste and Resource Action Programme (WRAP) which can offer guidance on recycling and sustainable waste disposal;
- Information on the procedure to follow with items of waste not covered by the standard weekly Local Authority collection scheme for example fridges / freezers, computer equipment, batteries and other potentially hazardous equipment; and
- Information and location of local recycling facilities and waste tips.



APPENDIX 1 - SAP SAMPLE APARTMENT MARK UP





APPENDIX 2 – SAMPLE RESIDENTIAL SAPS

Example Full SAP Calculation - Lean Scenario

Property Reference Unit 3				Issued on Date	26/09/2018
Survey Reference Lean		ор Туре	Unit 3 - Mid Floor S	South	
Property		R	ef		
SAP Rating	82 B	DER	17.92	TER	19.09
Environmental	87 B	% DER <ter< th=""><th></th><th>6.12</th><th></th></ter<>		6.12	
COI Emissions (t/year)	0.93	DFEE	50.98	TFEE	55.50
General Requirements Compliance	Pass	%		8.15	
		DFEE <tfee< th=""><th></th><th></th><th></th></tfee<>			
Surveyor Jessica Finnigan, Tel: .				Surveyor ID	Admin
Client Almax, 5006835					

SAP2012 - 9.92 input data (DesignData) -

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SAP2012 Input Data (Flat)
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                                                                                      England
Reas Region:
SAP Region:
Postcode:
DwellingOrientation:
                                                                                      Thames Valley
                                                                                      Flat, End-Terrace
 Property Type:
Storeys:
Date Built:
Sheltered Sides:
Sunlight Shade:
                                                                                      2019
                                                                                     Average or unknown
Perimeter, Floor Area, Storey Height
38.58, 62.3, 2.7
18.7 m2, fraction: 30.0%
Simple calculation
Measurements
             1st Storev:
Living Area:
Thermal Mass:
Thermal Mass Simple:
Thermal MassValue:
                                                                                      Medium
                                                                                      250
                                                                                     250
Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal 61.15, 85.4, 0, Other, Cavity, 0, 0.16, Gross 27.66, 29.76, 0, Other, Cavity, 0.43, 0.225733634311512, Gross Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal Area, Kappa, Construction, Element 62.3, 0, Other Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal Area, Kappa, Construction, Element 62.3, 0
External Walls
External Wall 1
Corridor Wall
External Roofs
Party Ceilings
Party Ceilings 1
Heat Loss Floors
Party Floors
              Partv Floor 1
                                                                                     62.3, 0
Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
Manufacturer, Solid Door, , , , ,
Manufacturer, Window, Double glazed, , , 0.45, , 0.7,
Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
Solid Door, Corridor Wall, North, , , , 0, 0, 0, 2.10,
Window, External Wall 1, East, , None, 0, , 0, 0, 7.49,
Window, External Wall 1, West, , None, 0, , 0, 0, 0, 6.61,
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Window, External Wall 1, North East, , None, 0, , 0, 0, 3.20,
None
Description
Front Door
Windows
Openings
Front Door
              East Windows
West Windows
South Windows
              South East Windows
North East Windows
Conservatory:
Draught Proofing:
Draught Lobby:
Thermal Bridges
                                                                                      Yes
              Bridging:
                                                                                      Calculate Bridges
                                                                                    Calculate Bridges
0.122
Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
External wall, E2 Other lintels (including other steel lintels), Table K1 - Approved, No, 10.23, 0.3, 0.3, 3.07,
External wall, E3 Sill, Table K1 - Approved, No, 10.23, 0.04, 0.04, 0.41,
External wall, E4 Jamb, Table K1 - Approved, No, 33.18, 0.05, 0.05, 1.66,
External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 57.22, 0.07, 0.07, 4.01,
External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Default, No, 19.94, 0.14, 0.14, 2.79,
External wall, E16 Corner (normal), Table K1 - Approved, No, 14.93, 0.09, 0.09, 1.34,
External wall, E17 Corner (inverted - internal area greater than external area), Table K1 - Default, No, 5.97, -0.09, -0.09, -
               List of Bridges
                                                                                      External wall, E17 Corner (inverted - internal area greater than external area), Table K1 - Default, No, 5.97, 0, 0.00,
                                                                                     External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 2.99, 0.06, 0.06, 0.18, External wall, E18 Party wall between dwellings, Table K1 - Default, No, 5.97, 0.12, 0.12, 0.72, External wall, E25 Staggered party wall between dwellings, Table K1 - Default, No, 2.99, 0.12, 0.12, 0.36,
10.
Pressure Test:
Designed q50:
                                                                                      True
Designed qoo:
AsBuilt q50:
Property Tested:
Mechanical Ventilation
MV System Present
Windows In Hot Weather
                                                                                      15
                                                                                      False
                                                                                      Windows fully open
              Cross Ventilation
Night Ventilation
Air Change Rate
Approved Installation
                                                                                      Yes
                                                                                      Yes
6.00
                                                                                      Yes
              DataType
                                                                                      Database
              Type
Database Ref Number
Configuration
                                                                                      Balanced mechanical ventilation with heat recovery
              HR Duct Insulated
                                                                                      Yes
              ManufacturerSFP
                                                                                      0.66
              DuctType
HR Efficiency
                                                                                     Rigid
87
Wet Rooms
Chimneys MHS:
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SAP2012 - 9.92 input data (DesignData) -

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Chimneys Other:
Chimneys Total:
Open Flues MHS:
Open Flues SHS:
Open Flues Other:
Open Flues Total:
Intermittent Fans:
Passive Vents:
Flueless Gas Fires:
Cooling System
Cooled Area
Data Source
                                                30.37
Manufacturer
Split or Multi-Split
        Type
Type
Energy Efficiency Ratio
Control
Light Fittings:
LEL Fittings:
Percentage of LEL Fittings:
External Lights Fitted:
External LELs Fitted:
Electricity Tariff:
Main Heating 1
Main Heating 2
                                                9.02
Modulating
                                                100
                                                Yes
Yes
Standard
                                                None
Heating 2
Heating Systems Interaction
Smoke Control Area
Community Heating
                                                None
                                                Each system heats separate parts of dwelling Unknown
       Type
PCDF Index
Distribution Loss
Controls
Ctrl SAP Code
                                                Space and Water Combined
                                                n/a n/a system >= 1991, pre-insulated, low temp, variable flow CCL 2312
Community Heating Heat Sources: Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency Boilers, Space and Water, 100, 95
Secondary Heating
Water Heating
                                                CommunityHeating
        Type
        WHS
Low Water Usage
SAP Code
Showers in Property
                                                HWP From main heating 1
                                           Non-electric only
        Snowers in Property Non-e
Hot Water Cylinder
Cylinder Type HotWa
Cylinder Insulation Type Foam
Cylinder Volume 3.00
Cylinder Stat Yes
                                                HotWaterCylinder
Pipeworks Insulated Full:
Cylinder in Heated Space Yes
Flue Gas Heat Recovery System None
Waste Water Heat Recovery none
                                                Fully insulated primary pipework
PV Unit
                                                None
Wind Turbine
Terrain Type:
Small Scale Hydro
Special Features
                                                Urban
                                                None
                                                None
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
Mid-floor flat, total floor area 62 m²
This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.
1a TER and DER
Fuel for main heating: Mains gas (c)
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.09 kgCO□/m² Dwelling Carbon Dioxide Emission Rate (DER) 17.92 kgCO□/m²OK
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.0 kWh/m²/yrOK
0.23 (max. 0.70)
                                                            1.00 (max. 3.30)
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
3 Air permeability
Air permeability at 50 pascals:
                                                                3.00 (design value)
Maximum
                                                                10.0
4 Heating efficiency
Main heating system:
                                                                Community heating scheme
Secondary heating system:
                                                                None
 5 Cylinder insulation
                                                               Nominal cylinder loss: 0.25 kWh/day
Hot water storage
Permitted by DBSCG 0.35
Primary pipework insulated:
                                                                Yes (assumed)
```



SAP2012 - 9.92 input data (DesignData) -

6 Controls Space heating controls:	Charging system linked to use of community heat	ing, programmer and at least two room statsOK
Hot water controls:	Cylinderstat	OK
7 Low energy lights Percentage of fixed lights with low-en Minimum	ergy fittings:100% 75%	OK
8 Mechanical ventilation Continuous supply and extract system Specific fan power: Maximum MVHR efficiency: Minimum:	0.66 1.5 87% 70%	ок ок
9 Summertime temperature Overheating risk (Thames Valley): Based on: Overshading: Windows facing North East: Windows facing East: Windows facing South East: Windows facing South:	Average 3.20 m², No overhang 7.49 m², No overhang 3.20 m², No overhang 3.75 m², No overhang 6.61 m², No overhang 6.00 ach None	OK
Door U-value Window U-value Air permeability	1.00 W/m²K 1.00 W/m²K 3.0 m²/m²h	



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014 1. Overall dwelling dimensions Volume (m2) (m) 62.3000 (1b) x 2.7000 (2b) = (m3) 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) other main secondary total m3 per hour Number of chimneys Number of open flues 0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0.0000 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires 0.0000 (7a) 0.0000 (7b) 0 * 40 = Air changes per hour 0.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a) + (6b) + (7a) + (7b) + (7c) =0.0000 (8) Pressure test Measured/design q50 0.1500 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.1769 0.1734 0.1700 0.1526 0.1492 0.1318 0.1318 0.1283 0.1388 0.1492 0.1561 0.1630 (22b) 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) 73.9500 (23c) 0.3037 0.3002 0.2829 0.2794 0.2621 0.2621 0.2586 0.2933 (25) Effective ac 0.3072 0.2690 0.2794 0.2863 A x U K-value Element Gross Openings NetArea U-value m2 2.1000 24.2500 61.1500 27.6600 W/m2K 1.0000 0.9615 W/K 2.1000 23.3173 kJ/m2K kJ/K Front Door Windows (Uw = 1.00) External Wall 1 Corridor Wall (26) (27) (29a) 85.4000 0.1600 29.7600 2.1000 0.2257 6.2438 (29a) Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U)
Party Floor 1
Party Ceilings 1 (31) (33) 115.1600 (26)...(30) + (32) = 62.3000 41.4451 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 13.9952 (36) (33) + (36) = 55.4403 (37) Total fabric heat loss Jan
(38)m 17.0500
Heat transfer coeff Jun 14.5469 Jul 14.5469 Oct 15.5096 Nov 15.8947 Sep 14.9320 Dec 16.2798 (38) 72.4903 72.2978 72.1052 71.1425 70.9499 69.9872 69.9872 69.7947 70.3723 70.9499 71.3350 71.7201 (39) Average = Sum(39)m / 12 = Mar May 1.1388 Jun Aug 1.1203 HLP (average) 1.1574 1.1419 1.1296 1.1636 1.1605 1.1234 1.1234 1.1388 1.1450 1.1512 (40) 1.1412 (40) 31 28 31 30 31 30 31 31 30 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) Feb Jan Mar Apr Mav Jun J111 Aug Sep Oct Nov Dec Daily hot water use 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860 91.0681 (44) 130.7901 (45) 1302.5967 (45) Energy content (annual) Total = Sum(45)m = Distribution loss (46) 20.2577



18.2829

15.9395

15.2943

19.6185 (46)

12.2297

14.0338

13.1978

14.2014

16.5504 18.0660

CALCULA	ATION C	OF DWE	LLING E	EMISSIO	NS FOR	REGUL	ATIONS	COMP	LIANCE	09 Ja	an 2014		
Water storage : Store volume b) If manufac Hot water sto	cturer dec	factor from			lay)							3.0000	
Volume factor Temperature : Enter (49) or Total storage :	factor from (54) in (5	m Table 2b										3.4200 0.6000 0.1475	(53)
If cylinder con	4.5734	4.1308 icated sola	4.5734 r storage	4.4259	4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	4.5734	(56)
-		4.1308		4.4259 22.5120	4.5734 23.2624	4.4259 22.5120	4.5734 23.2624	4.5734 23.2624	4.4259 22.5120	4.5734 23.2624	4.4259 22.5120	4.5734 23.2624	
	162.8872	143.2589	149.7218	133.2010	129.7978	114.9234	109.3673	121.3944		138.1715		158.6259	
Solar input Output from w/l	0.0000 h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 Solar inp	0.0000 ut (sum of	0.0000 months) = Si	0.0000 um(63)m =	0.0000	
Wash and a fine		143.2589	149.7218	133.2010	129.7978	114.9234	109.3673			138.1715 Wh/year) = St			
Heat gains from	67.1732	59.3875		56.8828	56.1710	50.8055	49.3779	53.3769	53.0301	58.9553	61.5966	65.7564	(65)
5. Internal gas													
Metabolic gains	s (Table 5), Watts							0	Oct	N.c.	P	
(66)m Lighting gains		102.2931			May 102.2931 L9a). also			Aug 102.2931	Sep 102.2931	Oct 102.2931	Nov 102.2931	Dec 102.2931	(66)
Appliances gains	15.9320	14.1506	11.5081	8.7123	6.5126	5.4982	5.9410	7.7223	10.3649	13.1606	15.3604	16.3748	(67)
	178.7081	180.5625	175.8894	165.9409	153.3827	141.5798	133.6947	131.8403	136.5134	146.4619	159.0201	170.8230	(68)
Pumps, fans	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000		33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	
Losses e.g. eva	-81.8345	-81.8345			-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	(71)
Water heating of total internal	90.2866		84.4029	79.0039	75.4987	70.5632	66.3681	71.7431	73.6529	79.2410	85.5509	88.3822	(72)
Total Internal		336.7753	325.4883	307.3451	289.0819	271.3291	259.6918	264.9937	274.2191	292.5514	313.6192	329.2679	(73)
6. Solar gains					Solar flux				FF	Acce:		Gains	
[Udii]					SOIGI IIUA		q			ACCE.		Gailla	
				m2	Table 6a W/m2	or '	Table 6b			facto Table		W	
Northeast East Southeast South West			3.2 7.4 3.2 3.7 6.6	2000 1900 2000 7500	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	or '	Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	or Tab: 0 0 0 0 0			6d 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(76) (77) (78)
Northeast East Southeast South West		240.7592	3.2 7.4 3.2 3.7 6.6	2000 1900 2000 7500	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	or '	Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	or Tab. 0 0 0 0 0 0 0 0 0 500.9302	le 6c .7000 .7000 .7000 .7000 .7000 .7000	Table 0.771 0.771 0.771 0.771 0.771 0.771	6d 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(76) (77) (78) (80)
Northeast East Southeast South West	132.3072 470.9218	240.7592 577.5345	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891	2000 1900 2000 7500 5100	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	or '	Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754	or Tab. 0 0 0 0 0 0 0 0 0 500.9302	le 6c .7000 .7000 .7000 .7000 .7000 .7000	Table 0.771 0.771 0.771 0.771 0.771 0.771	6d 00 00 00 00 00 00 00 161.4436	7.8816 32.1124 25.7021 38.2715 28.3395	(76) (77) (78) (80)
East Southeast South West Solar gains Total gains 7. Mean interne	132.3072 470.9218	240.7592 577.5345 ture (heati	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891	495.9646 803.3096	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543	597.3924 868.7216	Table 6b	or Tab:	le 6c .7000 .7000 .7000 .7000 .7000 .7000	Table 0.771 0.771 0.771 0.771 0.771 0.771	6d 00 00 00 00 00 00 00 161.4436	7.8816 32.1124 25.7021 38.2715 28.3395	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains Total gains Total gains	132.3072 470.9218 al temperaring heatir ctor for g Jan 59.6823 4.9788	240.7592 577.5345 ture (heati	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891	495.9646 803.3096	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780	597.3924 868.7216	Table 6b	or Tab:	le 6c .7000 .7000 .7000 .7000 .7000 .7000	Table 0.771 0.771 0.771 0.771 0.771 0.771	6d 00 00 00 00 00 00 00 161.4436	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains Total gains Tual gains Tual gains Temperature du: Utilisation fact tau alpha	132.3072 470.9218 al temperaring heatir ctor for g Jan 59.6823 4.9788	240.7592 577.5345 ture (heati 	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 	495.9646 803.3096	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780	597.3924 868.7216 Th1 (C) Jun 61.8169	Jul 61.8169	or Tab: 0 0 0 0 0 7 500.9302 765.9239	le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103	Table (0.77) 0.77)	6d 00 00 00 00 00 00 161.4436 475.0629	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains	132.3072 470.9218 	240.7592 577.5345 ture (heati 	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 	495.9646 803.3096 ng area fro nii,m (see Apr 60.8130 5.0542	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780 5.0652 0.6981	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 0.4501 570.8754 830.5671	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325	le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986	Table (0.77) 0.77)	00 00 00 00 00 00 00 161.4436 475.0629 Nov 60.6489 5.0433 0.9871 20.2115	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959	(76) (77) (78) (80) (83) (84) (85)
Northeast East Southeast South West Solar gains Total gains 7. Mean interned Temperature du Utilisation fact tau alpha util living arc	132.3072 470.9218 al tempera 	240.7592 577.5345 ture (heati 	3.2 7.4 3.2 3.7 6.6 3.63.4008 688.8891 ang season) in the liviting area, Mar 60.0010 5.0001 0.9539 20.4153 19.9542 0.9400	1900 1900 1900 1500 1500 1100 495.9646 803.3096 803.3096 101,m (see Apr 60.8130 5.0542 0.8623 20.7462 19.9667 0.8263	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 mm Table 9, 'Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302	Jul 61.8169 5.1211 0.3693 20.9982 19.9818 0.2846	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325 0.4164 20.9967 19.9843 0.3259	Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852	Table (0.77) 0.77)	00 00 00 00 00 00 00 161.4436 475.0629 Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89)
Northeast East Cast South West Solar gains Total gains Total gains Total gains The gains Total gains The gains Total gains The	132.3072 470.9218 al temperar	240.7592 577.5345 ture (heati- 	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 ang season) in the livi ving area, Mar 60.0010 5.0001 0.9539 20.4153 19.9542 0.9400 19.2429	495.9646 803.3096 495.0646 803.3096 495.9646 803.3096 495.9646 803.3096 495.0542 0.8623 20.7462 19.9667 0.8263 19.6936	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081	597.3924 868.7216 Ph1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752	Jul 61.8169 5.1211 0.3693 20.9982 19.9818 0.2846 19.9812	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325 0.4164 20.9967 19.9843	Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852 19.9476 ftA =	Table (0.77) 0.77)	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) =	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002	(85) (86) (88) (88) (86) (87) (88) (89) (90) (91)
Northeast East South South West Solar gains Total gains Total gains Total gains Total gains The gains Total gains	132.3072 470.9218 al temperaring heating tor for graph (1978) 130 59.6823 4.9788 ea 0.9944 19.8838 19.9493 ouse 0.9926 18.4803 action 18.9015 justment	240.7592 577.5345 ture (heati ng periods ains for li Feb 59.8412 4.9894 0.9845 20.1041 19.9517 0.9797 18.8005 19.1918	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 in the livi ving area, Mar 60.0010 5.0001 0.9539 20.4153 19.9542 0.9400 19.2429 19.5948	1900 1900 1900 1500 1500 1100 495.9646 803.3096 803.3096 101,m (see Apr 60.8130 5.0542 0.8623 20.7462 19.9667 0.8263	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, 7 Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302	Jul 61.8169 5.1211 0.3693 20.9982 19.9818 0.2846	Or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 61.4786 5.0986 0.6688 2.09576 19.9476 19.9476	Table 1 0.771 0.771 0.771 0.771 0.771 0.771 275.9194 568.4708 Oct 60.9780 5.0652 0.9229 20.6779 19.9692 0.8930 19.6217 Living area 19.9387	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) = 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East South South West Solar gains Total gain	132.3072 470.9218 al temperar- ring heatis ctor for g. Jan 59.6823 4.9788 ea 0.9944 19.8838 19.9493 ouse 0.9926 18.4803 action 18.9015 justment 18.9015	240.7592 577.5345 ture (heati 	3.2 7.4 3.2 3.7 6.6 3.63.4008 688.8891 ang season) in the liviting area, Mar 60.0010 5.0001 0.9539 20.4153 19.9542 0.9400 19.2429 19.5948		W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 mm Table 9, 'Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794 20.2794	Jul 61.8169 5.1211 0.3693 20.9982 19.9818 0.2846 20.2864	Or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 61, 4786 5.0986 0.6688 20,9576 19,9476 20.2508	Table 1 0.771 0.771 0.771 0.771 0.771 0.771 275.9194 568.4708 Oct 60.9780 5.0652 0.9229 20.6779 19.9692 0.8930 19.6217 Living area 19.9387	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) = 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East South West South 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 2 Living area from MIT Temperature ad; adjusted MIT 8. Space heatin	132.3072 470.9218 al temperar- ring heati: ctor for g. Jan 59.6823 4.9788 ea 0.9944 19.8838 19.9493 ouse 0.9926 18.4803 action 18.9015 justment 18.9015	240.7592 577.5345 ture (heati ng periods ains for li Feb 59.8412 4.9894 0.9845 20.1041 19.9517 0.9797 18.8005 19.1918 19.1918	3.2 7.4 3.2 3.7 6.6 3.63.4008 688.8891 363.4008 688.8891 in the livi ving area, Mar 60.0010 5.0001 0.9539 20.4153 19.9542 0.9400 19.2429 19.5948 19.5948	495.9646 803.3096 495.0542 0.8623 20.7462 19.6936 20.0095 20.0095	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794 20.2794	Jul 61.8169 5.1211 0.3693 20.9982 19.9818 0.2846 20.2864	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325 0.4164 20.9967 19.9843 0.3259 19.9831 20.2873	Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852 19.9476 20.2508 20.2508	Table (0.77) 0.770 0.770	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) = 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000 18.8557	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East South South West Solar gains Total gain	132.3072 470.9218 all tempera: ring heatic ctor for g. Jan 59.6823 4.9788 ea 0.9944 19.8838 19.9493 ouse 0.9926 18.4803 action 18.9015 justment 18.9015	240.7592 577.5345 ture (heati- ng periods ains for lire Feb 59.8412 4.9894 0.9845 20.1041 19.9517 0.9797 18.8005 19.1918 19.1918 19.1918 19.1918 19.1918	3.2 7.4 3.2 3.7 6.6 3.6 3.7 6.6 3.7 6.6 3.7 6.6 3.7 3.7 6.6 3.7 3.7 6.6 3.7 3.7 3.7 3.7 3.7 3.7 3.7 3.7 3.7 3.7		W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794 20.2794	Jul 61.8169 5.1211 0.3693 20.9882 20.2864 20.2864	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325 0.4164 20.9967 19.9843 0.3259 19.9831 20.2873 20.2873 Aug 0.3531 270.4626	Sep 61.4786 5.0986 0.6688 20.9576 fLA = 20.2508 Sep 0.6086 416.4365	Table (0.77) 0.77) 0.77) 0.77) 0.77) 0.77) 275.9194 568.4708 Oct 60.9780 5.0652 0.9229 20.6779 19.9692 0.8930 19.6217 Living are: 19.9387	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) = 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000 18.8557	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East East South South West Solar gains Total gains Temperature du: Utilisation fact tau alpha util living are MIT Th 2 Living area fr. MIT Temperature ad: adjusted MIT WIT Temperature ad: adjusted MIT 8. Space heatin Utilisation Useful gains Ext temp. Heat loss rate	132.3072 470.9218 al tempera: ring heati: ctor for g: Jan 59.6823 4.9788 ea 0.9944 19.8838 19.9493 ouse 0.9926 18.4803 action 18.9015 justment 18.9015 Jan 0.9901 4.3000 W 1058.4700	240.7592 577.5345 ture (heati 	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 363.4008 688.8891 in the livi ving area, Mar 60.0010 0.9539 20.4153 19.9542 0.9400 19.2429 19.5948 19.5948 19.5948	10000 19000 19000 15000 15000 15000 15000 16000 17000	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 mm Table 9, 'Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794 20.2794 20.2794	Jul 61.8169 5.1211 0.3693 20.2864 20.2864 20.2864 258.0032 258.0032	or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 61.4786 5.0986 0.5852 19.9476 fLA = 20.2508 Sep 0.6086 416.4365 14.1000 432.8428	Table (Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) = 19.3409 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000 18.8557	(76) (77) (78) (80) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92) (93) (93)
Northeast East South South West South West Total gains The gains Total gains T	132.3072 470.9218 al tempera:	240.7592 577.5345 ture (heati- ng periods ains for li- Feb 0.9750 563,1095 4.9000	3.2 7.4 3.2 3.7 6.6 3.2 3.7 6.6 363.4008 688.8891 ang season in the livi ving area, Mar 60.0010 0.9539 20.4153 19.9542 0.9400 19.2429 19.5948 19.5948 19.5948	20000 19000 19000 15000 15000 15000 15000 16000 17500	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146 20.2146 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794 20.2794 Jun 0.4530 393.5200 14.6000	Jul 61.8169 5.1211 0.3693 20.9982 19.9818 0.2864 20.2864 15.75,5564 16.6000	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325 0.4164 20.9967 19.9843 0.3259 19.9831 20.2873 20.2873 Aug 0.3531 270.4626 16.4000	Sep 61.4786 5.0986 0.6688 20.9576 ft.A = 20.2508 20.2508	Table (0.77) 0.77) 0.77) 0.77) 0.77) 0.77) 275.9194 568.4708 Oct 60.9780 5.0652 0.9229 20.6779 19.9692 0.8930 19.6217 Living are, 19.9387 19.9387	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) = 19.3409 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000 18.8557	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (93) (94) (95) (96) (97) (97a)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating p	per m2									(98)	/ (4) =	31.4685	(99)
9a Chaca cool:													
8c. Space cool:													
Calculated for	Jan	Feb	Mar 6.5000	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp. Heat loss rate		4.9000		8.9000		14.6000			14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000		0.0000	657.8797 0.9680	0.9856	530.4394 0.9784	0.0000	0.0000	0.0000		(101)
Useful loss Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	636.8557 1084.1110	1038.2602	963.5666	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti Space cooling l		0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	322.0238	392.7049	330.7517	0.0000	0.0000	0.0000	0.0000 1045.4805	(104)
Cooled fraction Intermittency:	factor (Table									cooled area		0.4875	
Space cooling D		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 p	0.0000 per m2	0.0000	0.0000	0.0000	0.0000	39.2450	47.8589	40.3087	0.0000	0.0000	0.0000	0.0000 127.4127 2.0451	(107)
9b. Energy requ													
Fraction of spa Fraction of spa Fraction of hee Fraction of to Factor for conf Factor for conf Distribution lo Space heating:	ace heat from at from commu tal space hea trol and char trol and char	n community unity Boile at from cor rging methor rging methor	y system ers nmunity Boi od (Table 4 od (Table 4	lers c(3)) for c c(3)) for c	ommunity s	space heatin						0.0000 1.0000 1.0000 1.0000 1.0000 1.0000	(302) (303a) (304a) (305) (305a)
Annual space heating: Space heat from Efficiency of a Space heating:	m Boilers = (secondary/sup	(98) x 1.00 oplementary	y heating s	ystem in %	(from Tabl	e 4a or App	endix E)					1960.4853 2058.5096 0.0000 0.0000	(307a) (308)
Water heating Annual water he Water heat from Electricity use Cooling System Space cooling Annual totals	m Boilers = 0 ed for heat of Energy Effic (if there is	(64) x 1.00 distribution ciency Rat	on Lo		enter 0)							1630.3410 1711.8580 37.7037 12.1770 10.4634	(310a) (313) (314)
	ithHeatRecove ventilation f ity for the a r lighting (d	ery, Databa Eans (SFP = above, kWh, calculated	= 0.83 /year	250)	.2500, SFF	P = 0.8250)						169.3034 169.3034 281.3633 4231.4977	(331) (332)
12b. Carbon did				-								Post of the	
neel at a second								Energy kWh/year		ion factor kg CO2/kWh		Emissions g CO2/year	
Efficiency of l Space heating : Electrical ene: Total CO2 assoc	from Boilers rgy for heat ciated with o	distribut:	systems					3968.8080 37.7037		0.2160 0.5190		95.0000 857.2625 19.5682 876.8307	(367) (372)
(negative value) Space and water		ince DFEE 4	- TFEE)					10 4634		0.5190		876.8307 5.4305	
Space cooling Pumps and fans	h to d us as							10.4634 169.3034 281.3633		0.5190		87.8684	(378)
Energy for light Total CO2, kg/y Dwelling Carbon	year	ission Rate	e (DER)					281.3033		0.5190		146.0276 1116.1572 17.9200	(383)
16 CO2 EMISSION	NS ASSOCIATED	WITH APP	LIANCES AND	COOKING AN	D SITE-WIR	DE ELECTRICT	TY GENERATI	ON TECHNOLOG	IES				
DER Total Floor Are Assumed number CO2 emission for CO2 emissions: Total CO2 emiss Total CO2 emiss Residual CO2 er Additional allo Resulting CO2 er Net CO2 emissions	ea of occupants actor in Tabl from appliand from cooking, sions missions offs owable electr emissions off	sees, equation better the property of the second se	electricity ion (L14) (L16) iofuel CHP eration, kWl	displaced	from grid						TFA N EF	17.9200 62.3000 2.0459 0.5190 16.9982 2.6982 37.6164 0.0000 0.0000 37.6164	ZC2 ZC3 ZC4 ZC5 ZC6 ZC7
												50101	



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014 1. Overall dwelling dimensions Volume (m2) (m) 62.3000 (1b) x 2.7000 (2b) = (m3) 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) other main secondary total m3 per hour 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 0 * 40 = 0.0000 (7c) Air changes per hour 20.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a) + (6b) + (7a) + (7b) + (7c) =0.1189 (8) Pressure test Measured/design q50 0.3689 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 1.2500 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.3754 0.4351 0.4265 0.4180 0.3668 0.3242 0.3242 0.3156 0.3412 0.3668 0.3839 0.4009 (22b) Effective ac 0.5804 (25) 3. Heat losses and heat loss parameter Openings A x U W/K 2.1000 Element Gross NetArea U-value K-value m2 2.1000 13.4700 71.9300 W/m2K 1.0000 1.3258 (26) TER Opaque door TER Opening Type (Uw = 1.40) External Wall 1 17.8580 12.9474 (27) (29a) 13.4700 85.4000 0.1800 EXTERNAL Wall I Corridor Wall Total net area of external elements Aum(A, m2) Fabric heat loss, W/K = Sum (A x U) 27.6600 0.1800 115.1600 (26)...(30) + (32) = 2.1000 4.9788 (29a) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) Total fabric heat loss 250.0000 (35) 9.0693 (36) (33) + (36) = Ventilation heat loss calculated monthly $(38) m = 0.33 \times (25) m \times (5)$ Jan Feb Mar Apr May Jan
(38)m 33.0082
Heat transfer coeff Feb 32.8042 Apr 31.6650 Aug 30.5198 32.6043 31.4893 31.8448 32.2164 (38) 79.7577 79.1699 (39) 78.6176 (39) 79.5577 78.6185 78.4428 77.6247 77.4732 77.9398 78.4428 78.7983 79.9617 Average = Sum(39)m / 12 = 77.6247 Dec 1.2708 (40) 1.2619 (40) Jan 1.2835 Feb 1.2802 Mar 1.2770 Jun 1.2460 Jul 1.2460 Aug 1.2436 Nov 1.2648 May 1.2591 Apr 1.2619 HLP (average) Days in month 31 3.0 3.0 31 31 31 3.0 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) 2.0459 (42) 82.7892 (43) Feb Jul May Jun Sep Oct Apr Aug Nov Daily hot water use 91.0681
Energy conte 135.0514
Energy content (annual) 87.7566 84.4450 81.1334 74.5103 74.5103 77.8219 81.1334 84.4450 87.7566 91.0681 (44) 110.3357 120.4400 Total = Sum(45)m = Distribution loss (46)m = 0.15 x (45)m 20.2577 17.7175 18.2829 15.9395 15.2943 13.1978 12.2297 14.0338 14.2014 16.5504 18.0660 19.6185 (46) Water storage loss: 3.0000 (47) 0.2602 (48) 0.5400 (49) Store volume a) If manufacturer declared loss factor is known $% \left(kWh/day\right) :$ Temperature factor from Table 2b Enter (49) or (54) in (55) Total storage loss 0.1405 (55)



CALCUL	ATION (OF TAR	GET EMI	SSIONS	S 09 J	an 2014							
If cylinder c	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
Primary loss	4.3553 23.2624	3.9338 21.0112	4.3553 23.2624	4.2148 22.5120	23.2624	4.2148 22.5120	4.3553 23.2624	4.3553 23.2624	4.2148 22.5120	4.3553 23.2624	4.2148 22.5120	4.3553 23.2624	
Total heat re-			149.5037 0.0000			114.7123 0.0000	109.1491 0.0000	0.0000	0.0000	137.9534 0.0000	0.0000	0.0000	(63)
Output from w		143.0618	149.5037	132.9899	129.5797	114.7123	109.1491	_		months) = Su 137.9534		0.0000	
Heat gains fr		ating, kWh/		56.7139	55.9965	50.6366	49.2034	Total po	er year (kW 52.8612	h/year) = Su 58.7808	im (64) m = 61.4277	1627.7725 65.5818	
	00.3307	03.2230	02.0212	30.7233	00.3300	30.0300	13.2001	00.2021	02.0012	30.7000	01.1277	00.0010	(00)
5. Internal g	ains (see T	able 5 and	5a)										
Metabolic gai			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gain	102.2931 s (calculat	102.2931 ed in Apper	102.2931 ndix L, equa	102.2931 tion L9 or	102.2931 L9a), also s	102.2931 see Table 5	102.2931	102.2931	102.2931	102.2931	102.2931	102.2931	
Appliances ga	ins (calcul	ated in App	oendix L, eq	uation L13	6.5193 or L13a), a 153.3827	lso see Tab		7.7303 131.8403	10.3756 136.5134	13.1741 146.4619	15.3762 159.0201	16.3916 170.8230	
Cooking gains	(calculate 33.2293		dix L, equat	ion L15 or 33.2293	L15a), also 33.2293			33.2293	33.2293	33.2293	33.2293	33.2293	
Pumps, fans Losses e.g. e			3.0000 values) (Tab -81.8345		3.0000 -81.8345	3.0000	3.0000 -81.8345	3.0000 -81.8345	3.0000	3.0000 -81.8345	3.0000	3.0000 -81.8345	
Water heating	gains (Tab 90.0521		84.1683	78.7693	75.2641	70.3286	66.1335	71.5085	73.4183	79.0064	85.3163	88.1476	
Total interna		339.5553	328.2655	310.1195	291.8541	274.1002	262.4633	267.7671	276.9952	295.3304	316.4005	332.0502	(73)
6. Solar gain	s												
[Jan]				rea m2		Speci or	g fic data Table 6b		FF data le 6c	Acces facto Table 6	or	Gains W	
Northeast East			1.7 4.1	800	11.2829 19.6403		0.6300 0.6300	0	.7000 .7000	0.770		6.1378 24.9697	
Southeast South West			1.7 2.0 3.6	800	36.7938 46.7521 19.6403		0.6300 0.6300 0.6300	0	.7000 .7000 .7000		0.7700 0.7700		(77) (78) (80)
Solar gains Total gains	102.8706 444.2670		282.5676 610.8332	385.6622 695.7817		464.5544 738.6546	443.9311 706.3944	389.5293 657.2963	318.8006 595.7958	214.5395 509.8699	125.5254 441.9259	86.4706 418.5208	
7. Mean inter	nal tempera	ture (heati	ing season)										
Temperature d	uring heati	ng periods	in the livi	ng area fro	m Table 9, 5							21.0000	(85)
tau	Jan 54.1058	Feb 54.2442	Mar 54.3805	Apr 55.0302	May 55.1534	Jun 55.7347	Jul 55.7347 4.7156	Aug 55.8436	Sep 55.5093	Oct 55.1534 4.6769	Nov 54.9046	Dec 54.6469	
alpha util living a	4.6071 rea 0.9958	4.6163 0.9903	4.6254 0.9744	4.6687 0.9249	4.6769 0.8123	4.7156 0.6347	0.4753	4.7229 0.5280	4.7006 0.7799	0.9553	4.6603 0.9913	4.6431 0.9968	(86)
MIT	19.6858	19.8772	20.1773	20.5453	20.8221	20.9586	20.9914	20.9862	20.8917	20.5141	20.0295		
Th 2 util rest of	19.8538 nouse 0.9944		19.8589	19.8708	19.8730	19.8834	19.8834	19.8853	0.6939	19.8730	19.8685		
MIT 2 Living area f			18.8383	19.3584	19.7088	19.8578	19.8805	19.8801		Living area		0.3002	(91)
MIT Temperature a adjusted MIT			19.2402	19.7147	20.0430	20.1882	20.2139	20.2121	20.1271	19.6853 19.6853	19.0547	0.0000	
8. Space heat	ing require	ment											
Utilisation	Jan 0.9921	Feb 0.9830	Mar 0.9595	Apr 0.8951	May 0.7635	Jun 0.5666	Jul 0.3940	Aug 0.4436	Sep 0.7149	Oct 0.9301	Nov 0.9842	Dec 0.9939	(94)
Useful gains Ext temp.	440.7561 4.3000	517.8223	586.0747		572.5970		278.3473 16.6000	291.5800	425.9349	474.2445 10.6000		415.9545	(95)
Month fracti	1142.9435 1.0000			850.2321 1.0000		433.7841 0.0000	280.5307 0.0000	295.3362 0.0000	469.7480 0.0000	712.6744 1.0000	942.0089 1.0000	1136.5459 1.0000	
Space heating Space heating		399.5359	318.0643	163.7684	60.8973	0.0000	0.0000	0.0000	0.0000	177.3918	365.0928	536.1200 2543.2979	
Space heating	per m2									(98)	/ (4) =	40.8234	
8c. Space coo													



Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements	- Individua	l heating s	ystems, inc	luding micr	o-CHP							
Fraction of space heat f Fraction of space heat f Efficiency of main space Efficiency of secondary/ Space heating requiremen	rom seconda rom main sy heating sy supplementa	ry/supplement stem(s) stem 1 (in	ntary system								0.0000 1.0000 93.5000 0.0000 2720.1048	(202) (206) (208)
Jan Space heating requiremen	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
522.4274 Space heating efficiency	399.5359	318.0643	163.7684	60.8973	0.0000	0.0000	0.0000	0.0000	177.3918	365.0928	536.1200	(98)
93.5000 Space heating fuel (main	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
558.7459	427.3111	340.1757	175.1534	65.1309	0.0000	0.0000	0.0000	0.0000	189.7239	390.4736	573.3903	(211)
Water heating requiremen 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating												
Water heating requiremen 162.6691	143.0618	149.5037	132.9899	129.5797	114.7123	109.1491	121.1762	121.4027	137.9534	147.1668	158.4078	
Efficiency of water heat (217)m 87.7076	87.4098	86.7795	85.3702	82.9349	79.8000	79.8000	79.8000	79.8000	85.4856	87.1431	79.8000 87.8144	
Fuel for water heating, 185.4674 Water heating fuel used	163.6679	172.2800	155.7803	156.2426	143.7497	136.7784	151.8499	152.1337	161.3762	168.8794	180.3892 1928.5947	
Annual totals kWh/year Space heating fuel - mai	n erretam										2720.1048	
Space heating fuel - sec											0.0000	
Electricity for pumps an central heating pump main heating flue fan Total electricity for th Electricity for lighting Total delivered energy f	e above, kW	d in Append	ix L)								30.0000 45.0000 75.0000 281.6528 5005.3523	(230e) (231) (232)
12a. Carbon dioxide emis	sions - Ind	ividual hea	ting system	s including	micro-CHP							
Space heating - main sys Space heating - secondar Water heating (other fue Space and water heating Pumps and fans Energy for lighting Total CO2, kg/m2/year Emissions per m2 for spa Fuel factor (mains gas) Emissions per m2 for lig Emissions per m2 for pum Target Carbon Dioxide Em	tem 1 y 1) ce and wate	r heating					Energy kWh/year 2720.1048 0.0000 1928.5947 75.0000 281.6528		ion factor kg CO2/kWh 0.2160 0.0000 0.2160 0.5190 0.5190	}	Emissions of CO2/year 587.5426 0.0000 416.5765 1004.1191 38.9250 146.1778 1189.2219 16.1175 1.0000 2.3464 0.6248 19.0900	(263) (264) (265) (267) (268) (272) (272a) (272b) (272c)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) SAF ZOIZ MONAGHED FOR NEW BUILT (AS DESIGNED) (VESTOR 5.32, Samulary 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014 1. Overall dwelling dimensions Volume (m2) 62.3000 (1b) (m) x 2.7000 (2b) (m3) 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
Dwelling volume 62.3000 $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) =$ 168.2100 (5) other main secondary total m3 per hour 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 0 * 40 = 0.0000 (7c) Air changes per hour 20.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a) + (6b) + (7a) + (7b) + (7c) =0.1189 (8) Pressure test Measured/design q50 0.2689 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 1.2500 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.3171 0.3109 0.3047 0.2736 0.2674 0.2363 0.2363 0.2301 0.2487 0.2674 0.2798 0.2923 (22b) Effective ac 0.5464 3. Heat losses and heat loss parameter A x U W/K 2.1000 23.3173 9.7840 Openings Element Gross NetArea U-value K-value W/m2K 1.0000 0.9615 m2 2.1000 24.2500 61.1500 Front Door (26) Windows (Uw = 1.00) External Wall 1 (27) (29a) 24.2500 85.4000 0.1600 Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U) 29.7600 2.1000 27.6600 0.2257 6.2438 (29a) Party Floor 1 (32d) Party Ceilings 1 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) Total fabric heat loss 250.0000 (35) 13.9952 (36) 55.4403 (37) (33) + (36) = Aug 29.2239 Jan (38)m 30.5460 Heat transfer coeff Dec 30.1253 (38) 29.9279 29.3043 29.7390 29.3043 85.9863 Average = Sum(39)m / 12 85.8779 85 7717 85 2727 85 1793 84 7446 84 7446 84 6642 84 9121 85 1793 85.3682 85.5656 (39) 85.2722 (39) Feb 1.3785 Mar 1.3768 Jun 1.3603 Jul Oct 1.3672 Nov 1.3703 Apr 1.3687 May 1.3672 Aug 1.3590 Sep 1.3630 1.3802 1.3603 1.3734 (40) 1.3687 (40) HLP (average) Days in month 31 (41) 4. Water heating energy requirements (kWh/year) 2.0459 (42) 82.7892 (43) Assumed occupancy Average daily hot water use (litres/day) Feb Mar Jan Apr May Jun Jul Aug Sep Nov Daily hot water use 91.0681 87.7566 84.4450 81.1334 77.8219 74.5103 74.5103 77.8219 81.1334 84.4450 87.7566 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860
Energy content (2000) 91.0681 (44) 106.2632 101.9620 87.9855 81.5315 93.5586 94.6759 110.3357 120.4400 Total = Sum(45)m = 120.4400 130.7901 (45) 1302.5967 (45) Energy content (annual)
Distribution loss (46)m = 0.15 x (45)m
0.0000 0.0000 0 Water storage loss: Total storage 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 (56) If cylinder contains dedicated solar storage



CALCULA	ATION C	F FABF	RIC ENEI	RGY EF	FICIENC	CY 09	Jan 20	14					
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains fro	m water hea	ating, kWh/				18.6969	17.3254	19.8812	20.1186	23.4463	25.5935	27.7929	
5. Internal ga													
Metabolic gain	s (Table 5)	, Watts											
	102.2931				102.2931		Jul 102.2931	Aug 102.2931	Sep 102.2931	Oct 102.2931	Nov 102.2931	Dec 102.2931	(66)
Lighting gains	15.9320	14.1506	11.5081	8.7123	6.5126	5.4982		7.7223	10.3649	13.1606	15.3604	16.3748	(67)
	178.7081	180.5625	175.8894	165.9409	153.3827	141.5798	133.6947	131.8403	136.5134	146.4619	159.0201	170.8230	(68)
Cooking gains	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	
Pumps, fans Losses e.g. ev	aporation (le 5)		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating	gains (Tabl	.e 5)			-81.8345			-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	
Total internal	gains		34.8129 275.8983		29.1222	25.9679 226.7339	23.2869	26.7220 219.9726	27.9426 228.5088	31.5139	35.5465 263.6149	37.3560 278.2417	
	200.9011	203.7320	273.0903	239.7036	242.7033	220.7339	210.0103	219.9720	220.3000	244.0243	203.0149	270.2417	(73)
6. Solar gains													
[Jan]			Aı	rea	Solar flux		a		FF	Acces		Gains	
				m2	Table 6a W/m2					facto Table (W	
Northeast East					11.2829 19.6403					0.770		7.8816 32.1124	
Southeast South			3.20	000	36.7938		0.4500	0	.7000	0.770	00	25.7021 38.2715	(77)
West			6.61	100	46.7521 19.6403		0.4500	0	.7000	0.77		28.3395	
Solar gains			363.4008		589.0724			500.9302		275.9194			
Total gains	419.2083	526.5112	639.2991	755.6681	831.7778	824.1263	787.4859	720.9028	638.5000	520.7437	425.0585	389.4568	(84)
7. Mean intern													
Temperature du												21.0000	(85)
Utilisation fa		ins for li		nil,m (see Apr		Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau alpha	50.3148 4.3543	50.3784 4.3586	50.4408 4.3627			51.0521 4.4035	51.0521 4.4035	51.1006 4.4067	50.9514 4.3968	50.7916 4.3861	50.6792 4.3786	50.5622 4.3708	
util living ar	ea 0.9967	0.9907	0.9726	0.9159	0.7939	0.6183	0.4641	0.5232	0.7781	0.9575	0.9928	0.9976	(86)
MIT Th 2	19.5269 19.7785	19.7539 19.7799	20.0996 19.7812	20.5076 19.7874	20.8089 19.7885	20.9524 19.7939	20.9892 19.7939	20.9821 19.7949	20.8707 19.7918	20.4384 19.7885	19.8918 19.7862	19.4805 19.7838	
util rest of h		0.9876	0.9630	0.8873	0.7307	0.5178	0.3417	0.3945	0.6874	0.9369	0.9898	0.9967	
MIT 2 Living area fr	18.4567 action	18.6830	19.0234	19.4135	19.6707	19.7745	19.7916	19.7905	19.7274 fLA =	19.3611 Living area	18.8264 a / (4) =	18.4145 0.3002	
MIT Temperature ad	18.7779 justment	19.0045	19.3464	19.7419	20.0124	20.1280	20.1511	20.1482	20.0706	19.6845	19.1462	18.7345 0.0000	(92)
adjusted MIT	18.7779	19.0045	19.3464	19.7419	20.0124	20.1280	20.1511	20.1482	20.0706	19.6845	19.1462	18.7345	(93)
O Conno booti													
8. Space heati													
Utilisation	Jan 0.9942	Feb 0.9849	Mar 0.9587	Apr 0.8860	May 0.7435	Jun 0.5470	Jul 0.3787	Aug 0.4335	Sep 0.7107	Oct 0.9347	Nov 0.9876	Dec 0.9957	(94)
Useful gains Ext temp.	416.7701 4.3000		612.9116			450.8295 14.6000		312.5032 16.4000	453.7749 14.1000	486.7401 10.6000		387.7809 4.2000	(95)
Month fracti	1244.9051	1211.2619	1101.8589	924.5184 1.0000	708.0422 1.0000	468.4704 0.0000	300.9335	317.3381 0.0000	506.9739 0.0000	773.8085 1.0000	1028.3587	1243.6533 1.0000	
Space heating		465.5110	363.7768	183.5724	66.6643	0.0000	0.0000	0.0000	0.0000	213.5788	438.1595	636.7690	
Space heating Space heating	per m2									(98)	/ (4) =	2984.1643 47.8999	
8c. Space cool	ing require	ement											
Calculated for					May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp. Heat loss rate	4.3000	4.9000	6.5000	8.9000		14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	796.5996 0.9051	627.1103 0.9472	643.4475 0.9269	0.0000	0.0000	0.0000	0.0000	
Useful loss Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	720.9957 1039.5158	594.0275 995.1790	596.4373 918.5455	0.0000	0.0000	0.0000	0.0000	(102) (103)
Month fracti Space cooling	0.0000 kWh	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014 Space cooling Cooled fraction Intermittency factor (Table 10b) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 229.3344 298.4567 239.6485 0.0000 0.0000 (104) 767.4396 (104) 1.0000 (105) 0.0000 0.0000 0.0000 fC = cooled area / (4) =0.0000 0.0000 0.0000 0.2500 0.2500 0.2500 0.0000 0.0000 0.0000 0.0000 (106) Space cooling kWh 0.0000 0.0000 0.0000 (107) 191.8599 (107) 3.0796 (108) 47.8999 (99) 3.0796 (108) 50.9795 (109) 51.0 (109) 0.0000 0.0000 0.0000 57.3336 74.6142 59.9121 0.0000 0.0000 0.0000 0.0000 0.0000 0.



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) ersion 9.52, c...._ 09 Jan 2014 CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 1. Overall dwelling dimensions Volume (m2) 62.3000 (1b) (m3) 168.2100 (1b) - (3b) (m) x 2.7000 (2b) Ground floor Total floor area TFA = $(1a) + (1b) + (1c) + (1d) + (1e) \dots (1n)$ Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) other main secondary total m3 per hour Number of chimneys Number of open flues 0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0.0000 (6a) 0.0000 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires 20.0000 (7a) 0.0000 0 * 40 = 0.0000 (7c) Air changes per hour 20.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a) + (6b) + (7a) + (7b) + (7c) =0.1189 (8) Pressure test Measured/design q50 0.3689 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 1.2500 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.4351 0.4265 0.4180 0.3754 0.3668 0.3242 0.3242 0.3156 0.3412 0.3668 0.3839 0.4009 (22b) Effective ac 0.5804 (25) 3. Heat losses and heat loss parameter Openings A x U W/K 2.1000 Element Gross NetArea U-value K-value W/m2K 1.0000 1.3258 m2 2.1000 (26) TER Opaque door TER Opening Type (Uw = 1.40) External Wall 1 13.4700 71.9300 17.8580 12.9474 (27) (29a) 13.4700 85.4000 0.1800 EXTERNAL Wall I Corridor Wall Total net area of external elements Aum(A, m2) Fabric heat loss, W/K = Sum (A x U) 2.1000 27.6600 0.1800 4.9788 (29a) 115.1600 (26)...(30) + (32) = Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) Total fabric heat loss 250.0000 (35) 9.0693 (36) (33) + (36) = Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) Jan Feb Mar Apr May Jan
(38)m 33.0082
Heat transfer coeff Feb 32.8042 Apr 31.6650 Aug 30.5198 Oct 31.4893 32.6043 31.4893 31.8448 32.2164 (38) 77.6247 79.1699 (39) 78.6176 (39) 79.7577 79.5577 78.6185 78.4428 77.4732 77.9398 78.4428 78.7983 79.9617 Average = Sum(39)m / 12 = 77.6247 Aug 1.2436 Dec 1.2708 (40) 1.2619 (40) Jan 1.2835 Feb 1.2802 Mar 1.2770 May 1.2591 Jun 1.2460 Jul 1.2460 Nov 1.2648 Apr 1.2619 1.2591 HLP (average) Days in month 31 3.0 31 3.0 31 31 31 30 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) 2.0459 (42) 82.7892 (43) Jul Feb Mar May Jun Sep Oct Apr Aug Nov Daily hot water use 91.0681
Energy conte 135.0514
Energy content (annual) 87.7566 84.4450 81.1334 77.8219 74.5103 74.5103 77.8219 81.1334 84.4450 87.7566 91.0681 (44) 110.3357 120.4400 Total = Sum(45)m = 130.7901 (45) 1302.5967 (45) Distribution loss (46)m = 0.15 x (45)m 0.0000 0.0000 Water storage loss:
Total storage loss
0.0000 0.0000 0.0000 (46) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56) If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 (57) 0.0000 (59) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Primary loss



CALCULA	ATION C	OF TARC	GET FAB	RIC EN	IERGY E	FFICIEN	NCY (09 Jan 2	014				
Heat gains fro	m water he	ating, kWh/ 25.0998	month 25.9008	22.5809	21.6669	18.6969	17.3254	19.8812	20.1186	23.4463	25.5935	27.7929	(65)
5. Internal ga	ins (see T	able 5 and	5a)										
Metabolic gain), Watts	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gains	102.2931	102.2931	102.2931	102.2931	102.2931	102.2931	102.2931		102.2931	102.2931	102.2931	102.2931	(66)
Appliances gai	15.9484	14.1652	11.5199	8.7213	6.5193	5.5038	5.9471	7.7303	10.3756	13.1741	15.3762	16.3916	(67)
Cooking gains	178.7081	180.5625	175.8894	165.9409	153.3827	141.5798	133.6947	131.8403	136.5134	146.4619	159.0201	170.8230	(68)
Pumps, fans	33.2293 0.0000	33.2293	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293	33.2293	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	
Losses e.g. ev			alues) (Tabl -81.8345		-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	(71)
Water heating	gains (Tab. 38.5732	le 5) 37.3509	34.8129	31.3624	29.1222	25.9679	23.2869	26.7220	27.9426	31.5139	35.5465	37.3560	(72)
Total internal	gains 286.9175	285.7665	275.9101	259.7125	242.7122	226.7395	216.6167	219.9805	228.5194	244.8379	263.6307	278.2586	(73)
6. Solar gains													
[Jan]			Aı	rea	Solar flux		a		FF	Acces		Gains	
				m2	Table 6a W/m2	or	Table 6b	Specific or Tab	le 6c	facto Table (W	
Northeast East Southeast South West			1.78 4.16 1.78 2.08 3.67	300 500 300	11.2829 19.6403 36.7938 46.7521 19.6403			0 0 0	.7000 .7000 .7000 .7000 .7000	0.770 0.770 0.770 0.770 0.770	00 00 00	6.1378 24.9697 20.0155 29.7191 22.0285	(76) (77) (78)
Solar gains Total gains		187.1982 472.9647	282.5676	385.6622 645.3748	458.0780		443.9311		318.8006 547.3201	214.5395 459.3774	125.5254 389.1561	86.4706 364.7292	
Utilisation fa tau alpha util living ar	Jan 54.1058 4.6071	Feb 54.2442 4.6163	Mar 54.3805 4.6254	Apr 55.0302 4.6687	May 55.1534 4.6769	Jun 55.7347 4.7156	Jul 55.7347 4.7156	Aug 55.8436 4.7229	Sep 55.5093 4.7006	Oct 55.1534 4.6769	Nov 54.9046 4.6603	Dec 54.6469 4.6431	
		0.9937	0.9817	0.9409	0.8400	0.6685	0.5057	0.5645	0.8173	0.9690	0.9948	0.9982	(86)
MIT	19.6070	19.8012	20.1081	20.4917	20.7918	20.9486	20.9888	20.9818	20.8661	20.4521	19.9543	19.5752	
Th 2 util rest of h		19.8564	19.8589	19.8708	19.8730	19.8834	19.8834	19.8853	19.8794	19.8730	19.8685	19.8638	
MIT 2 Living area fr	0.9967 18.5952	18.7903	19.0954	19.4732	19.7388	19.8612	19.8808	19.8805	0.7361 19.8089	0.9536 19.4454 Living area	18.9532	18.5713 0.3002	(90)
MIT Temperature ad	18.8989	19.0937	19.3993	19.7789	20.0549	20.1876	20.2134	20.2111	20.1263	19.7476	19.2537	18.8726 0.0000	(92)
adjusted MIT		19.0937	19.3993	19.7789	20.0549	20.1876	20.2134	20.2111	20.1263	19.7476	19.2537	18.8726	
8. Space heati													
	4.3000		Mar 0.9718 542.7030 6.5000	Apr 0.9173 592.0276 8.9000	May 0.7952 557.2476 11.7000	Jun 0.5995 414.4530 14.6000	Jul 0.4203 277.6236 16.6000	Aug 0.4761 290.2117 16.4000	Sep 0.7562 413.9034 14.1000	Oct 0.9514 437.0745 10.6000	Nov 0.9910 385.6594 7.1000	Dec 0.9968 363.5731 4.2000	(95)
Month fracti	1167.3526 1.0000		1026.2423	855.2823 1.0000	655.3800 1.0000	433.7358 0.0000	280.4874	295.2550 0.0000	469.6849 0.0000	717.5596 1.0000	957.6920 1.0000	1161.6295 1.0000	
Space heating Space heating		446.2293	359.7533	189.5433	73.0105	0.0000	0.0000	0.0000	0.0000	208.6809	411.8634	593.7539 2862.5791	
Space heating	per m2									(98)	/ (4) =	45.9483	
8c. Space cool	ing require	ement											
Calculated for					May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp. Heat loss rate	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation Useful 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	0.0000 0.0000 0.0000	729.6725 0.8940 652.3427	574.4230 0.9421 541.1724		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)
Total gains Month fracti Space cooling	0.0000 0.0000 kWh	0.0000	0.0000	0.0000	0.0000	884.2646 1.0000	846.8178	788.3565	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	166.9838	227.4002	182.8890	0.0000	0.0000	0.0000	0.0000 577.2730	



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction								fC =	cooled area	/ (4) =	1.0000	(105)
Intermittency factor (Tab.	Le 10b)											
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	41.7459	56.8500	45.7223	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											144.3182	(107)
Space cooling per m2											2.3165	
Energy for space heating											45.9483	
Energy for space cooling											2.3165	
Total											48.2648	
Target Fabric Energy Effic	ciency (TFE	Ξ)									55.5	(109)



CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF HEAT DEMAND 1. Overall dwelling dimensions Volume (m2) (m) (m3) 62.3000 (1b) x 2.7000 (2b) = 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)...(ln)Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) secondary other main total m3 per hour Number of chimneys Number of open flues Number of intermittent fans Number of passive vents Number of flueless gas fires 0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0.0000 (6b) 0.0000 (7a) 0.0000 (7b) 0 * 40 = Air changes per hour 0.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 (8) Pressure test Measured/design q50 0.1500 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 3.7000 0.9250 Aug 3.2000 0.8000 Sep 3.3000 0.8250 Wind speed 4.2000 1.0500 4.0000 1.0000 3.7000 0.9250 3.5000 0.8750 3.5000 0.8750 3.8000 (22) 0.9500 (22a) Wind factor Adj infilt rate 0.1457 0.1388 0.1388 0.1283 0.1283 0.1145 0.1179 0.1110 0.1145 0.1214 0.1214 0.1318 (22b) 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) 73.9500 (23c) 0.2690 0.2690 0.2586 0.2586 0.2447 0.2482 0.2413 0.2621 (25) Effective ac 0.2759 0.2447 0.2517 0.2517 A x U K-value Element Gross Openings NetArea U-value W/m2K 1.0000 0.9615 W/K 2.1000 23.3173 m2 2.1000 24.2500 61.1500 27.6600 kJ/m2K kJ/K Front Door Windows (Uw = 1.00) External Wall 1 Corridor Wall (26) (27) (29a) 24.2500 85.4000 0.1600 29.7600 2.1000 0.2257 6.2438 (29a) Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U)
Party Floor 1
Party Ceilings 1 (31) (33) 115.1600 (26)...(30) + (32) = 62.3000 41.4451 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 13.9952 (36) (33) + (36) = Total fabric heat loss 55.4403 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) $$\rm Jan$$ Feb Mar Apr May (38)m 15.3171 14.9320 14.9320 14.3544 14.3544 Heat transfer coeff Jun 13.5842 Oct 13.9693 Nov 13.9693 Dec 14.5469 (38) 70.7574 70.3723 70.3723 69.7947 69.7947 69.0245 69.2170 68.8319 69.0245 69.4096 69.9872 (39) 69.4096 Average = Sum(39)m / 12 = 69.6663 (39) Mar May 1.1203 Jun HLP (average) 1.1296 1.1203 1.1048 1.1079 1.1358 1.1296 1.1079 1.1110 1.1141 1.1141 1.1234 (40) 1.1182 (40) 31 28 31 30 31 30 31 31 30 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) Feb Jan Mar Apr Jun J111 Aug Sep Oct Nov Daily hot water use 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860 91.0681 (44) 130.7901 (45) 1302.5967 (45) Energy content (annual) Total = Sum(45)m = Distribution loss (46) 20.2577



18.2829

15.9395

15.2943

19.6185 (46)

12.2297

14.0338

14.2014

16.5504 18.0660

Water storage loss: Store volume b) If manufacturer declared loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) Volume factor from Table 2a Temperature factor from Table 2b Enter (49) or (54) in (55) Total storage loss 4.5734 4.1308 4.5734 4.4259 4.5734 4.4259 4.5734 4.5734 4.4259 4.5734	(47)							14	Jan 20	ND U	DEIVIAI	JE HEAT	ATION	CALCULA
Store volume b) If manufacturer declared loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) Volume factor from Table 2a Temperature factor from Table 2b Enter (49) or (54) in (55) Total storage loss 4.5734 4.1308 4.5734 4.1308 4.5734 4.4259 4.5734 4.4259 4.5734 3.0000 (4 0.0240 6.02	(47)													
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0240 (5 Volume factor from Table 2a 3.4200 (5 Enter (49) or (54) in (55)		3.0000												Store volume
Temperature factor from Table 2b									ay)			factor from	torage loss	Hot water st
Total storage loss 4.5734 4.1308 4.5734 4.4259 4.5734 4.4259 4.5734 4.5734 4.4259 4.5734 4.4259 4.5734 (5.5734 4.4259 4.5734 4.4259 4.5734 (5.5734 4.4259 4.5734 4.4259 4.5734 (5.5734 4.4259 4.5734 4.4259 4.5734 (5.5734 4.4259 4.5734 4.4259 4.5734 (5.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 (5.5734 4.4259 4.4259 4.5734 4.4259 4.5734 4.4259 4.4259 4.5734 4.4259 4.5734 4.4259 4.4259 4.5734 4.4259 4.4259 4.5734 4.4259 4.4259 4.5734 4.4259 4.4259 4.5734 4.4259 4.4259 4.5734 4.4259 4.4259 4.5734 4.4259 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.425	(53)	0.6000										m Table 2b	factor fro	Temperature
			4 4259	4 5734	4 4259	4 5734	4 5734	4 4259	4 5734	4 4259	4 5734		loss	
11 Cylinder Concains dedicated solar Storage 4.5734 4.1308 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.4259 4.5734 4.5734 4.4259 4.5734											r storage	icated sola	ontains ded	If cylinder co
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 (5.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 (5.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 (5.5120 23.2624 22.5120 22.5120 2			22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	21.0112	23.2624	
162.8872 143.2589 149.7218 133.2010 129.7978 114.9234 109.3673 121.3944 121.6138 138.1715 147.3779 158.6259 (6 Solar input 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														
Solar input (sum of months) = Sum(63)m = 0.0000 (6						_								Output from w/
162.8872 143.2589 149.7218 133.2010 129.7978 114.9234 109.3673 121.3944 121.6138 138.1715 147.3779 158.6259 (6 Total per year (kWh/year) = Sum(64)m = 1630.3410 (6	(64)	1630.3410					109.3673	114.9234	129.7978	133.2010	149.7218			DIII water best
RHI water heating demand Heat gains from water heating, kWh/month 67:1732 59.3875 62.7957 56.8828 56.1710 50.8055 49.3779 53.3769 53.0301 58.9553 61.5966 65.7564 (6			61.5966	58.9553	53.0301	53.3769	49.3779	50.8055	56.1710	56.8828		ating, kWh/	om water he	
5 Taboural makes (and Mahla 5 and 5a)														
5. Internal gains (see Table 5 and 5a) Metabolic gains (Table 5), Watts														
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m 122.7517 122.7517 122.7517 122.7517 122.7517 122.7517 122.7517 122.7517 122.7517 122.7517 122.7517 122.7517 122.7517	(66)							Jun 122.7517	May 122.7517	Apr 122.7517	Mar 122.7517	Feb	Jan	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 39.8299 35.3766 28.7701 21.7809 16.2814 13.7455 14.8525 19.3058 25.9122 32.9015 38.4009 40.9369 (6								see Table 5	L9a), also :	tion L9 or	dix L, equa	ed in Appen	s (calculat	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 266.7285 269.4963 262.5215 247.6730 228.9295 211.3132 199.5444 196.7766 203.7514 218.5999 237.3434 254.9597 (6	(68)	254.9597	237.3434	218.5999	203.7514	196.7766	199.5444	211.3132	228.9295	247.6730	262.5215	269.4963	266.7285	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 49.3210 49.3210 49.3210 49.3210 49.3210 49.3210 49.3210 49.3210 49.3210 49.3210 49.3210 49.3210 (6							49.3210	49.3210	49.3210	49.3210	49.3210	49.3210	49.3210	3 3
Pumps, fans 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 (7 Losses e.g. evaporation (negative values) (Table 5)										le 5)	alues) (Tab	(negative v	vaporation	
01 0345 01 0345 01 0345 01 0345 01 0345 01 0345 01 0345 01 0345 01 0345 01 0345 01 0345 01 0345 01	(/I)											le 5)	gains (Tab	Water heating
-81.8345 -81.8345 -81.8345 -81.8345 -81.8345 -81.8345 -81.8345 -81.8345 -81.8345 -81.8345 -81.8345 -81.8345 -81.8345 (7 Water heating gains (Table 5)	(72)		00.0003	, 3.2110	75.0023	71.7101	00.5001		70.1307				l gains	Total internal
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains		474.5171	451.5335	420.9806	393.5547	378.0638	371.0032	385.8601	410.9479	438.6960	465.9328	483.4853		
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains		474.5171	451.5335	420.9806	393.5547	378.0638	371.0032	385.8601	410.9479	438.6960	465.9328	483.4853		
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains 487.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.5547 420.9806 451.5335 474.5171 (7		474.5171	451.5335	420.9806	393.5547	378.0638	371.0032	385.8601	410.9479	438.6960	465.9328	483.4853		
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains		474.5171	451.5335	420.9806	393.5547								s	
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains 487.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.5547 420.9806 451.5335 474.5171 (7		Gains	s	Acces	FF		g		Solar flux		A:		s	
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains 487.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.5547 420.9806 451.5335 474.5171 (7		Gains	s or	Acces facto	FF	Specific or Tab	g fic data Table 6b	Speci:	Solar flux Table 6a W/m2	rea m2	A:		s	[Jan]
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains 487.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.5547 420.9806 451.5335 474.5171 (7 6. Solar gains Jan Area Solar flux g FF Access Gains	(73) (75) (76)	Gains W 9.0277 36.5124	s er id 0	Acces facto Table 6 0.770 0.777	FF data Le 6c .7000 .7000	Specific or Tab.	g fic data Table 6b 0.4500 0.4500	Speci: or '	Solar flux Table 6a W/m2 12.9236 22.3313	rea m2 	A: 3.21 7.4		s	[Jan] Northeast East
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains 487.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.5547 420.9806 451.5335 474.5171 (7 6. Solar gains [Jan] Area Solar flux g FF Access Gains m2 Table 6a Specific data Specific data factor W W/m2 or Table 6b or Table 6c Table 6d Northeast 3.2000 12.9236 0.4500 0.7000 0.7700 9.0277 (7 East 7.4900 22.3313 0.4500 0.7000 0.7700 36.5124 (7 Southeast 3.2000 40.4699 0.4500 0.7000 0.7700 28.2700 (7 Southeast 3.2000 40.4699 0.4500 0.7000 0.7700 11.7365 (7 South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7700 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7000 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7000 0.7700 0.7700 11.7365 (7 Base South 3.7500 50.9848 0.4500 0.7000 0.7000 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 0	(73) (75) (76) (77) (78)	Gains W 9.0277 36.5124 28.2700 41.7365	ss rr id 0 0 0 0	Acces facto Table 6 0.770 0.770 0.770	FF data Le 6c .7000 .7000 .7000 .7000	Specific or Tab:	gfic data Table 6b 0.4500 0.4500 0.4500	Speci: or '	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848	rea m2	A: 3.2: 7.4: 3.2: 3.2:		s	[Jan] Northeast East Southeast South
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains 487.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.5547 420.9806 451.5335 474.5171 (7	(73) (75) (76) (77) (78)	Gains W 9.0277 36.5124 28.2700 41.7365	ss rr id 0 0 0 0	Acces facto Table 6 0.770 0.770 0.770	FF data Le 6c .7000 .7000 .7000 .7000	Specific or Tab:	gfic data Table 6b 0.4500 0.4500 0.4500	Speci: or '	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848	rea m2	A: 3.2: 7.4: 3.2: 3.2:		s	[Jan] Northeast East Southeast South
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains 487.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.5547 420.9806 451.5335 474.5171 (7 6. Solar gains [Jan] Area Solar flux g g FF Access Gains m2 Table 6a Specific data factor W m2 or Table 6b or Table 6c Table 6d Northeast 3.2000 12.9236 0.4500 0.7000 0.7700 9.0277 (7 East 7.4900 22.3313 0.4500 0.7000 0.7700 36.5124 (7 Southeast 3.2000 40.4699 0.4500 0.7000 0.7700 28.2700 South Southeast 3.7500 50.9848 0.4500 0.7000 0.7700 28.2700 West 6.6100 22.3313 0.4500 0.7000 0.7700 32.2225 (8 Solar gains 147.7691 242.2342 361.7973 509.8524 590.8352 641.6272 606.3533 543.4568 442.7927 296.5908 184.7814 122.9762 (8	(73) (75) (76) (77) (78) (80)	Gains W 9.0277 36.5124 28.2700 41.7365 32.2225	184.7814	Acces facto Table 6 0.770 0.770 0.770 0.770	FF data te 6c 7000 7000 7000 7000 7000 442.7927	Specific or Tab:	gfic data Table 6b 	Speci: or :	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313	rea m2	3.22 7.4 3.21 3.7: 6.6	242.2342	147.7691	[Jan] Northeast East Southeast South West Solar gains
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains 487.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.5547 420.9806 451.5335 474.5171 (7 6. Solar gains [Jan] Area Solar flux g g FF Access Gains m2 Table 6a Specific data Specific data factor W m/m2 or Table 6b or Table 6c Table 6d Northeast 3.2000 12.9236 0.4500 0.7000 0.7700 9.0277 (7 East 7.4900 22.3313 0.4500 0.7000 0.7700 36.5124 (7 Southeast 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 South 3.7500 50.9848 0.4500 0.7000 0.7700 11.7365 (7 West 6.6100 22.3313 0.4500 0.7000 0.7700 32.2225 (8	(73) (75) (76) (77) (78) (80)	Gains W 9.0277 36.5124 28.2700 41.7365 32.2225	184.7814	Acces facto Table 6 0.770 0.770 0.770 0.770	FF data te 6c 7000 7000 7000 7000 7000 442.7927	Specific or Tab:	gfic data Table 6b 	Speci: or :	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313	rea m2	3.22 7.4 3.21 3.7: 6.6	242.2342	147.7691	[Jan] Northeast East Southeast South West Solar gains
Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7.7501 internal gains 487.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.5547 420.9806 451.5335 474.5171 (7.7501 fr. 1.7501	(73) (75) (76) (77) (78) (80)	Gains W 9.0277 36.5124 28.2700 41.7365 32.2225	184.7814	Acces facto Table 6 0.770 0.770 0.770 0.770	FF data te 6c 7000 7000 7000 7000 7000 442.7927	Specific or Tab:	gfic data Table 6b 	Speci: or :	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313	rea m2	3.22 7.4 3.2 3.7; 6.6	242.2342 725.7195	147.7691 634.8523	[Jan] Northeast East Southeast South West Solar gains Total gains
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Water heating gains (Table 5) 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (Total internal gains 90.2866 88.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (Total internal gains 87.0833 483.4853 465.9328 438.6960 410.9479 385.8601 371.0032 378.0638 393.547 420.9906 451.5335 474.5171 (Total internal gains 88.3822 (Total internal gains	(73) (75) (76) (77) (78) (80) (83) (84) (85)	Gains W 9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	Nov 62.3313 5.1554 0.9449 20.5431 1.99893 0.9270 19.4508 1/(4) = 19.7787	Acces factor Table 6 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 296.5908 717.5714 Oct 62.3313 5.1554 0.7953 20.8759 19.8875 19.88745 Living area 20.1750	FF data lee 6c	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	Speci:	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	rea m2 000 900 000 500 100 509.8524 948.5484 ing area fro nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805 20.1844 20.1844	3.21 7.4 3.22 3.7 6.6 361.7973 827.7301 mg season) in the livin ving area, 19 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	242.2342 725.7195 ture (heati: ng periods ains for 1: Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949	147.7691 634.8523 	[Jan] Northeast East Southeast Southeast South West
## Northeast 3,2000 12,9366 3,2000 1,0310 3,000	(73) (75) (76) (77) (78) (80) (83) (84) (85)	Gains W 9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 19.7787 19.7787	Acces factr Table 6 0.770 0.770 0.770 0.770 0.770 296.5908 717.5714 Oct 62.3313 5.1554 0.7953 20.8759 19.9893 0.7395 19.8745 Living area 20.1750 20.1750	FF data te 6c	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	Speci:	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	rea m2 000 900 000 500 100 509.8524 948.5484 mg area fro nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805 20.1844 20.1844	A: 3.2: 7.4 3.2: 3.7: 6.6 361.7973 827.7301 in the living area, 10 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	242.2342 725.7195 ture (heati: ng periods ains for li- Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949	147.7691 634.8523	[Jan] Northeast East Southeast Southeast South West
Mater National Salar S	(73) (75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)	Gains W 9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 Dec 0.9695	Nov 0.9449 20.5431 19.7787 19.7787 Nov 0.9225	Acces factor fac	FF data Le 6c 7000 7000 7000 7000 7000 442.7927 836.3474 Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 fLA = 20.2915 20.2915	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	Specimon or some series of	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	rea m2 000 900 000 500 100 509.8524 948.5484 ang area fro nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.8805 20.1844 20.1844	3.2: 7.4 3.2: 7.4 3.2: 3.7: 6.6 361.7973 827.7301 in the livin ying area, 1 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187	242.2342 725.7195 ture (heati: ng periods ains for li- Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949	147.7691 634.8523 nal tempera uring heati actor for g Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717 house 0.9680 19.3728 djustment 19.3728 ing require Jan 0.9626	[Jan] Northeast East Southeast South West 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
Mater hearing gains (fable 5) Solida 68 83.3742 84.4029 79.0039 75.4987 70.5632 66.3681 71.7431 73.6529 79.2410 85.5509 88.3822 (7 Total internal gains	(73) (75) (76) (77) (78) (80) (83) (84) (85)	Gains W 9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345 0.0000 19.3345	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 1/ (4) = 19.7787 19.7787	Acces fact: Table 6 0.770 0.777 0.777 0.777 0.777 296.5908 717.5714 Oct 62.3313 5.1554 0.7953 20.8759 19.88745 Living area 20.1750 20.1750 Oct 0.7505 538.5687	FF data Lee 6c	Specific or Tab: On Tab: On Tab: Specific or Tab: On O	Jul 62.5047 5.1670 0.2195 20.2944 20.2944 Jul 0.1696 165.7194	Speci:	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	rea m2 000 900 000 500 100 509.8524 948.5484 ang area fro nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805 20.1844 20.1844 Apr 0.7030 666.8083	3.21 7.4 3.22 3.7 6.6 361.7973 827.7301 mg season) in the livin ving area, 19 Mar 61.4786 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187	242.2342 725.7195 ture (heati: ng periods ains for 1: Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949	147.7691 634.8523 nal tempera actor for in actor for in	[Jan] Northeast East Southeast Southeast South West 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 Utilisation Useful gains Ext temp.
## Northeast 3,2000 12,9356 12	(73) (75) (76) (77) (78) (80) (83) (84) (85)	Gains W 9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345 Dec 0.9695 579.2522 5.1000 996.2359	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 1/(4) = 19.7787 Nov 0.9225 587.0269 8.0000 817.5526	Acces factor fac	FF data lee 6c	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 62.5047 5.1670 0.2195 20.9999 19.9918 20.2944 20.2944 17.9000 165.7338	Speci:	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	rea m2 000 900 000 500 100 509.8524 948.5484 ang area fro nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805 20.1844 20.1844 Apr 0.7030 666.8083 9.9000 717.7945	A: 3.21 7.4 3.2: 3.7: 6.6 361.7973 827.7301 mg season) mg season mg season Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187	242.2342 725.7195 ture (heating periods in the control of the con	147.7691 634.8523 	[Jan] Northeast East Southeast Southeast South West 7. Mean interr Temperature du Utilisation fe tau alpha util living ar MIT Th 2 util rest of h MIT 2 util rest of h MIT 2 util rest of h MIT 2 Utilisation Useful gains Ext temp. Heat loss rate



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating RHI space heating demand 1188.9587 (98) (98)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) 1. Overall dwelling dimensions Volume (m2) (m) (m3) 62.3000 (1b) x 2.7000 (2b) = 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) secondary other main total m3 per hour Number of chimneys Number of open flues Number of intermittent fans Number of passive vents Number of flueless gas fires 0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0.0000 (6b) 0.0000 (7a) 0.0000 (7b) 0 * 40 = Air changes per hour 0.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 (8) Pressure test Measured/design q50 0.1500 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.1769 0.1734 0.1700 0.1526 0.1492 0.1318 0.1318 0.1283 0.1388 0.1492 0.1561 0.1630 (22b) 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) 73.9500 (23c) 0.3037 0.3002 0.2829 0.2794 0.2621 0.2621 0.2586 0.2933 (25) Effective ac 0.3072 0.2690 0.2794 0.2863 A x U K-value Element Gross Openings NetArea U-value m2 2.1000 24.2500 61.1500 27.6600 W/m2K 1.0000 0.9615 W/K 2.1000 23.3173 kJ/m2K Front Door Windows (Uw = 1.00) External Wall 1 Corridor Wall (26) (27) (29a) 24.2500 85.4000 0.1600 29.7600 2.1000 0.2257 6.2438 (29a) Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U)
Party Floor 1
Party Ceilings 1 (31) (33) 115.1600 (26)...(30) + (32) = 62.3000 41.4451 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 13.9952 (36) (33) + (36) = Total fabric heat loss 55.4403 (37) Jan
(38)m 17.0500
Heat transfer coeff Jun 14.5469 Jul 14.5469 Oct 15.5096 Nov 15.8947 Aug 14.3544 Sep 14.9320 Dec 16.2798 (38) 72.4903 72.2978 72.1052 71.1425 70.9499 69.9872 69.9872 69.7947 70.3723 70.9499 71.3350 71.7201 (39) Average = Sum(39)m / 12 = Mar May 1.1388 Jun Aug 1.1203 HLP (average) 1.1574 1.1419 1.1296 1.1636 1.1605 1.1234 1.1234 1.1388 1.1450 1.1512 (40) 1.1412 (40) 31 28 31 30 31 30 31 30 31 30 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) Feb Jan Mar Apr Jun J111 Aug Sep Oct Nov Daily hot water use 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860 91.0681 (44) 130.7901 (45) 1302.5967 (45) Energy content (annual) Total = Sum(45)m = Distribution loss (46) 20.2577 18.2829 15.9395 15.2943 13.1978 12.2297 14.0338 14.2014 16.5504 18.0660 19.6185 (46)



CALCULA	ATION C)E ENIEE	SCA BV	TINGS	09 Jan	201/							
		JI LINLI	MITTA	TINGS	UJ Jan	12014							
Water storage Store volume b) If manufa		lared loss	factor is n	ot known :								3.0000	(47)
Hot water st Volume facto Temperature	orage loss or from Tab factor fro	factor from le 2a m Table 2b			lay)							0.0240 3.4200 0.6000	(52) (53)
Enter (49) or Total storage			4.5734	4.4259	4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	0.1475 4.5734	
If cylinder co	ntains ded 4.5734	icated sola: 4.1308	r storage 4.5734	4.4259	4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	4.5734	(57)
Primary loss Total heat req	uired for	water heati	ng calculat	ed for each			23.2624			23.2624 138.1715			
	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	(63)
Output from w/		143.2589	149.7218	133.2010	129.7978	114.9234	109.3673			138.1715 Th/year) = Su			
Heat gains fro		ating, kWh/1 59.3875		56.8828	56.1710	50.8055	49.3779	53.3769	53.0301		61.5966	65.7564	
5. Internal ga	ins (see T	able 5 and	5a)										
Metabolic gain	Jan	Feb	Mar	Apr 122 7517	May	Jun 122 7517	Jul	Aug	Sep	Oct 122.7517	Nov 122 7517	Dec	1661
Lighting gains	(calculat	ed in Appen	dix L, equa	tion L9 or		see Table 5		19.3058	25.9122	32.9015	38.4009	40.9369	
Appliances gai	ns (calcul 266.7285	ated in App 269.4963	endix L, eq 262.5215	uation L13 247.6730	or L13a), a: 228.9295	lso see Tab 211.3132	le 5 199.5444		203.7514		237.3434		
Cooking gains Pumps, fans		49.3210			49.3210	49.3210		49.3210 0.0000	49.3210 0.0000		49.3210	49.3210 0.0000	
Losses e.g. ev	aporation	(negative v	alues) (Tab	le 5)	-81.8345						-81.8345	-81.8345	
Water heating Total internal	90.2866	le 5) 88.3742	84.4029	79.0039	75.4987	70.5632	66.3681	71.7431	73.6529	79.2410	85.5509	88.3822	(72)
iotai internai		483.4853	465.9328	438.6960	410.9479	385.8601	371.0032	378.0638	393.5547	420.9806	451.5335	474.5171	(73)
6. Solar gains													
[Jan]			70.	rea	Solar flux					Acces		Gains	
				m2	Table 6a W/m2	Speci or	Table 6b		le 6c	facto Table 6	or	W	
Northeast East			3.2	m2	Table 6a W/m2 11.2829 19.6403	Speci or	fic data Table 6b	or Tab	data le 6c	facto Table 6 0.770 0.770	or 5d 00		(75)
Northeast			3.2 7.4 3.2 3.7 6.6	m2 000 900 000 500 100	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	Speci or	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	or Tab. 0 0 0 0 0	data le 6c .7000	facto Table 6	or 5d 00 00 00	W 7.8816	(75) (76) (77) (78)
Northeast East Southeast South West	132.3072	240.7592	3.2 7.4 3.2 3.7 6.6	m2 000 900 000 500 100 495.9646	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	Speci or 597.3924	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754	or Tab.	data le 6c .7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 5d 00 00 00 00 00 00 00 00 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(75) (76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains	132.3072 619.3905	240.7592 724.2445	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336	m2 	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202	Speci or 597.3924 983.2525	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786	or Tab.	data le 6c .7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 5d 00 00 00 00 00 00 00 00 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(75) (76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains	132.3072 619.3905 all tempera	240.7592 724.2445 ture (heati	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336	m2 000 900 000 500 100 495.9646 934.6606	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202	Speci or	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786	or Tab.	data le 6c .7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 5d 00 00 00 00 00 00 00 00 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains Total gains Total gains	132.3072 619.3905 all tempera uring heati	240.7592 724.2445 ture (heati: ng periods ains for li: Feb	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 ng season) in the livi	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May	Speci or	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786	or Tab 0 0 0 0 0 500.9302 878.9940	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460	factor Table 6 0.770 0.7	ne de	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains	132.3072 619.3905 wal tempera viring heati tector for g Jan 59.6823 4.9788	240.7592 724.2445 ture (heating periods ains for liver Feb 59.8412 4.9894	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 in the livi ving area, Mar 60.0010 5.0001	m2 000 900 000 500 100 495.9646 934.6606 ng area frc nii,m (see Apr Apr 60.8130 5.0542	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May 60.9780 5.0652	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786 Jul 61.8169 5.1211	or Tab. 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986	factor Table 6 0.770 0.7	Nov 60.6489 5.0433	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West	132.3072 619.3905 	240.7592 724.2445 ture (heati: ng periods ains for li Feb 59.8412 4.9894 0.9624	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 	m2 000 900 000 500 100 495.9646 934.6606 area fro nil,m (see Apr 60.8130 5.0542 0.7987	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 m Table 9, 7 Table 9a) May 60.9780 5.0652 0.6301	Speci or	Jul 61.8169 5.1211 0.3262	or Tab 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851	Factor Table 6 0.770 0.7	Nov 60.6489 5.0433 0.9643	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West	132.3072 619.3905 all tempera aring heati actor for g Jan 59.6823 4.9788 eea 0.9823 20.0945 19.9493	240.7592 724.2445 ture (heati: ng periods ains for li: Feb 59.8412 4.9894 0.9624 20.2974 19.9517	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 in the livi ving area, Mar 60.0010 5.0001 0.9135 20.5666 19.9542	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211	Jul 61.8169 5.1211 0.3262 20.9990 19.9818	or Tab 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982 19.9843	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768	Factor Table 6 0.770 0.7	Nov 60.6489 5.0433 0.9643 20.3957 19.9642	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215	(75) (76) (77) (78) (80) (83) (84) (85)
Northeast East Southeast South West	132.3072 619.3905 	240.7592 724.2445 ture (heating periods ains for ling periods ains for linger	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 in the liviving area, Mar 60.0010 5.0001 0.9135 20.5666	m2 000 900 000 500 100 495.9646 934.6606 arg area fr nii,m (see Apr 60.8130 5.0542 0.7987 20.8274	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, 7 Table 9a) May 60.9780 5.0652 0.6301 20.9551	597.3924 983.2525 Ph1 (C) Jun 61.8169 5.1211 0.4511 20.9934	Jul 61.8169 5.1211 0.3262 20.9990	or Tab. 0 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614	Factor Table 6 0.770 0.7	Nov 60.4436 612.9771 Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338	(75) (76) (77) (78) (80) (83) (84) (85) (85)
Northeast East Southeast South West 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Living area fr MIT	132.3072 619.3905 all tempera 	240.7592 724.2445 ture (heating periods ains for live Feb 59.8412 4.9894 0.9624 20.2974 19.9517 0.9519 19.0730	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Dom Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697	Speci or	Jul 61.8169 5.1211 0.3262 20.9990 19.9818 0.2511	or Tab. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614	Factor Table 6 0.770 0.7	Nov 60.4436 612.9771 Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303	(75) (76) (77) (78) (80) (83) (84) (85) (85)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr	132.3072 619.3905 	240.7592 724.2445 ture (heating periods ains for 1imes	3.2 7.4 3.2 3.7 6.6 6.6 363.4008 829.3336 829.3336 829.3336 829.3336 829.3336 829.3336 829.3336 829.335 820.5666 19.9542 0.8913 19.4451	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389	597.3924 983.2525 Ph1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818 0.3813 19.9780	Jul 61.8169 5.1211 0.3262 20.9990 19.9818 0.2511 19.9814	Or Tab. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 flA =	Oct 60.9780 5.0652 0.8580 20.7886 19.9692 0.8148 19.7548 Living area 20.0651	Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad	132.3072 619.3905 aal tempera uring heati ictor for g Jan 59.6823 4.9788 rea 0.9823 20.0945 19.9493 iouse 0.9771 18.7836 action 19.1771 ljustment 19.1771	240.7592 724.2445 ture (heating periods ains for live Feb Feb Feb Feb Feb Feb Feb Feb Feb Fe	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 in the livit ving area, Mar 60.0010 5.0001 0.9135 20.5666 19.9542 0.8913 19.4451 19.7817	m2 000 900 900 000 500 100 495.9646 934.6606 ang area frc nil,m (see Apr 60.8130 5.0542 0.7987 20.8274 19.9667 0.7560 19.7882 20.1002 20.1002	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Dom Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 20.2389	Speci or	Jul 61.8169 5.1211 0.3262 20.9990 19.9818 0.2511 19.9814 20.2869 20.2869	Or Tab. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA = 20.2662	Oct 60.9780 5.0652 0.8580 20.7886 19.9692 0.8148 19.7548 Living area 20.0651	Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265 1/(4) = 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West Total gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati	132.3072 619.3905 	240.7592 724.2445 ture (heati: ng periods ains for li- Feb 59.8412 4.9894 0.9624 20.2974 19.9517 0.9519 19.0730 19.4405	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 ang season) in the livit ving area, Mar 60.0010 5.0001 0.9135 20.5666 19.9542 0.8913 19.4451 19.7817	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 May May	Speci or	Jul 61.8169 5.1211 0.3262 20.9990 20.2869 Jul	or Tab. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA = 20.2662 20.2662	Factor Table 6 0.770 0.7	Nov 60.6489 5.0433 0.9643 20.3957 19.9265 1/(4) = 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000 19.1303	(75) (76) (77) (78) (80) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains Ext temp.	132.3072 619.3905 	240.7592 724.2445 ture (heati: ng periods ains for li- Feb 59.8412 4.9894 0.9624 20.2974 19.9517 0.9519 19.0730 19.4405 19.4405	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 363.4008 9.0010 5.0001 0.9135 20.5666 19.9542 0.8913 19.4451 19.7817	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 m Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 20.2389	Speci or	Jul 61.8169 5.1211 0.3262 20.9990 19.9818 0.2511 19.9814 20.2869 20.2869	or Tab 0 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982 19.9843 0.2843 19.9837 20.2882 20.2882	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA = 20.2662 20.2662	Oct 60.9780 5.0652 0.8580 20.7886 19.9692 0.8148 19.7548 20.0651	Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265 1/(4) = 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains Ext temp. Heat loss rate	132.3072 619.3905 	240.7592 724.2445 ture (heati: 	3.2 7.4 3.2 3.7 6.6 6.6 363.4008 829.3336 ang season) in the livitiving area, Mar 60.0010 5.0001 0.9135 20.5666 19.9542 0.8913 19.4451 19.7817 19.7817	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 May 0.5860 586.0263 11.7000 605.8361	Speci or	Jul 61.8169 5.1211 0.3262 20.9990 20.2869 Jul 0.2737 257.7862 16.6000 258.0335	or Tab 0 0 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982 19.9843 0.2843 19.9837 20.2882 Aug 0.3082 270.9248 16.4000 271.3754	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA = 20.2662 Sep 0.5290 425.0948 14.1000 433.9270	Factor Table 6 0.770 0.7	Nov 60.6489 5.0433 0.9643 20.3957 19.9265 4 / (4) = 19.5775 19.5775 Nov 0.9470 580.4765 7.1000 890.0794	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000 19.1303	(75) (76) (77) (78) (80) (83) (84) (85) (85) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains Ext temp. Heat loss rate Heat loss rate	132.3072 619.3905 all tempera arring heati actor for g Jan 59.6823 4.9788 ae 0.9823 20.0945 19.9493 action 19.1771 19.1771 19.1771 ang require Jan 0.9721 602.0912 4.3000 action 19.0000 kWh	240.7592 724.2445 ture (heating periods ains for livel peb 19.8412 4.9894 0.9624 20.2974 19.9517 0.9519 19.0730 19.4405 19.4405 ment Feb 0.9457 684.9197 4.9000 1051.2453 1.0000	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 363.4008 829.3336 360.0010 5.0001 0.9135 20.5666 19.9542 0.8913 19.4451 19.7817 19.7817	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Dem Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 May 0.5860 586.0263 11.7000 605.8361 1.0000	Speci or	Jul 61.8169 5.1211 0.3262 20.2869 20.2869 Jul 0.2737 257.7862 16.6000	or Tab 0 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982 19.9843 0.2843 19.9837 20.2882 20.2882 Aug 0.3082 270.9248 16.4000	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA = 20.2662 20.2662 Sep 0.5290 425.0948 14.1000	Oct 60.9780 5.0652 0.8148 19.7548 120.0651 20.0651	Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265 1/ (4) = 19.5775 19.5775 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000 19.1303	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (90) (91) (92) (93) (93)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2									(98)	/ (4) =	24.2357	(99)
8c. Space cooling requireme	ent											
Calculated for June, July a	and August.	See Table	10b					Com	Oat	Non	Dee	
Jan Ext. temp. 4.3000 Heat loss rate W	Feb 4.9000	Mar 6.5000	Apr 8.9000		Jun 14.6000			Sep 14.1000	0ct 10.6000	Nov 7.1000		
0.0000 Utilisation 0.0000 Useful loss 0.0000 Total gains 0.0000 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	657.8797 0.9680 636.8557 1084.1110 1.0000	0.9856 510.4310	0.9784 519.0078	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 kWh 0.0000 Space cooling	0.0000	0.0000	0.0000	0.0000	322.0238	392.7049	330.7517	0.0000	0.0000	0.0000	1045.4805	(104)
Cooled fraction Intermittency factor (Table			0.0000		0.0500	0.0500	0.0500		cooled area		0.4875	
0.0000 Space cooling kWh 0.0000	0.0000	0.0000	0.0000	0.0000	0.2500 39.2450	0.2500 47.8589	0.2500 40.3087	0.0000	0.0000	0.0000		
Space cooling Space cooling per m2	0.0000	0.0000	0.0000	0.0000	39.2430	47.0303	40.3007	0.0000	0.0000	0.0000	127.4127 2.0451	(107)
9b. Energy requirements											0 0000	(201)
Fraction of space heat from Fraction of space heat from Fraction of heat from commun Fraction of total space hee Factor for control and char Factor for control and char Distribution loss factor (1 Space heating:	n community unity Boile at from com rging methor ging methor	system rs munity Boil d (Table 4c d (Table 4c	ers (3)) for c (3)) for c	ommunity s	pace heatin						0.0000 1.0000 1.0000 1.0000 1.0000 1.0000	(302) (303a) (304a) (305) (305a)
Annual space heating requir Space heat from Boilers = Efficiency of secondary/sug Space heating fuel for seco	(98) x 1.00 oplementary	heating sy	stem in %	(from Tabl	e 4a or App	endix E)					1509.8848 1585.3790 0.0000 0.0000	(307a) (308)
Water heating Annual water heating requir Water heat from Boilers = 0 Electricity used for heat of Cooling System Energy Effic Space cooling (if there is Annual totals kWh/year	(64) x 1.00 distribution ciency Ration	n o		enter 0)							1630.3410 1711.8580 32.9724 12.1770 10.4634	(310a) (313) (314)
Electricity for pumps and f (BalancedWithHeatRecove mechanical ventilation f Total electricity for the & Electricity for lighting (o Total delivered energy for	ery, Databa Eans (SFP = above, kWh/ calculated	0.82 year	50)	.2500, SFP	= 0.8250)						169.3034 169.3034 281.3633 3758.3671	(331) (332)
10b. Fuel costs - using Tak												
Space heating from Boilers Space heating - secondary Water heating from Boilers Space cooling Mechanical ventilation fans Pumps and fans for heating Energy for lighting Additional standing charges Total energy cost	3						Fuel kWh/year 1585.3790 0.0000 1711.8580 10.4634 169.3034 0.0000 281.3633		Fuel price p/kWh 4.2400 0.0000 4.2400 13.1900 13.1900 0.0000 13.1900		Fuel cost f/year 67.2201 0.0000 72.5828 1.3801 22.3311 0.0000 37.1118 120.0000 320.6259	(340a) (341) (342a) (348) (349) (349) (350) (351)
11b. SAP rating - Community												
Energy cost deflator (Table Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band								255) x (256	(4) +	45.0] =	0.4200 1.2550 82.4926 82 B	(357) (358)
12b. Carbon dioxide emission	ons - Commu	nity heatin	g scheme									
Efficiency of heat source E							Energy kWh/year		ion factor kg CO2/kWh		Emissions kg CO2/year 95.0000	
Space heating from Boilers Electrical energy for heat Total CO2 associated with o	distributi	ystems					3470.7758 32.9724		0.2160 0.5190		749.6876 17.1127 766.8002	(367) (372)
(negative value allowed si Space and water heating Space cooling	ince DrEE <	- 15EE)					10.4634		0.5190		766.8002 5.4305	



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Pumps and fans
Energy for lighting
Total kg/year
CO2 emissions per m2
EI value
EI rating
EI band 87.8684 (378) 146.0276 (379) 1006.1267 (383) 16.1500 (384) 87.4351 (384a) 87 (385) B 169.3034 281.3633 0.5190 0.5190

Calculation of stars for heating and \mathtt{DHW}

Space heating energy efficiency = 4.452, stars = 4
Space heating environmental impact = 0.2387, stars = 4
Water heating energy efficiency
Water heating environmental impact 1.00 × 4.240 × 1.05 1.00 × 0.216 × 1.05 / 0.9500

4.452, stars = 4 0.2387, stars = 4



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014 1. Overall dwelling dimensions Volume (m2) (m) (m3) 62.3000 (1b) x 2.7000 (2b) = 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) secondary other main total m3 per hour Number of chimneys Number of open flues 0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0.0000 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires 0.0000 (7a) 0.0000 (7b) 0 * 40 = Air changes per hour 0.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 (8) Pressure test Measured/design q50 0.1500 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 3.7000 0.9250 Aug 3.2000 0.8000 Sep 3.3000 0.8250 Wind speed 4.2000 1.0500 4.0000 1.0000 3.7000 0.9250 3.5000 0.8750 3.5000 0.8750 3.8000 (22) 0.9500 (22a) Wind factor Adj infilt rate 0.1457 0.1388 0.1388 0.1283 0.1283 0.1145 0.1179 0.1110 0.1145 0.1214 0.1214 0.1318 (22b) 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) 73.9500 (23c) 0.2690 0.2690 0.2586 0.2586 0.2447 0.2482 0.2621 (25) Effective ac 0.2759 0.2413 0.2447 0.2517 0.2517 A x U K-value Element Gross Openings NetArea U-value m2 2.1000 24.2500 61.1500 27.6600 W/m2K 1.0000 0.9615 W/K 2.1000 23.3173 kJ/m2K kJ/K Front Door Windows (Uw = 1.00) External Wall 1 Corridor Wall (26) (27) (29a) 24.2500 85.4000 0.1600 29.7600 2.1000 0.2257 6.2438 (29a) Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U)
Party Floor 1
Party Ceilings 1 (31) (33) 115.1600 (26)...(30) + (32) = 62.3000 41.4451 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 13.9952 (36) (33) + (36) = Total fabric heat loss 55.4403 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) $$\rm Jan$$ Feb Mar Apr May (38)m 15.3171 14.9320 14.9320 14.3544 14.3544 Heat transfer coeff Jun 13.5842 Nov 13.9693 Dec 14.5469 (38) 70.7574 70.3723 70.3723 69.7947 69.7947 69.0245 69.2170 68.8319 69.0245 69.4096 69.9872 (39) 69.4096 Average = Sum(39)m / 12 = 69.6663 (39) Mar May 1.1203 Jun Aug 1.1048 Sep 1.1079 HLP (average) 1.1296 1.1203 1.1358 1.1296 1.1079 1.1110 1.1141 1.1141 1.1234 (40) 1.1182 (40) 31 28 31 30 30 31 31 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) Feb Jan Mar Apr Jun J111 Aug Sep Oct Nov Daily hot water use 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860 91.0681 (44) 130.7901 (45) 1302.5967 (45) Energy content (annual) Total = Sum(45)m = Distribution loss (46) 20.2577



18.2829

15.9395

15.2943

19.6185 (46)

12.2297

14.0338

13.1978

14.2014

16.5504 18.0660

CALCULA	ATION	OF EPU	JUS 13,	LIVIIOO	IONS AN	ח ארוואו	ARIEN	ENGI	U9 Jai	12014			
Water storage	loss:												
Store volume b) If manufa		lared less t	Factor is n	ot known .								3.0000	(47)
Hot water st	orage loss	factor from			iay)							0.0240	
Volume facto Temperature												3.4200 0.6000	
Enter (49) or Total storage	(54) in (55											0.1475	
-	4.5734		4.5734	4.4259	4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	4.5734	(56)
If cylinder co	4.5734	4.1308	4.5734		4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	4.5734	(57)
Primary loss Total heat rec					23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
	162.8872	143.2589	149.7218	133.2010	129.7978		109.3673					158.6259	
•		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000 months) = Si	0.0000 am(63)m =	0.0000	
Output from w/		143.2589	149.7218	133.2010	129.7978	114.9234	109.3673	121.3944	121.6138	138.1715	147.3779	158.6259	(64)
Heek mains for								Total pe	er year (kW	h/year) = Si	am (64) m =	1630.3410	(64)
Heat gains fro		59.3875		56.8828	56.1710	50.8055	49.3779	53.3769	53.0301	58.9553	61.5966	65.7564	(65)
5. Internal ga	ins (see Ta	able 5 and 5	āa)										
Metabolic gain													
(66)m		Feb 122.7517	Mar 122.7517	Apr 122.7517	May 122.7517	Jun 122.7517	Jul 122.7517	Aug 122.7517	Sep 122.7517	Oct 122.7517	Nov 122.7517	Dec 122.7517	(66)
Lighting gains	(calculate	ed in Append	dix L, equa	tion L9 or	L9a), also s	see Table 5		19.3058					
Appliances gai	ns (calcula	ated in Appe	endix L, eq	uation L13		so see Tab	le 5		25.9122	32.9015	38.4009	40.9369	
Cooking gains	(calculated	d in Appendi	ix L, equat:	ion L15 or		see Table		196.7766	203.7514	218.5999	237.3434	254.9597	(68)
		49.3210			49.3210		49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	
Losses e.g. ev	aporation	(negative va	alues) (Tab	le 5)									
Water heating			-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	(71)
Total internal		88.3742	84.4029	79.0039	75.4987	70.5632	66.3681	71.7431	73.6529	79.2410	85.5509	88.3822	(72)
		483.4853	465.9328	438.6960	410.9479	385.8601	371.0032	378.0638	393.5547	420.9806	451.5335	474.5171	(73)
6. Solar gains													
				rea	Solar flux		a		H.H.	Acces		Gains	
[Jan]				m2	Table 6a	Speci:	fic datá	Specific	data	facto	or	W	
[Jan]				m2	Table 6a W/m2	Speci: or '	fic data Table 6b	Specific or Tab	data le 6c		or		
Northeast			3.2	m2 000	12.9236		0.4500		.7000	facto Table (or 5d 00	W 9.0277	
Northeast East Southeast			3.2 7.4 3.2	m2 000 900 000	12.9236 22.3313 40.4699		0.4500 0.4500 0.4500	0 0 0	.7000 .7000 .7000	facto Table (0.770 0.770 0.770	or 5d 00 00	9.0277 36.5124 28.2700	(76) (77)
Northeast East			3.2	m2 000 900 000 500	12.9236		0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000	facto Table (0.770 0.770	or 6d 00 00 00	9.0277 36.5124	(76) (77) (78)
Northeast East Southeast South			3.2l 7.4 3.2l 3.7	m2 000 900 000 500	12.9236 22.3313 40.4699 50.9848		0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000 .7000 .7000	facto Table (0.770 0.770 0.770 0.770	or 6d 00 00 00	9.0277 36.5124 28.2700 41.7365	(76) (77) (78)
Northeast East Southeast South West			3.2: 7.4: 3.2: 3.7: 6.6:	m2 000 900 000 500	12.9236 22.3313 40.4699 50.9848 22.3313		0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.77(0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80)
Northeast East Southeast South			3.2: 7.4: 3.2: 3.7: 6.6:	m2 000 900 000 500	12.9236 22.3313 40.4699 50.9848 22.3313		0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.77(0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80)
Northeast East Southeast South West			3.2: 7.4: 3.2: 3.7: 6.6:	m2 000 900 000 500	12.9236 22.3313 40.4699 50.9848 22.3313		0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.77(0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains	147.7691 634.8523	242.2342 725.7195	3.2 ¹ 7.4 ¹ 3.2 ¹ 3.7 ¹ 6.6	m2 	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831	641.6272 1027.4873	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.77(0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains	147.7691 634.8523	242.2342 725.7195 ture (heatin	3.2: 7.4' 3.2: 3.7' 6.6' 361.7973 827.7301	m2 000 900 000 500 100 509.8524 948.5484	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831	641.6272 1027.4873	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.77(0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains	147.7691 634.8523 all temperat	242.2342 725.7195 ture (heatin	3.2: 7.4 3.2: 3.7: 6.6 361.7973 827.7301	m2 000 900 000 500 100 509.8524 948.5484	12.9236 22.3313 40.4699 50.9948 22.3313 590.8352 1001.7831	641.6272 1027.4873	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.77(0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains Total gains Total gains	147.7691 634.8523 all temperaturing heatinctor for ge	242.2342 725.7195 cure (heating periods : ains for liv Feb	3.2: 7.4 3.2: 3.7: 6.6 361.7973 827.7301 g season) in the living area, 1	m2 000 900 000 500 100 509.8524 948.5484 ang area fromil, m (see Apr	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9, 7 Table 9a) May	641.6272 1027.4873 Ph1 (C) Jun	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 0.77.3566	0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474	fact: Table (0.77	Dr 6d 00 00 00 00 00 00 00 00 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha	147.7691 634.8523 all temperaturing heating the total for general factor factor for general factor facto	242.2342 725.7195 cure (heating periods :	3.2 7.4 3.2 3.7 6.6 361.7973 827.7301 g season) in the living area, in the living area,	m2 000 900 000 500 100 509.8524 948.5484	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9, 7 Table 9a) May 61.9874	641.6272 1027.4873	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474	fact: Table 0 .77(0.77(0.77(0.77(0.77) 296.5908 717.5714	184.7814 636.3148	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa	147.7691 634.8523 all temperaturing heating the total for general factor factor for general factor facto	242.2342 725.7195 ture (heatir- ng periods : ains for liv Feb 61.4786	3.2: 7.4: 3.2: 3.7: 6.6: 361.7973 827.7301 ag season) in the living area, 11 Mar 61.4786	m2 000 900 000 500 509.8524 948.5484 	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 om Table 9, 7 Table 9a) May 61.9874 5.1325	641.6272 1027.4873 Th1 (C) Jun 62.6791	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566	0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474	fact: Table 0 0.77(0.77(0.77(0.77(0.77(0.77(4)714	Dr 66d 000 000 000 000 000 000 000 000 000	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha	147.7691 634.8523 wal temperaturing heating totor for general forms of 1.1440 5.0763	242.2342 725.7195 ture (heating periods sains for live Feb 61.4786 5.0986	3.22 7.44 3.21 3.71 6.66 361.7973 827.7301 In the living area, 1 Mar 61.4786 5.0986	m2 000 900 900 500 509.8524 948.5484 ang area from fin, (see Apr 61,9874 5.1325	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9, 1 Table 9a) May 61.9874 5.1325 0.5447	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786	0.4500 0.	0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474 Sep 62.6791 5.1786	fact: Table 6 0.77(0.77	Nov 62.3313 5.1554	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804	(76) (77) (78) (80) (83) (84) (85)
Northeast East Southeast South West 7. Mean intern Temperature du Utilisation fa tau alpha util living ar	147.7691 634.8523 all temperative tor for garage of 1.1440 5.0763 rea 0.9754 20.2355 19.9717	242.2342 725.7195 ture (heating periods sains for live Feb 61.4786 5.0986 0.9532 20.4069	3.2: 7.4 3.2: 3.7: 6.6 361.7973 827.7301 g season) in the living area, 1 Mar 61.4786 5.0986 0.8903	m2 000 900 000 509.8524 948.5484 ng area frc nil,m (see Apr 61.9874 5.1325 0.7423	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 Table 9a) May 61.9874 5.1325 0.5447 20.9808	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988	0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .3474 .3474 .3474 .3474 .3474 .3474	fact: Table 0 0.77(0.77	Nov 62.3313 5.1554 0.9449 20.5431	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017	(76) (77) (78) (80) (83) (84) (85)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h	147.7691 634.8523 all temperaturing heating to for gray Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717	242.2342 725.7195 ture (heatir- ng periods : ains for liv Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402	3.2: 7.4' 3.2: 3.7': 6.6' 361.7973 827.7301 ang season) In the living area, in Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627	m2 000 900 000 500 100 509.8524 948.5484 ang area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 590.8352 005447 20.9808 19.9843 0.4803	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681	0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .51786 .62.6791 .51786 .64731 .6	fact: Table 0.77(Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr	147.7691 634.8523 aal temperaturing heating tor for garanting of 1.1440 5.0763 rea 0.9754 20.2355 19.9717 rouse 0.9680 19.0027	242.2342 725.7195 ture (heating periods sains for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467	3.21 7.44 3.21 3.71 6.66 361.7973 827.7301 In the living area, 19 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978	m2 000 900 900 000 500 100 509.8524 948.5484 ng area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 590.8352 1001.7831 20.9808 19.9843 0.4803 19.9703	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .8ep 62.6791 5.1786 0.4731 .20.9929 19.9944 0.3937 19.9907 fLA =	fact: Table 6 0.77(0.77	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91)
Northeast East Southeast South West 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT 2 Living area fr MIT	147.7691 634.8523 all temperatering heating totor for garantic for	242.2342 725.7195 ture (heatir- ng periods : ains for liv Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402	3.2: 7.4' 3.2: 3.7': 6.6' 361.7973 827.7301 ang season) In the living area, in Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627	m2 000 900 000 500 100 509.8524 948.5484 ang area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 590.8352 005447 20.9808 19.9843 0.4803	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681	0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .8ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .0.3937 .19.9907	fact: Table 6 0.77(0.77	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr	147.7691 634.8523 wal temperation of the control of	242.2342 725.7195 ture (heating periods sining for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949	3.21 7.44 3.21 3.71 6.66 361.7973 827.7301 In the living area, 19 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978	m2 000 900 900 000 500 100 509.8524 948.5484 ng area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 590.8352 1001.7831 20.9808 19.9843 0.4803 19.9703	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .8ep 62.6791 5.1786 0.4731 .20.9929 19.9944 0.3937 19.9907 fLA =	fact: Table 6 0.77(0.77	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad Temperature ad	147.7691 634.8523 wal temperation of the control of	242.2342 725.7195 ture (heating periods sining for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949	3.2: 7.4 3.2: 3.7: 6.6 361.7973 827.7301 g season) in the living area, 1 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 000 509.8524 948.5484 100 101 102 103 104 105 107 107 107 107 107 107 107	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 20.2808 19.9843 0.4803 19.9703 20.2736	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944	Aug 62.8544 5.1903 0.2389 20.9998 19.9969 0.1641 19.9969 20.2979	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .85ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .3937 .19.9907 .614 = 20.2915	Oct 62.3313 5.1554 0.7953 20.8759 19.88745 Living area 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad Temperature ad	147.7691 634.8523 all temperatering heating for the sector for gardinal form of the sector for the sect	242.2342 725.7195 ture (heatir- ng periods : sins for liv Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949	3.22 7.44 3.2 3.77 6.6 361.7973 827.7301 ang season) in the living ying area, in Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 000 509.8524 948.5484 509.8524 948.5484 20.8929 19.8805 20.1844 20.1844	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 0 m Table 9, 1 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .85ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .3937 .19.9907 .614 = 20.2915	Oct 62.3313 5.1554 0.7953 20.8759 19.88745 Living area 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati	147.7691 634.8523 all temperaturing heating the control of the con	242.2342 725.7195 ture (heating periods sains for live periods for live p	3.2: 7.4' 3.2: 3.7': 6.6. 361.7973 827.7301 ang season) In the living area, in mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 000 509 8524 948.5484 100 100 100 100 100 100 100 100 100 1	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 7 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 Ch1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .85ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .3937 .19.9907 .614 = 20.2915	Oct 62.3313 5.1554 0.7953 20.8759 19.88745 Living area 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT	147.7691 634.8523 wal temperaturing heating to the following of the follow	242.2342 725.7195 ture (heating periods sains for live Feb 61.4786 5.0886 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949	3.22 7.4 3.2 3.7; 6.6 361.7973 827.7301 g season) in the living area, 1 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 900 000 500 100 509.8524 948.5484 ng area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805 20.1844 20.1844	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 20.8352 1001.7831 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 201.027.4873 201.026791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	Jul 62.5047 5.1670 0.4510 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	Aug 62.8544 5.1903 0.2389 20.9998 19.9969 0.1641 19.9969 20.2979	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .8ep 62.6791 5.1786 0.4731 .20.9929 19.9944 0.3937 19.9907 fLA = 20.2915 .20.2915	fact: Table 6 0.77(0.77(0.	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a/(4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati	147.7691 634.8523 all temperaturing heating the control of the con	242.2342 725.7195 ture (heating periods sains for live periods for live p	3.2: 7.4' 3.2: 3.7': 6.6. 361.7973 827.7301 ang season) In the living area, in mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 000 509 8524 948.5484 100 100 100 100 100 100 100 100 100 1	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 0m Table 9, 1 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 Ch1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .85ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .3937 .19.9907 .614 = 20.2915	Oct 62.3313 5.1554 0.7953 20.8759 19.88745 Living area 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains	147.7691 634.8523 all temperaturing heating the control of the con	242.2342 725.7195 ture (heating periods is ains for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949 19.5949 19.5949	3.2: 7.4' 3.2: 3.7': 6.6. 361.7973 827.7301 ang season) In the living area, in a season and a s	m2 000 900 000 509 8524 948.5484 100 900 900 100 900 100 900 900 900 90	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 7able 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 20.2944	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .8ep 62.6791 5.1786 0.4731 .20.9929 19.9944 0.3937 19.9907 fLA = 20.2915 .20.2915	fact: Table (Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains Ext temp. Heat loss rate Heat loss rates	147.7691 634.8523 all temperations of the property of the pro	242.2342 725.7195 ture (heating periods sains for live Feb 1.4786 5.0886 0.9532 0.4069 19.9768 0.9402 19.2467 19.5949	3.21 7.4 3.21 3.7: 6.6 361.7973 827.7301 g season) in the living area, in Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187 Mar 0.8609 712.6230 7.4000	m2 000 900 900 000 500 100 509.8524 948.5484 mg area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805 20.1844 20.1844 Apr 0.7030 666.8083 9.9000	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 590.8352 1001.7831 20.2736 20.2736 20.2736 May 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	Jul 62.5047 5.1670 0.4590 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 Jul 65.7194 17.9000	Aug 62.8544 5.1903 0.2389 20.9998 19.9969 20.2979 20.2979 20.2979	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 fLA = 20.2915 20.2915 20.2915	fact: Table 6 0.77(0.77(0	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4708 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 Dec 0.9695 579.2522 5.1000	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains Ext temp. Heat loss rate Heat loss rates	147.7691 634.8523 Lal temperation and the second a	242.2342 725.7195 ture (heating periods is ains for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949 19.5949 19.5949	3.21 7.4 3.21 3.7: 6.6 361.7973 827.7301 g season) in the living area, in Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187 Mar 0.8609 712.6230 7.4000	m2 000 900 900 000 500 100 509.8524 948.5484 mg area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805 20.1844 20.1844 Apr 0.7030 666.8083 9.9000	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 0m Table 9, 1 Table 9a) May 61.9874 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	Jul 62.5047 5.1670 0.4590 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 Jul 65.7194 17.9000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 fLA = 20.2915 20.2915 20.2915	fact: Table (Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4708 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 Dec 0.9695 579.2522 5.1000	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (93)
Northeast East Southeast South West 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains Ext temp. Heat loss rate	147.7691 634.8523 all temperate control of the con	242.2342 725.7195 ture (heating periods is ains for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949	3.2: 7.4' 3.2: 3.7': 6.6. 361.7973 827.7301 ang season) In the livir Ing area, ing ar	m2 000 900 000 500 100 509.8524 948.5484 100 100 100 100 100 100 100	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 7able 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736 May 0.4990 499.8940 13.0000 507.6619 1.0000	641.6272 1027.4873 201.027.4873 201.0282 201.0282 201.0282 201.0282 201.0282 201.0000 296.4944 0.0000	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 20.2944 17.9000 165.7194 17.9000 165.7338 0.0000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .8ep 62.6791 5.1786 0.4731 .20.9929 19.9944 0.3937 19.9907 fLA = 20.2915 .20.2915 .20.2915	fact: Table (Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345 0.0000 19.3345	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (93)
Northeast East Southeast South West Total gains Total gains Total gains Total gains Total gains Total gains The second gains Total gains The second gains Temperature and adjusted MIT Temperature and adjusted MIT Temperature and adjusted MIT Temperature and gains Temperat	147.7691 634.8523 all temperate control of the con	242.2342 725.7195 Ture (heatir 	3.2: 7.4' 3.2: 3.7': 6.6. 361.7973 827.7301 ang season) In the livir Ing area, ing ar	m2 000 900 900 000 509.8524 948.5484 509.8524 948.5484 0.6927 19.8805 20.1844 20.1844 Apr 0.7030 666.8083 9.9000 717.7945	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 7able 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736 May 0.4990 499.8940 13.0000 507.6619 1.0000	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 20.2944 20.2944 17.9000 165.7338	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .51786 .62.6791 .51786 .64731 .64	fact: Table (Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(76) (77) (77) (78) (80) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97a)

09 Jan 2014

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014 Space heating per m2 (98) / (4) = 19.0844 (99) 8c. Space cooling requirement Calculated for June, July and August. See Table 10b May Jun Jul 13.0000 16.0000 17.9000 Jan Feb Mar Apr 5.1000 5.6000 7.4000 9.9000 Sep 15.2000 Nov 8.0000 Dec 5.1000 17.8000 11.6000 Heat loss rate W Heat loss rate W 0.0000 0.0000 0.0000 Utilisation 0.0000 0.0000 0.0000 Useful loss 0.0000 0.0000 Total gains 0.0000 0.0000 Month fracti 0.0000 0.0000 Space cooling kWh 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 552.1957 422.2238 0.0000 0.9876 0.9952 0.0000 545.3413 420.2077 426.7579 0.9935 423.9679 0.0000 (100) 0.0000 (101) 0.0000 (102) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1135.8139 1079.7279 1013.2730 0.0000 1.0000 1.0000 1.0000 0.0000 0.0000 0.0000 0.0000 (103) 0.0000 0.0000 0.0000 0.0000 0.0000 425.1403 490.6830 438.4430 0.0000 (104) 1354.2664 (104) fC = cooled area / (4) = 0.4875 (105) Space cooling 0.0000 0.0000 0.0000 0.2500 0.2500 0.2500 0.0000 0.0000 (106) 0.0000 0.0000 0.0000 0.0000 0.0000 51.8118 59.7995 53.4330 0.0000 0.0000 0.0000 0.0000 (107) 165.0444 (107) 2.6492 (108) Space cooling Space cooling per m2 9b. Energy requirements Fraction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from community system Fraction of heat from community Boilers Fraction of total space heat from community Boilers Fraction for control and charging method (Table 4c(3)) for community space heating Factor for control and charging method (Table 4c(3)) for community water heating Distribution loss factor (Table 12c) for community heating system Space heating: Annual space heating requirement 0.0000 (301) 1.0000 (302) 1.0000 (302) 1.0000 (303a) 1.0000 (304a) 1.0000 (305) 1.0000 (305a) 1.0500 (306) 1188.9587 (98) 1248.4066 (307a) 0.0000 (308) Annual space neating requirement Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) Space heating fuel for secondary/supplementary system Annual water heating requirement Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05 Electricity used for heat distribution Cooling System Energy Efficiency Ratio 1630.3410 (64) 1711.8580 (310a) 29.6026 (313) 12.1770 (314) Space cooling (if there is a fixed cooling system, if not enter 0) Annual totals kWh/year 13.5538 (315) Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8250) mechanical ventilation fans (SFP = 0.8250) Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L) Total delivered energy for all uses 169.3034 (330a) 169.3034 (331) 281.3633 (332) 3424.4851 (338) 10b. Fuel costs - using BEDF prices (424) Fuel price Fuel cost kWh/year 1248.4066 0.0000 fuer cost f/year 61.0471 (340a) 0.0000 (341) p/kWh 4.8900 Space heating from Boilers Space heating - secondary Water heating from Boilers Space cooling Mechanical ventilation fans 0.0000 1711.8580 13.5538 169.3034 83.7099 (342a) 2.1849 (348) 27.2917 (349) 4.8900 16.1200 16.1200 Pumps and fans for heating Energy for lighting Additional standing charges Total energy cost 0.0000 0.0000 0.0000 (349) 45.3558 (350) 281.3633 16.1200 12b. Carbon dioxide emissions - Community heating scheme Emission factor Emissions kg CO2/year 95.0000 (367a) 673.0707 (367) kWh/year Efficiency of heat source Boilers Space heating from Boilers Electrical energy for heat distribution Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE) Space and water heating Space cooling 3116.0680 0.5190 15.3638 (372) 688.4345 (373)

13b. Primary energy - Community heating scheme

Pumps and fans Energy for lighting Total kg/year

Primary energy kWh/year

688.4345 (376)

7.0344 (377) 87.8684 (378) 146.0276 (379) 929.3649 (383)

13.5538

0.5190

0.5190

Energy Primary energy factor Wh/year kg CO2/kWh

CALCULATION OF EPC C	OSTS, EM	ISSIONS A	ND PRIMARY EN	IERGY	09 Jan 2014	
Efficiency of heat source Boilers Space heating from Boilers Electrical energy for heat distributi Total CO2 associated with community s (negative value allowed since DFEE <	ystems			3116.0680 29.6026	1.2200 3.0700	95.0000 (367a) 3801.6030 (367) 90.8801 (372) 3892.4831 (373)
Space and water heating Space cooling Pumps and fans Energy for lighting Primary energy kWh/year Primary energy kWh/m2/year				13.5538 169.3034 281.3633	3.0700 3.0700 3.0700	3892.4831 (376) 41.6101 (377) 519.7613 (378) 863.7854 (379) 5317.6399 (383) 85.3554 (384)
SAP 2012 EPC IMPROVEMENTS						
Current energy efficiency rating: Current environmental impact rating:			B 82 B 87			
(For testing purposes):						
A B C D E Low energy lighting F G			Not considered Not considered Not considered Not considered Already installed Not considered Not considered			
H I J K M N Solar water heating O P R			Not considered Not considered Not considered Not considered Not considered Not applicable Not considered Not considered Not considered Not considered Not considered			
T U Solar photovoltaic panels A2 A3 T2 W X Y J2 Q2 Z1			Not considered Not applicable Not considered			
Z2 Z3 Z4 Z5 V2 Wind turbine L2			Not considered Not considered Not considered Not considered Not applicable Not considered			
Q3 03			Not considered Not considered			
Recommended measures: (none)	SAP change	Cost change	CO2 change			
			Energy Environment	al		
Recommended measures (none)	Typical an	nual savings	efficiency impact			
Total Savi Potential energy efficiency rating:	ngs £0	0.00 kg/	/m² B 82			
Potential environmental impact rating Fuel prices for cost data on this pag		revision numbe	B 87 er 424 TEST (27 Feb 2018	1)		
Recommendation texts revision number			Tallau).			
Typical heating and lighting costs of Electricity Community scheme	Current £75 £232	Potential £75 £	Saving			
Space heating Space cooling Water heating Lighting	£175 £2 £84 £45	£2 £ £84 £	0 0 0 0 0			
Total cost of fuels Total cost of uses Delivered energy Carbon dioxide emissions CO2 emissions per m ² Primary energy	£307 £306 55 kWh/m ² 0.9 tonnes 15 kg/m ² 85 kWh/m ²	£307 £306 55 kWh/m ² 0.9 tonnes 15 kg/m ² 85 kWh/m ²	£0 £0 0 kWh/m² 0.0 tonnes 0 kg/m² 0 kWh/m²			







CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014
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 EndTerrace Flat Yes SAP Region Front of dwelling faces Overshading Thermal mass parameter Thames Valley North Average or unknown 250.0 Night ventilation Ventilation rate during hot weather (ach) Yes 6.00 (Windows fully open) Overheating Calculation 333.06 (P1) Summer ventilation heat loss coefficient Transmission heat loss coefficient Summer heat loss coefficient 55.44 (37) 388.50 (P2) Overhangs Orientation Ratio Z overhangs Overhang type 0.000 0.000 0.000 North East East South East 1.000 None None South 0.000 1.000 None Solar shading Orientation Z blinds Solar access Z overhangs Z summer 0.900 (P8) 0.900 (P8) 0.900 (P8) 0.900 (P8) North East 0 90 1 000 1.000 0.90 1.000 East South East South 1.000 0.90 1.000 1.000 0.900 (P8) Solar flux Shading [Jul] Area FF Gains Specific data or Table 6b Table 6a W/m2 Specific data or Table 6c 0.7000 80.7052 3.2000 98.8453 0.4500 0.9000 North East 7.4900 3.2000 3.7500 6.6100 117.5071 119.9223 112.2060 117.5071 0.4500 0.4500 0.4500 0.4500 0.7000 0.7000 0.7000 0.7000 0.9000 0.9000 0.9000 0.9000 224.5646 97.9142 107.3601 198.1805 East South East South West total: 708.7247 Aug 635 378 Jun 750 709 371 (P3) Solar gains Internal gains Total summer gains 386 1080 1013 (P5) 2.92 2.78 Summer gain/loss ratio (P6) Summer external temperature
Thermal mass temperature increment (TMP = 250.0)
Threshold temperature
Likelihood of high internal temperature 16.00 0.25 19.17 Not significant 17.90 0.25 20.93 Slight 17.80 0.25 20.66 Slight (P7)

Slight



Assessment of likelihood of high internal temperature:



Example Full SAP Calculation - Green Scenario

Property Reference Unit 3				Issued on Date	25/09/2018
Survey Reference Green			Prop Type	Unit 3 - Mid Floor S	South
Property			Ref		
SAP Rating	82 B	DER	10.44	TER	27.95
Environmental	93 A	% DER <te< th=""><th>R</th><th>62.65</th><th></th></te<>	R	62.65	
COI Emissions (t/year)	0.56	DFEE	50.98	TFEE	55.50
General Requirements Compliance	Pass	%		8.15	
		DFEE <tfe< th=""><th>E</th><th></th><th></th></tfe<>	E		
Surveyor Jessica Finnigan, Tel: .				Surveyor ID	Admin
Client Almax, 5006835					

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)
                                                                                     26/09/2018
FullRefNo:
                                                                                      England
Reas Region:
SAP Region:
Postcode:
DwellingOrientation:
                                                                                      Thames Valley
                                                                                      Flat, End-Terrace
 Property Type:
Storeys:
Date Built:
Sheltered Sides:
Sunlight Shade:
                                                                                      2019
                                                                                     Average or unknown
Perimeter, Floor Area, Storey Height
38.58, 62.3, 2.7
18.7 m2, fraction: 30.0%
Simple calculation
Measurements
             1st Storev:
Living Area:
Thermal Mass:
Thermal Mass Simple:
Thermal MassValue:
                                                                                      Medium
                                                                                      250
                                                                                    250
Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal 61.15, 85.4, 0, Other, Cavity, 0, 0.16, Gross 27.66, 29.76, 0, Other, Cavity, 0.43, 0.225733634311512, Gross Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal Area, Kappa, Construction, Element 62.3, 0, Other Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal Area, Kappa, Construction, Element 62.3, 0
External Walls
External Wall 1
Corridor Wall
External Roofs
Party Ceilings
Party Ceilings 1
Heat Loss Floors
Party Floors
              Partv Floor 1
                                                                                    62.3, 0
Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
Manufacturer, Solid Door, , , , ,
Manufacturer, Window, Double glazed, , 0.45, , 0.7,
Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
Solid Door, Corridor Wall, North, , , , 0, 0, 0, 2.10,
Window, External Wall 1, East, , None, 0, , 0, 0, 7.49,
Window, External Wall 1, West, , None, 0, , 0, 0, 0, 6.61,
Window, External Wall 1, South, None, 0, , 0, 0, 0, 3.75,
Window, External Wall 1, South East, , None, 0, , 0, 0, 3.20,
Window, External Wall 1, North East, , None, 0, , 0, 0, 3.20,
None
Description
Front Door
Windows
Openings
Front Door
              East Windows
West Windows
South Windows
              South East Windows
North East Windows
Conservatory:
Draught Proofing:
Draught Lobby:
Thermal Bridges
                                                                                      Yes
              Bridging:
                                                                                      Calculate Bridges
                                                                                    Calculate Bridges
0.122
Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
External wall, E2 Other lintels (including other steel lintels), Table K1 - Approved, No, 10.23, 0.3, 0.3, 3.07,
External wall, E3 Sill, Table K1 - Approved, No, 10.23, 0.04, 0.04, 0.41,
External wall, E4 Jamb, Table K1 - Approved, No, 33.18, 0.05, 0.05, 1.66,
External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 57.22, 0.07, 0.07, 4.01,
External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Default, No, 19.94, 0.14, 0.14, 2.79,
External wall, E16 Corner (normal), Table K1 - Approved, No, 14.93, 0.09, 0.09, 1.34,
External wall, E17 Corner (inverted - internal area greater than external area), Table K1 - Default, No, 5.97, -0.09, -0.09, -
               List of Bridges
                                                                                      External wall, E17 Corner (inverted - internal area greater than external area), Table K1 - Default, No, 5.97, 0, 0.00,
                                                                                     External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 2.99, 0.06, 0.06, 0.18, External wall, E18 Party wall between dwellings, Table K1 - Default, No, 5.97, 0.12, 0.12, 0.72, External wall, E25 Staggered party wall between dwellings, Table K1 - Default, No, 2.99, 0.12, 0.12, 0.36,
10.
Pressure Test:
Designed q50:
                                                                                      True
Designed qoo:
AsBuilt q50:
Property Tested:
Mechanical Ventilation
MV System Present
Windows In Hot Weather
                                                                                      15
                                                                                      False
                                                                                      Windows fully open
              Cross Ventilation
Night Ventilation
Air Change Rate
Approved Installation
                                                                                      Yes
                                                                                      Yes
6.00
                                                                                      Yes
              DataType
                                                                                      Database
              Type
Database Ref Number
Configuration
                                                                                      Balanced mechanical ventilation with heat recovery
              HR Duct Insulated
                                                                                      Yes
              ManufacturerSFP
                                                                                      0.66
              DuctType
HR Efficiency
                                                                                     Rigid
87
Wet Rooms
Chimneys MHS:
```



SAP2012 - 9.92 input data (DesignData) -

```
Chimneys SHS:
Chimneys Other:
Chimneys Total:
Open Flues MHS:
Open Flues SHS:
Open Flues Other:
Open Flues Total:
Intermittent Fans:
Passive Vents:
Flueless Gas Fires:
Cooling System
Cooled Area
Data Source
                                                  30.37
Manufacturer
Split or Multi-Split
        Type
Type
Energy Efficiency Ratio
Control
Light Fittings:
LEL Fittings:
Percentage of LEL Fittings:
External Lights Fitted:
External LELs Fitted:
Electricity Tariff:
Main Heating 1
Main Heating 2
                                                  9.02
Modulating
                                                  100
                                                  Yes
Yes
Standard
                                                  None
Heating 2
Heating Systems Interaction
Smoke Control Area
Community Heating
                                                  None
                                                  Each system heats separate parts of dwelling Unknown
       Type
PCDF Index
Distribution Loss
Controls
Ctrl SAP Code
                                                  Space and Water Combined
                                                  n/a n/a system >= 1991, pre-insulated, low temp, variable flow CCL 2312
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency

Heat pump, Space and Water, 100, 500

Secondary Heating

None
Water Heating
                                                  CommunityHeating
        Type
        WHS
Low Water Usage
SAP Code
Showers in Property
                                                  HWP From main heating 1
                                                Non-electric only
        Snowers in Property
Hot Water Cylinder
Cylinder Type
Cylinder Insulation Type
Cylinder Volume
3.00
Cylinder Stat
Yes
                                                  HotWaterCylinder
Pipeworks Insulated Full:
Cylinder in Heated Space Yes
Flue Gas Heat Recovery System None
Waste Water Heat Recovery none
                                                  Fully insulated primary pipework
PV Unit
                                                  None
Wind Turbine
Terrain Type:
Small Scale Hydro
Special Features
                                                  Urban
                                                  None
                                                  None
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
Mid-floor flat, total floor area 62 m²
This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.
1a TER and DER
la TER and DER
Fuel for main heating:Electricity (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 27.95 kgCOU/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.44 kgCOU/m²OK
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.0 kWh/m²/yrOK
0.23 (max. 0.70)
                                                              1.00 (max. 3.30)
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
3 Air permeability
Air permeability at 50 pascals:
                                                                   3.00 (design value)
Maximum
                                                                  10.0
4 Heating efficiency
Main heating system:
                                                                  Community heating scheme
Secondary heating system:
                                                                  None
 5 Cylinder insulation
                                                                  Nominal cylinder loss: 0.25 kWh/day
Hot water storage
Permitted by DBSCG 0.35
Primary pipework insulated:
                                                                  Yes (assumed)
```



SAP2012 - 9.92 input data (DesignData) -

6 Controls Space heating controls:	Charging system linked to use of community heat	ing, programmer and at least two room statsOK
Hot water controls:	Cylinderstat	OK
7 Low energy lights Percentage of fixed lights with low-en Minimum	ergy fittings:100% 75%	OK
8 Mechanical ventilation Continuous supply and extract system Specific fan power: Maximum MVHR efficiency: Minimum:	0.66 1.5 87% 70%	ок ок
9 Summertime temperature Overheating risk (Thames Valley): Based on: Overshading: Windows facing North East: Windows facing East: Windows facing South East: Windows facing South:	Average 3.20 m², No overhang 7.49 m², No overhang 3.20 m², No overhang 3.75 m², No overhang 6.61 m², No overhang 6.00 ach None	OK
Door U-value Window U-value Air permeability	1.00 W/m²K 1.00 W/m²K 3.0 m²/m²h	



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014 1. Overall dwelling dimensions Volume (m2) (m) 62.3000 (1b) x 2.7000 (2b) = (m3) 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) other main secondary total m3 per hour Number of chimneys Number of open flues 0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0.0000 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires 0.0000 (7a) 0.0000 (7b) 0 * 40 = Air changes per hour 0.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 (8) Pressure test Measured/design q50 0.1500 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.1769 0.1734 0.1700 0.1526 0.1492 0.1318 0.1318 0.1283 0.1388 0.1492 0.1561 0.1630 (22b) 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) 73.9500 (23c) 0.3037 0.3002 0.2829 0.2794 0.2621 0.2621 0.2586 0.2933 (25) Effective ac 0.3072 0.2690 0.2794 0.2863 A x U K-value Element Gross Openings NetArea U-value m2 2.1000 24.2500 61.1500 27.6600 W/m2K 1.0000 0.9615 W/K 2.1000 23.3173 kJ/m2K kJ/K Front Door Windows (Uw = 1.00) External Wall 1 Corridor Wall (26) (27) (29a) 85.4000 0.1600 29.7600 2.1000 0.2257 6.2438 (29a) Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U)
Party Floor 1
Party Ceilings 1 (31) (33) 115.1600 (26)...(30) + (32) = 62.3000 41.4451 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 13.9952 (36) (33) + (36) = 55.4403 (37) Total fabric heat loss Jan
(38)m 17.0500
Heat transfer coeff Jun 14.5469 Jul 14.5469 Oct 15.5096 Nov 15.8947 Sep 14.9320 Dec 16.2798 (38) 72.4903 72.2978 72.1052 71.1425 70.9499 69.9872 69.9872 69.7947 70.3723 70.9499 71.3350 71.7201 (39) Average = Sum(39)m / 12 = Mar May 1.1388 Jun Aug 1.1203 HLP (average) 1.1574 1.1419 1.1296 1.1636 1.1605 1.1234 1.1234 1.1388 1.1450 1.1512 (40) 1.1412 (40) 31 28 31 30 31 30 31 31 30 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) Feb Jan Mar Apr Mav Jun J111 Aug Sep Oct Nov Dec Daily hot water use 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860 91.0681 (44) 130.7901 (45) 1302.5967 (45) Energy content (annual) Total = Sum(45)m = Distribution loss (46) 20.2577



18.2829

15.9395

15.2943

19.6185 (46)

12.2297

14.0338

13.1978

14.2014

16.5504 18.0660

CALCULA	ATION C	OF DWE	LLING E	EMISSIO	NS FOR	REGUL	ATIONS	COMP	LIANCE	09 Ja	an 2014		
Water storage Store volume b) If manufa Hot water st	cturer dec	factor from			lay)							3.0000	
Volume facto Temperature Enter (49) or Total storage	factor from (54) in (5	m Table 2b										3.4200 0.6000 0.1475	(53)
If cylinder co	4.5734	4.1308 icated sola	4.5734 r storage	4.4259	4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	4.5734	(56)
-		4.1308		4.4259 22.5120	4.5734 23.2624	4.4259 22.5120	4.5734 23.2624	4.5734 23.2624	4.4259 22.5120	4.5734 23.2624	4.4259 22.5120	4.5734 23.2624	
	162.8872	143.2589	149.7218	133.2010	129.7978	114.9234	109.3673	121.3944		138.1715		158.6259	
Solar input Output from w/	0.0000 h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 Solar inp	0.0000 ut (sum of	0.0000 months) = Si	0.0000 um(63)m =	0.0000	
		143.2589	149.7218	133.2010	129.7978	114.9234	109.3673			138.1715 Wh/year) = St			
Heat gains fro	67.1732	59.3875		56.8828	56.1710	50.8055	49.3779	53.3769	53.0301	58.9553	61.5966	65.7564	(65)
5. Internal ga													
Metabolic gain	s (Table 5), Watts							0.	0			
(66)m Lighting gains		102.2931			May 102.2931 L9a), also			Aug 102.2931	Sep 102.2931	Oct 102.2931	Nov 102.2931	Dec 102.2931	(66)
Appliances gains	15.9320	14.1506	11.5081	8.7123	6.5126	5.4982	5.9410	7.7223	10.3649	13.1606	15.3604	16.3748	(67)
	178.7081	180.5625	175.8894	165.9409	153.3827	141.5798	133.6947	131.8403	136.5134	146.4619	159.0201	170.8230	(68)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	
Losses e.g. ev	-81.8345	-81.8345		-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	(71)
Water heating Total internal	90.2866		84.4029	79.0039	75.4987	70.5632	66.3681	71.7431	73.6529	79.2410	85.5509	88.3822	(72)
Total Internal		336.7753	325.4883	307.3451	289.0819	271.3291	259.6918	264.9937	274.2191	292.5514	313.6192	329.2679	(73)
6. Solar gains													
[Jan]			A	rea	Solar flux		g		FF	Acce:		Gains	
				m2	Table 6a W/m2	or	fic data Table 6b		data	fact Table	or	W	
Northeast East Southeast South West			3.2 7.4 3.2 3.7 6.6	2000 1900 2000 2500	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	or '	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500	or Tab: 0 0 0 0 0	data	fact	or 6d 00 00 00 00		(75) (76) (77) (78)
East Southeast South West 		240.7592	3.2 7.4 3.2 3.7 6.6	2000 1900 2000 2500	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	or '	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500	or Tab. 0 0 0 0 0 0 0 0 0 500.9302	data le 6c .7000 .7000 .7000 .7000 .7000	factor Table (0.77)	or 6d 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(75) (76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains	132.3072 470.9218	240.7592 577.5345	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891	1000 1900 1000 1500 1100	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	or '	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754	or Tab. 0 0 0 0 0 0 0 0 0 500.9302	data le 6c .7000 .7000 .7000 .7000 .7000	factor Table (0.77)	or 6d 00 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(75) (76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern	132.3072 470.9218 al tempera	240.7592 577.5345 ture (heati	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891	0000 1900 1000 1500 1100 495,9646 803,3096	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543	597.3924 868.7216	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 830.5671	or Tab:	data le 6c .7000 .7000 .7000 .7000 .7000	factor Table (0.77)	or 6d 00 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(75) (76) (77) (78) (80) (83) (84)
Northeast East South West South Total gains Total gains Total gains Tuesperature du Utilisation fa tau alpha	132.3072 470.9218 all temperal arring heatin totor for gr Jan 59.6823 4.9788	240.7592 577.5345 ture (heati	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891	0000 1900 1000 1500 1100 495,9646 803,3096	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780	597.3924 868.7216	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 830.5671	or Tab:	data le 6c .7000 .7000 .7000 .7000 .7000	factor Table (0.77)	or 6d 00 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829	(75) (76) (77) (78) (80) (83) (84)
Northeast East South West South Total gains Total gains Total gains Tuesperature du Utilisation fa tau alpha	132.3072 470.9218 all temperal arring heatin totor for gr Jan 59.6823 4.9788	240.7592 577.5345 ture (heati 	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 		W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780	597.3924 868.7216 Th1 (C) Jun 61.8169	fic data Table 6b	or Tab: 0 0 0 0 0 7 500.9302 765.9239	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103	factor Table 0.771	or 6d 00 00 00 00 00 00 161.4436 475.0629	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains	132.3072 470.9218 all temperar- uring heatis sector for gr Jan 59.6823 4.9788	240.7592 577.5345 ture (heati 	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 	495.9646 803.3096	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780 5.0652 0.6981	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211	fic data Table 6b	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986	factor Table 10 . 777	00 00 00 00 00 00 00 161.4436 475.0629 Nov 60.6489 5.0433 0.9871 20.2115	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452	(75) (76) (77) (78) (80) (83) (84) (85)
Northeast East South West South West Solar gains Total	132.3072 470.9218 aal tempera arring heatin tetor for gr Jan 59.6823 4.9788 rea 0.9944 19.8838 19.9493 nouse 0.9926	240.7592 577.5345 ture (heati 	3.2 7.4 3.2 3.7 6.6 3.63.4008 688.8891 ang season) in the liviting area, Mar 60.0010 5.0001 0.9539 20.4153 19.9542 0.9400		W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 mm Table 9, 'Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302	Jul 61.8169 5.1211 0.3693 0.4590 0.4500 0.45	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325 0.4164 20.9967 19.9843 0.3259	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852	Cott 60,9780 5.0652 0.9229 20.6779 19.9692 0.8930	Nov 60.6489 5.0433 0.9871 20.2115 19.9642	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946	(75) (76) (77) (78) (80) (83) (84) (85)
Northeast East South West South West Total gains Total	132.3072 470.9218 all temperaristic of for graph of the sea 19.6823 4.9788 rea 0.9944 19.8838 19.9493 19.9493 19.926 18.4803 raction	240.7592 577.5345 ture (heati- 	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 ang season) in the livi ving area, Mar 60.0010 5.0001 0.9539 20.4153 19.9542 0.9400 19.2429	495.9646 803.3096 495.9646 803.3096 495.9646 803.3096 0.8623 20.7462 19.9667 0.8263 19.6936	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081	597.3924 868.7216 Ph1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752	Jul 61.8169 5.1211 0.2846 19.9812	Or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852 19.9476 fLA =	Cot 60.9780 5.0652 0.9229 20.6779 19.9692 0.8930 19.6217 Elving are.	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) =	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (90)
Northeast East South West South West Solar gains Total	132.3072 470.9218 132.3072 470.9218 134 135.6823 4.9788 14.9788 19.9493 19.8838 19.9493 10.9926 18.4803 18.2015 18.9015	240.7592 577.5345 ture (heati ng periods ains for li Feb 59.8412 4.9894 0.9845 20.1041 19.9517 0.9797 18.8005 19.1918	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 in the livi ving area, Mar 60.0010 5.0001 0.9539 20.4153 19.9542 0.9400 19.2429 19.5948		W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, 7 Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302	Jul 61.8169 5.1211 0.3693 0.4590 0.4500 0.45	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325 0.4164 20.9967 19.9843 0.3259	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852 19.9476	Oct 60.9780 5.0652 0.9229 20.6779 19.6217 Living area 19.9387	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) = 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000	(75) (76) (77) (78) (80) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East South West South West Solar gains Total	132.3072 470.9218 all temperariants for graphs of the second of the sec	240.7592 577.5345 ture (heati ng periods ains for li Feb 59.8412 4.9894 0.9845 20.1041 19.9517 0.9797 18.8005 19.1918	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 363.4008 688.8891 in the liviving area, Mar 60.0010 0.9539 20.4153 19.9542 0.9400 19.2429 19.5948		W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 mm Table 9, 'Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794	Jul 61.8169 5.1211 0.2846 0.2864 0.4500 0.45	or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852 19.9476 £LA = 20.2508	Oct 60.9780 5.0652 0.9229 20.6779 19.6217 Living area 19.9387	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) = 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East South West Southast South West Total gains Total g	132.3072 470.9218 wal temperarizing heating to the following temperary of	240.7592 577.5345 ture (heati ng periods ains for li Feb 59.8412 4.9894 0.9845 20.1041 19.9517 0.9797 18.8005 19.1918 19.1918	3.2 7.4 3.2 3.7 6.6 3.63.4008 688.8891	495.9646 803.3096 495.9646 803.3096 495.9646 803.3096 495.9646 803.3096 495.9642 0.8623 20.7462 19.9667 0.8263 19.6936 20.0095 20.0095	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794 20.2794	Jul 61.8169 5.1211 0.3693 20.9982 19.9812 20.2864	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325 0.4164 20.9967 19.9843 0.3259 19.9831 20.2873	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852 19.9476 fLA = 20.2508 20.2508	Oct 60.9780 5.0652 0.9229 20.6779 19.9692 19.9387	Nov 60.6489 5.0433 0.9871 20.215 19.9642 0.9822 18.9675 a / (4) = 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000 18.8557	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East South South West South West Total gains	132.3072 470.9218 all temperariants aring heatistor for gramma fo	240.7592 577.5345 ture (heati- ng periods ains for lire Feb 59.8412 4.9894 0.9845 20.1041 19.9517 0.9797 18.8005 19.1918 19.1918 19.1918 19.1918 19.1918	3.2 7.4 3.2 3.7 6.6 3.6 3.7 6.6 3.7 6.6 3.7 6.6 3.7 3.7 6.6 3.7 3.7 6.6 3.7 3.7 3.7 3.7 3.7 3.7 3.7 3.7 3.7 3.7	495.9646 803.3096 495.9646 803.3096 495.9646 803.3096 495.9646 803.3096 495.9642 0.8623 20.7462 19.9667 0.8263 19.6936 20.0095 20.0095	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794 20.2794	Jul 61.8169 5.1211 0.3693 20.9982 20.2864 20.2864	or Tab: 0 0 0 0 0 7 500.9302 765.9239 Aug 61.9874 5.1325 0.4164 20.9967 19.9843 0.3259 19.9831 20.2873 20.2873 Aug 0.3531 270.4626	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852 19.9476 20.2508 Sep 61.6086 46.4365	Cot 60.9780 5.0652 0.9229 20.6779 19.9692 0.8930 19.6217 19.9387	Nov 60,6489 5.0433 0.9871 20,2115 19,9642 0.9822 18,9675 2 / (4) = 19,3409 19,3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000 18.8557	(75) (76) (77) (78) (80) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East South South West	132.3072 470.9218 	240.7592 577.5345 ture (heati 	3.2 7.4 3.2 3.7 6.6 363.4008 688.8891 363.4008 688.8891 in the livi ving area, Mar 60.0010 0.9539 20.4153 19.9542 0.9400 19.2429 19.5948 19.5948 19.5948		W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 mm Table 9, 'Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794 20.2794 20.2794	Jul 61.8169 5.1211 0.3693 20.9982 19.9818 0.2864 Jul 0.3101 257.5564 16.6000 258.0032	or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986 0.6688 20.9576 flA = 20.2508 Sep 0.6086 416.4365 14.1000 432.8428	Cot 60.9780 5.0652 0.8930 19.9387 Oct 0.8920 0.8920 0.70,0549 10.6000 662,5807	Nov 60.6489 5.0433 0.9871 20.2115 19.9642 0.9822 18.9675 a / (4) = 19.3409 19.3409	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000 18.8557	(75) (76) (77) (78) (80) (83) (84) (85) (85) (86) (87) (92) (93) (93) (94) (95) (96) (97)
Northeast East South South West	132.3072 470.9218 all tempera: iring heati: ictor for gr Jan 59.6823 4.9788 rea 0.9944 19.8838 19.9493 icuse 0.9926 18.4803 raction 18.9015 ijustment 18.9015 ijustment 18.9015 cng require: Jan 0.9901 466.2492 4.3000 iw 1058.4700 1.0000 kWh	240.7592 577.5345 ture (heati- ng periods ains for li- Feb 0.9750 563,1095 4.9000	3.2 7.4 3.2 3.7 6.6 3.2 3.7 6.6 6 363.4008 688.8891 ang season) in the liviving area, Mar 60.0010 0.9539 20.4153 19.9542 0.9400 19.2429 19.5948 19.5948 19.5948 19.5948	495.9646 803.3096 495.9646 803.3096 495.9646 803.3096 495.9646 803.3096 495.9642 0.8623 20.7462 19.9667 0.8263 19.6936 20.0095 20.0095	W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 878.1543 m Table 9, Table 9a) May 60.9780 5.0652 0.6981 20.9292 19.9692 0.6366 19.9081 20.2146 20.2146 20.2146	597.3924 868.7216 Th1 (C) Jun 61.8169 5.1211 0.5071 20.9888 19.9818 0.4302 19.9752 20.2794 20.2794 Jun 0.4530 393.5200 14.6000	Jul 61.8169 5.1211 0.3693 20.9982 19.9812 20.2864 20.2864 Jul 0.3101 257.5564 16.6000	or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 684.2103 Sep 61.4786 5.0986 0.6688 20.9576 19.9768 0.5852 19.9476 20.2508 Sep 0.6086 46.4365 14.1000 432.8428 0.0000	Oct 60.9780 5.0652 0.9229 20.6779 19.9387 19.9387	Nov 60,6489 5.0433 0.9871 20,2115 19,9642 0.9822 19,3409 19,3409 Nov 0.9783 464,7465 7.1000	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 440.4829 21.0000 Dec 60.3232 5.0215 0.9959 19.8452 19.9592 0.9946 18.4314 0.3002 18.8557 0.0000 18.8557	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (87) (91) (92) (93) (94) (95) (96) (97) (97a) (98)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating	per m2									(98)	/ (4) =	31.4685	(99)
9a Cnaac acci													
8c. Space cool													
Calculated for	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp. Heat loss rate		4.9000	6.5000	8.9000		14.6000			14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000			0.0000	0.0000	657.8797 0.9680	517.9053 0.9856	530.4394 0.9784	0.0000	0.0000	0.0000	0.0000	
Useful loss Total gains	0.0000	0.0000	0.0000	0.0000		636.8557 1084.1110		519.0078 963.5666	0.0000	0.0000	0.0000	0.0000	
Month fracti Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	322.0238	392.7049	330.7517	0.0000	0.0000	0.0000	0.0000 1045.4805	
Cooled fractio		10b)							fC =	cooled area	/ (4) =	0.4875	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	39.2450	47.8589	40.3087	0.0000	0.0000	0.0000	0.0000	
Space cooling Space cooling	per m2											127.4127 2.0451	
9b. Energy req													
Fraction of sp Fraction of sp Fraction of he Fraction of to Factor for con Factor for con Distribution 1	ace heat from ace heat from at from commutal space heat trol and char trol and char	m secondary m community unity Heat at from con rging methor ging methor	y/supplement y system pump nmunity Heat od (Table 4d od (Table 4d	tary system t pump c(3)) for c c(3)) for c	(Table 11 ommunity s ommunity w	.) space heatin	ā					0.0000 1.0000 1.0000 1.0000 1.0000 1.0000	(302) (303a) (304a) (305) (305a)
Space heating: Annual space h Space heat fro Efficiency of Space heating	m Heat pump = secondary/sup	= (98) x 1. oplementary	y heating s	ystem in %	(from Tabl	e 4a or App	endix E)					1960.4853 2058.5096 0.0000 0.0000	(307a) (308)
Water heating Annual water h Water heat fro Electricity us Cooling System Space cooling Annual totals	m Heat pump = ed for heat o Energy Effic (if there is	= (64) x 1. distributio ciency Rati	on Lo		enter 0)							1630.3410 1711.8580 37.7037 12.1770 10.4634	(310a) (313) (314)
	ithHeatRecove ventilation f ity for the a r lighting (ery, Databa fans (SFP = above, kWh, calculated	= 0.83 /year	250)	.2500, SFP	P = 0.8250)						169.3034 169.3034 281.3633 4231.4977	(331) (332)
12b. Carbon di				-					Pmic-	ion factor		Pminoier-	
=======================================								Energy kWh/year		ion factor kg CO2/kWh	k	Emissions g CO2/year	
Efficiency of Space heating Electrical ene Total CO2 asso	from Heat pun rgy for heat ciated with o	mp distributi community s	systems					754.0735 37.7037		0.5190 0.5190		500.0000 391.3642 19.5682 410.9324	(367) (372)
(negative val Space and wate		ince Dree <	(= TFEE)									410.9324	
Space cooling Pumps and fans								10.4634 169.3034		0.5190 0.5190		5.4305 87.8684	(378)
Energy for lig Total CO2, kg/								281.3633		0.5190		146.0276 650.2589	
Dwelling Carbo	n Dioxide Emi	ission Rate	e (DER)									10.4400	(384)
16 CO2 EMISSIO	NS ASSOCIATEI	WITH APPI	LIANCES AND	COOKING AN	D SITE-WID	DE ELECTRICI	TY GENERATI	ON TECHNOLOG	IES				
DER Total Floor Ar	ea										TFA	10.4400 62.3000	
Assumed number CO2 emission f CO2 emissions CO2 emissions Total CO2 emis Residual CO2 e Additional all	actor in Tabl from appliand from cooking, sions missions offs owable electr	le 12 for e ces, equation equation set from bi ricity gene	ion (L14) (L16) iofuel CHP eration, kWl	h/m²/year							N EF	2.0459 0.5190 16.9982 2.6982 30.1364 0.0000 0.0000	ZC2 ZC3 ZC4 ZC5 ZC6
Resulting CO2 Net CO2 emissi		tset from a	additional a	allowable e	Lectricity	generation						0.0000 30.1364	



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014 1. Overall dwelling dimensions Volume (m2) (m) 62.3000 (1b) x 2.7000 (2b) = (m3) 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) other main secondary total m3 per hour 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 0 * 40 = 0.0000 (7c) Air changes per hour 20.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.1189 (8) Pressure test Measured/design q50 0.3689 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 1.2500 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.3754 0.4351 0.4265 0.4180 0.3668 0.3242 0.3242 0.3156 0.3412 0.3668 0.3839 0.4009 (22b) Effective ac 0.5804 (25) 3. Heat losses and heat loss parameter Openings A x U W/K 2.1000 Element Gross NetArea U-value K-value m2 2.1000 13.4700 71.9300 W/m2K 1.0000 1.3258 (26) TER Opaque door TER Opening Type (Uw = 1.40) External Wall 1 17.8580 12.9474 (27) (29a) 13.4700 85.4000 0.1800 EXTERNAL Wall I Corridor Wall Total net area of external elements Aum(A, m2) Fabric heat loss, W/K = Sum (A x U) 27.6600 0.1800 115.1600 (26)...(30) + (32) = 2.1000 4.9788 (29a) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) Total fabric heat loss 250.0000 (35) 9.0693 (36) (33) + (36) = Ventilation heat loss calculated monthly $(38) m = 0.33 \times (25) m \times (5)$ Jan Feb Mar Apr May Jan
(38)m 33.0082
Heat transfer coeff Feb 32.8042 Apr 31.6650 Aug 30.5198 32.6043 31.4893 31.8448 32.2164 (38) 79.7577 79.1699 (39) 78.6176 (39) 79.5577 78.6185 78.4428 77.6247 77.4732 77.9398 78.4428 78.7983 79.9617 Average = Sum(39)m / 12 = 77.6247 Dec 1.2708 (40) 1.2619 (40) Jan 1.2835 Feb 1.2802 Mar 1.2770 Jun 1.2460 Jul 1.2460 Aug 1.2436 Nov 1.2648 May 1.2591 Apr 1.2619 HLP (average) Days in month 31 3.0 3.0 31 31 31 3.0 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) 2.0459 (42) 82.7892 (43) Feb Jul May Jun Sep Oct Apr Aug Nov Daily hot water use 91.0681
Energy conte 135.0514
Energy content (annual) 87.7566 84.4450 81.1334 74.5103 74.5103 77.8219 81.1334 84.4450 87.7566 91.0681 (44) 110.3357 120.4400 Total = Sum(45)m = Distribution loss (46)m = 0.15 x (45)m 20.2577 17.7175 18.2829 15.9395 15.2943 13.1978 12.2297 14.0338 14.2014 16.5504 18.0660 19.6185 (46) Water storage loss: 3.0000 (47) 0.2602 (48) 0.5400 (49) Store volume a) If manufacturer declared loss factor is known $% \left(kWh/day\right) :$ Temperature factor from Table 2b Enter (49) or (54) in (55) Total storage loss 0.1405 (55)



CALCUL	ATION (OF TAR	GET EMI	SSIONS	S 09 J	an 2014							
If cylinder c	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
Primary loss	4.3553 23.2624	3.9338 21.0112	4.3553 23.2624	4.2148 22.5120	23.2624	4.2148 22.5120	4.3553 23.2624	4.3553 23.2624	4.2148 22.5120	4.3553 23.2624	4.2148 22.5120	4.3553 23.2624	
Total heat re-			149.5037 0.0000			114.7123 0.0000	109.1491 0.0000	0.0000	0.0000	137.9534 0.0000	0.0000	0.0000	(63)
Output from w		143.0618	149.5037	132.9899	129.5797	114.7123	109.1491	_		months) = Su 137.9534		0.0000	
Heat gains fr		ating, kWh/		56.7139	55.9965	50.6366	49.2034	Total po	er year (kW 52.8612	h/year) = Su 58.7808	im (64) m = 61.4277	1627.7725 65.5818	
	00.3307	03.2230	02.0212	30.7233	00.3300	30.0300	13.2001	00.2021	02.0012	30.7000	01.1277	00.0010	(00)
5. Internal g	ains (see T	able 5 and	5a)										
Metabolic gai			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gain	102.2931 s (calculat	102.2931 ed in Apper	102.2931 ndix L, equa	102.2931 tion L9 or	102.2931 L9a), also s	102.2931 see Table 5	102.2931	102.2931	102.2931	102.2931	102.2931	102.2931	
Appliances ga	ins (calcul	ated in App	oendix L, eq	uation L13	6.5193 or L13a), a 153.3827	lso see Tab		7.7303 131.8403	10.3756 136.5134	13.1741 146.4619	15.3762 159.0201	16.3916 170.8230	
Cooking gains	(calculate 33.2293		dix L, equat	ion L15 or 33.2293	L15a), also 33.2293			33.2293	33.2293	33.2293	33.2293	33.2293	
Pumps, fans Losses e.g. e			3.0000 values) (Tab -81.8345		3.0000 -81.8345	3.0000 -81.8345	3.0000 -81.8345	3.0000 -81.8345	3.0000	3.0000 -81.8345	3.0000	3.0000 -81.8345	
Water heating	gains (Tab 90.0521		84.1683	78.7693	75.2641	70.3286	66.1335	71.5085	73.4183	79.0064	85.3163	88.1476	
Total interna		339.5553	328.2655	310.1195	291.8541	274.1002	262.4633	267.7671	276.9952	295.3304	316.4005	332.0502	(73)
6. Solar gain	s												
[Jan]				rea m2		Speci or	g fic data Table 6b		FF data le 6c	Acces facto Table 6	or	Gains W	
Northeast East			1.7 4.1	800	11.2829 19.6403		0.6300 0.6300	0	.7000 .7000	0.770		6.1378 24.9697	
Southeast South West			1.7 2.0 3.6	800	36.7938 46.7521 19.6403		0.6300 0.6300 0.6300	0	.7000 .7000 .7000	0.770 0.770 0.770	00	20.0155 29.7191 22.0285	(78)
Solar gains Total gains	102.8706 444.2670		282.5676 610.8332	385.6622 695.7817		464.5544 738.6546	443.9311 706.3944	389.5293 657.2963	318.8006 595.7958	214.5395 509.8699	125.5254 441.9259	86.4706 418.5208	
7. Mean inter	nal tempera	ture (heati	ing season)										
Temperature d	uring heati	ng periods	in the livi	ng area fro	m Table 9, 5							21.0000	(85)
tau	Jan 54.1058	Feb 54.2442	Mar 54.3805	Apr 55.0302	May 55.1534	Jun 55.7347	Jul 55.7347 4.7156	Aug 55.8436	Sep 55.5093	Oct 55.1534 4.6769	Nov 54.9046	Dec 54.6469	
alpha util living a	4.6071 rea 0.9958	4.6163 0.9903	4.6254 0.9744	4.6687 0.9249	4.6769 0.8123	4.7156 0.6347	0.4753	4.7229 0.5280	4.7006 0.7799	0.9553	4.6603 0.9913	4.6431 0.9968	(86)
MIT	19.6858	19.8772	20.1773	20.5453	20.8221	20.9586	20.9914	20.9862	20.8917	20.5141	20.0295		
Th 2 util rest of	19.8538 nouse 0.9944		19.8589	19.8708	19.8730	19.8834	19.8834	19.8853	0.6939	19.8730	19.8685		
MIT 2 Living area f			18.8383	19.3584	19.7088	19.8578	19.8805	19.8801		Living area		0.3002	(91)
MIT Temperature a adjusted MIT			19.2402	19.7147	20.0430	20.1882	20.2139	20.2121	20.1271	19.6853 19.6853	19.0547	0.0000	
8. Space heat	ing require	ment											
Utilisation	Jan 0.9921	Feb 0.9830	Mar 0.9595	Apr 0.8951	May 0.7635	Jun 0.5666	Jul 0.3940	Aug 0.4436	Sep 0.7149	Oct 0.9301	Nov 0.9842	Dec 0.9939	(94)
Useful gains Ext temp.	440.7561 4.3000	517.8223	586.0747		572.5970		278.3473 16.6000	291.5800	425.9349	474.2445 10.6000		415.9545	(95)
Month fracti	1142.9435 1.0000			850.2321 1.0000		433.7841 0.0000	280.5307 0.0000	295.3362 0.0000	469.7480 0.0000	712.6744 1.0000	942.0089 1.0000	1136.5459 1.0000	
Space heating Space heating		399.5359	318.0643	163.7684	60.8973	0.0000	0.0000	0.0000	0.0000	177.3918	365.0928	536.1200 2543.2979	
Space heating	per m2									(98)	/ (4) =	40.8234	
8c. Space coo													



Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Indiv											
Fraction of space heat from sec Fraction of space heat from mai Efficiency of main space heatin Efficiency of secondary/suppler Space heating requirement	condary/suppleme n system(s) ng system 1 (in	ntary system								0.0000 1.0000 93.5000 0.0000 2720.1048	(202) (206) (208)
Jan Feb Space heating requirement	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
522.4274 399.5 Space heating efficiency (main		163.7684	60.8973	0.0000	0.0000	0.0000	0.0000	177.3918	365.0928	536.1200	(98)
93.5000 93.5 Space heating fuel (main heating	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
558.7459 427.3 Water heating requirement		175.1534	65.1309	0.0000	0.0000	0.0000	0.0000	189.7239	390.4736	573.3903	(211)
	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											
162.6691 143.0 Efficiency of water heater	618 149.5037	132.9899	129.5797	114.7123	109.1491	121.1762	121.4027	137.9534	147.1668	158.4078 79.8000	
(217)m 87.7076 87.4 Fuel for water heating, kWh/mor		85.3702	82.9349	79.8000	79.8000	79.8000	79.8000	85.4856	87.1431	87.8144	
185.4674 163.6 Water heating fuel used		155.7803	156.2426	143.7497	136.7784	151.8499	152.1337	161.3762	168.8794	180.3892 1928.5947	
Annual totals kWh/year Space heating fuel - main syste Space heating fuel - secondary	em									2720.1048 0.0000	
Electricity for pumps and fans: central heating pump main heating flue fan Total electricity for the above Electricity for lighting (calcu Total delivered energy for all	e, kWh/year Llated in Append	ix L)								30.0000 45.0000 75.0000 281.6528 5005.3523	(230e) (231) (232)
12a. Carbon dioxide emissions -	Individual hea	ting 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 kWh/year 2720.1048 0.0000 1928.5947		ion factor kg CO2/kWh 0.2160 0.0000 0.2160	k	Emissions ag CO2/year 587.5426 0.0000 416.5765 1004.1191 38.9250	(263) (264) (265)
Energy for lighting Total CO2, kg/m2/year Emissions per m2 for space and Fuel factor (electricity) Emissions per m2 for lighting Emissions per m2 for pumps and Target Carbon Dioxide Emission	fans	6.1175 * 1.	55) + 2.346	4 + 0.6248,	rounded to	281.6528		0.5190		146.1778 1189.2219 16.1175 1.5500 2.3464 0.6248 27.9500	(268) (272) (272a) (272b) (272c)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) SAF ZOIZ MONAGHED FOR NEW BUILT (AS DESIGNED) (VESTOR 5.32, Samulary 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014 1. Overall dwelling dimensions Volume (m2) 62.3000 (1b) (m) x 2.7000 (2b) (m3) 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
Dwelling volume 62.3000 $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) =$ 168.2100 (5) other main secondary total m3 per hour 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 0 * 40 = 0.0000 (7c) Air changes per hour 20.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.1189 (8) Pressure test Measured/design q50 0.2689 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 1.2500 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.3171 0.3109 0.3047 0.2736 0.2674 0.2363 0.2363 0.2301 0.2487 0.2674 0.2798 0.2923 (22b) Effective ac 0.5464 3. Heat losses and heat loss parameter A x U W/K 2.1000 23.3173 9.7840 Openings Element Gross NetArea U-value K-value W/m2K 1.0000 0.9615 m2 2.1000 24.2500 61.1500 Front Door (26) Windows (Uw = 1.00) External Wall 1 (27) (29a) 24.2500 85.4000 0.1600 Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U) 29.7600 2.1000 27.6600 0.2257 6.2438 (29a) Party Floor 1 (32d) Party Ceilings 1 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) Total fabric heat loss 250.0000 (35) 13.9952 (36) 55.4403 (37) (33) + (36) = Aug 29.2239 Jan (38)m 30.5460 Heat transfer coeff Dec 30.1253 (38) 29.9279 29.3043 29.7390 29.3043 85.9863 Average = Sum(39)m / 12 85.8779 85 7717 85 2727 85 1793 84 7446 84 7446 84 6642 84 9121 85 1793 85.3682 85.5656 (39) 85.2722 (39) Feb 1.3785 Mar 1.3768 Jun 1.3603 Jul Oct 1.3672 Nov 1.3703 Apr 1.3687 May 1.3672 Aug 1.3590 Sep 1.3630 1.3802 1.3603 1.3734 (40) 1.3687 (40) HLP (average) Days in month 31 (41) 4. Water heating energy requirements (kWh/year) 2.0459 (42) 82.7892 (43) Assumed occupancy Average daily hot water use (litres/day) Feb Mar Jan Apr May Jun Jul Aug Sep Nov Daily hot water use 91.0681 87.7566 84.4450 81.1334 77.8219 74.5103 74.5103 77.8219 81.1334 84.4450 87.7566 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860
Energy content (2000) 91.0681 (44) 106.2632 101.9620 87.9855 81.5315 93.5586 94.6759 110.3357 120.4400 Total = Sum(45)m = 120.4400 130.7901 (45) 1302.5967 (45) Energy content (annual)
Distribution loss (46)m = 0.15 x (45)m
0.0000 0.0000 0 Water storage loss: Total storage 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 (56) If cylinder contains dedicated solar storage



CALCULA	ATION C	F FABF	RIC ENEI	RGY EF	FICIENC	CY 09	Jan 20	14					
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains fro	m water hea	ating, kWh/				18.6969	17.3254	19.8812	20.1186	23.4463	25.5935	27.7929	
5. Internal ga													
Metabolic gain	s (Table 5)	, Watts											
	102.2931				102.2931		Jul 102.2931	Aug 102.2931	Sep 102.2931	Oct 102.2931	Nov 102.2931	Dec 102.2931	(66)
Lighting gains	15.9320	14.1506	11.5081	8.7123	6.5126	5.4982		7.7223	10.3649	13.1606	15.3604	16.3748	(67)
	178.7081	180.5625	175.8894	165.9409	153.3827	141.5798	133.6947	131.8403	136.5134	146.4619	159.0201	170.8230	(68)
Cooking gains	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	33.2293	
Pumps, fans Losses e.g. ev	aporation (le 5)		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating	gains (Tabl	.e 5)			-81.8345			-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	
Total internal	gains		34.8129 275.8983		29.1222	25.9679 226.7339	23.2869	26.7220 219.9726	27.9426 228.5088	31.5139	35.5465 263.6149	37.3560 278.2417	
	200.9011	203.7320	273.0903	239.7036	242.7033	220.7339	210.0103	219.9720	220.3000	244.0243	203.0149	270.2417	(73)
6. Solar gains													
[Jan]			Aı	rea	Solar flux		a		FF	Acces		Gains	
				m2	Table 6a W/m2					facto Table (W	
Northeast East					11.2829 19.6403					0.770		7.8816 32.1124	
Southeast South			3.20	000	36.7938		0.4500	0	.7000	0.770	00	25.7021 38.2715	(77)
West			6.61	100	46.7521 19.6403		0.4500	0	.7000	0.77		28.3395	
Solar gains			363.4008		589.0724			500.9302		275.9194			
Total gains	419.2083	526.5112	639.2991	755.6681	831.7778	824.1263	787.4859	720.9028	638.5000	520.7437	425.0585	389.4568	(84)
7. Mean intern													
Temperature du												21.0000	(85)
Utilisation fa		ins for li		nil,m (see Apr		Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau alpha	50.3148 4.3543	50.3784 4.3586	50.4408 4.3627			51.0521 4.4035	51.0521 4.4035	51.1006 4.4067	50.9514 4.3968	50.7916 4.3861	50.6792 4.3786	50.5622 4.3708	
util living ar	ea 0.9967	0.9907	0.9726	0.9159	0.7939	0.6183	0.4641	0.5232	0.7781	0.9575	0.9928	0.9976	(86)
MIT Th 2	19.5269 19.7785	19.7539 19.7799	20.0996 19.7812	20.5076 19.7874	20.8089 19.7885	20.9524 19.7939	20.9892 19.7939	20.9821 19.7949	20.8707 19.7918	20.4384 19.7885	19.8918 19.7862	19.4805 19.7838	
util rest of h		0.9876	0.9630	0.8873	0.7307	0.5178	0.3417	0.3945	0.6874	0.9369	0.9898	0.9967	
MIT 2 Living area fr	18.4567 action	18.6830	19.0234	19.4135	19.6707	19.7745	19.7916	19.7905	19.7274 fLA =	19.3611 Living area	18.8264 a / (4) =	18.4145 0.3002	
MIT Temperature ad	18.7779 justment	19.0045	19.3464	19.7419	20.0124	20.1280	20.1511	20.1482	20.0706	19.6845	19.1462	18.7345 0.0000	(92)
adjusted MIT	18.7779	19.0045	19.3464	19.7419	20.0124	20.1280	20.1511	20.1482	20.0706	19.6845	19.1462	18.7345	(93)
O Conno booti													
8. Space heati													
Utilisation	Jan 0.9942	Feb 0.9849	Mar 0.9587	Apr 0.8860	May 0.7435	Jun 0.5470	Jul 0.3787	Aug 0.4335	Sep 0.7107	Oct 0.9347	Nov 0.9876	Dec 0.9957	(94)
Useful gains Ext temp.	416.7701 4.3000		612.9116			450.8295 14.6000		312.5032 16.4000	453.7749 14.1000	486.7401 10.6000		387.7809 4.2000	(95)
Month fracti	1244.9051	1211.2619	1101.8589	924.5184 1.0000	708.0422 1.0000	468.4704 0.0000	300.9335	317.3381 0.0000	506.9739 0.0000	773.8085 1.0000	1028.3587	1243.6533 1.0000	
Space heating		465.5110	363.7768	183.5724	66.6643	0.0000	0.0000	0.0000	0.0000	213.5788	438.1595	636.7690	
Space heating Space heating	per m2									(98)	/ (4) =	2984.1643 47.8999	
8c. Space cool	ing require	ement											
Calculated for					May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp. Heat loss rate	4.3000	4.9000	6.5000	8.9000		14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	796.5996 0.9051	627.1103 0.9472	643.4475 0.9269	0.0000	0.0000	0.0000	0.0000	
Useful loss Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	720.9957 1039.5158	594.0275 995.1790	596.4373 918.5455	0.0000	0.0000	0.0000	0.0000	(102) (103)
Month fracti Space cooling	0.0000 kWh	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014 Space cooling Cooled fraction Intermittency factor (Table 10b) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 229.3344 298.4567 239.6485 0.0000 0.0000 (104) 767.4396 (104) 1.0000 (105) 0.0000 0.0000 0.0000 fC = cooled area / (4) =0.0000 0.0000 0.0000 0.2500 0.2500 0.2500 0.0000 0.0000 0.0000 0.0000 (106) Space cooling kWh 0.0000 0.0000 0.0000 (107) 191.8599 (107) 3.0796 (108) 47.8999 (99) 3.0796 (108) 50.9795 (109) 51.0 (109) 0.0000 0.0000 0.0000 57.3336 74.6142 59.9121 0.0000 0.0000 0.0000 0.0000 0.0000 0.



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) ersion 9.52, c...._ 09 Jan 2014 CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 1. Overall dwelling dimensions Volume (m2) 62.3000 (1b) (m3) 168.2100 (1b) - (3b) (m) x 2.7000 (2b) Ground floor Total floor area TFA = $(1a) + (1b) + (1c) + (1d) + (1e) \dots (1n)$ Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) other main secondary total m3 per hour Number of chimneys Number of open flues 0 * 40 = 0 * 20 = 2 * 10 = 0 * 10 = 0.0000 (6a) 0.0000 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires 20.0000 (7a) 0.0000 0 * 40 = 0.0000 (7c) Air changes per hour 20.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.1189 (8) Pressure test Measured/design q50 0.3689 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Aug 3.7000 0.9250 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 1.2500 4.9000 1.2250 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.4351 0.4265 0.4180 0.3754 0.3668 0.3242 0.3242 0.3156 0.3412 0.3668 0.3839 0.4009 (22b) Effective ac 0.5804 (25) 3. Heat losses and heat loss parameter Openings A x U W/K 2.1000 Element Gross NetArea U-value K-value W/m2K 1.0000 1.3258 m2 2.1000 (26) TER Opaque door TER Opening Type (Uw = 1.40) External Wall 1 13.4700 71.9300 17.8580 12.9474 (27) (29a) 13.4700 85.4000 0.1800 EXTERNAL Wall I Corridor Wall Total net area of external elements Aum(A, m2) Fabric heat loss, W/K = Sum (A x U) 2.1000 27.6600 0.1800 4.9788 (29a) 115.1600 (26)...(30) + (32) = Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) Total fabric heat loss 250.0000 (35) 9.0693 (36) (33) + (36) = Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) Jan Feb Mar Apr May Jan
(38)m 33.0082
Heat transfer coeff Feb 32.8042 Apr 31.6650 Aug 30.5198 Oct 31.4893 32.6043 31.4893 31.8448 32.2164 (38) 77.6247 79.1699 (39) 78.6176 (39) 79.7577 79.5577 78.6185 78.4428 77.4732 77.9398 78.4428 78.7983 79.9617 Average = Sum(39)m / 12 = 77.6247 Aug 1.2436 Dec 1.2708 (40) 1.2619 (40) Jan 1.2835 Feb 1.2802 Mar 1.2770 May 1.2591 Jun 1.2460 Jul 1.2460 Nov 1.2648 Apr 1.2619 1.2591 HLP (average) Days in month 31 3.0 31 3.0 31 31 31 30 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) 2.0459 (42) 82.7892 (43) Jul Feb Mar May Jun Sep Oct Apr Aug Nov Daily hot water use 91.0681
Energy conte 135.0514
Energy content (annual) 87.7566 84.4450 81.1334 77.8219 74.5103 74.5103 77.8219 81.1334 84.4450 87.7566 91.0681 (44) 110.3357 120.4400 Total = Sum(45)m = 130.7901 (45) 1302.5967 (45) Distribution loss (46)m = 0.15 x (45)m 0.0000 0.0000 Water storage loss:
Total storage loss
0.0000 0.0000 0.0000 (46) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56) If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 (57) 0.0000 (59) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Primary loss



CALCULA	ATION C	OF TARC	GET FAB	RIC EN	IERGY E	FFICIEN	NCY (09 Jan 2	014				
Heat gains fro	m water hea	ating, kWh/ 25.0998	month 25.9008	22.5809	21.6669	18.6969	17.3254	19.8812	20.1186	23.4463	25.5935	27.7929	(65)
5. Internal ga	ins (see Ta	able 5 and	5a)										
Metabolic gain), Watts	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gains	102.2931	102.2931	102.2931	102.2931	102.2931	102.2931	102.2931		102.2931	102.2931	102.2931	102.2931	(66)
Appliances gai	15.9484	14.1652	11.5199	8.7213	6.5193	5.5038	5.9471	7.7303	10.3756	13.1741	15.3762	16.3916	(67)
Cooking gains	178.7081	180.5625	175.8894	165.9409	153.3827	141.5798	133.6947	131.8403	136.5134	146.4619	159.0201	170.8230	(68)
Pumps, fans	33.2293 0.0000	33.2293	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	33.2293	33.2293	33.2293 0.0000	33.2293 0.0000	33.2293 0.0000	
Losses e.g. ev			alues) (Tab: -81.8345		-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	(71)
Water heating	gains (Tab: 38.5732	le 5) 37.3509	34.8129	31.3624	29.1222	25.9679	23.2869	26.7220	27.9426	31.5139	35.5465	37.3560	(72)
Total internal	gains 286.9175	285.7665	275.9101	259.7125	242.7122	226.7395	216.6167	219.9805	228.5194	244.8379	263.6307	278.2586	(73)
6. Solar gains													
[Jan]			A	rea	Solar flux		a		FF	Acces		Gains	
				m2	Table 6a W/m2	or	Table 6b	Specific or Tab	le 6c	facto Table (W	
Northeast East Southeast South West			1.78 4.16 1.78 2.08 3.6	300 500 300 300 700	11.2829 19.6403 36.7938 46.7521 19.6403		0.6300 0.6300 0.6300 0.6300 0.6300	0 0 0 0	.7000 .7000 .7000 .7000 .7000	0.770 0.770 0.770 0.770 0.770	00 00 00	6.1378 24.9697 20.0155 29.7191 22.0285	(76) (77) (78)
Solar gains Total gains		187.1982 472.9647	282.5676	385.6622 645.3748	458.0780		443.9311		318.8006 547.3201	214.5395 459.3774	125.5254 389.1561	86.4706 364.7292	
Utilisation fa tau alpha util living ar	Jan 54.1058 4.6071	Feb 54.2442 4.6163	ving area, 1 Mar 54.3805 4.6254	Apr 55.0302 4.6687	May 55.1534 4.6769	Jun 55.7347 4.7156	Jul 55.7347 4.7156	Aug 55.8436 4.7229	Sep 55.5093 4.7006	Oct 55.1534 4.6769	Nov 54.9046 4.6603	Dec 54.6469 4.6431	
		0.9937	0.9817	0.9409	0.8400	0.6685	0.5057	0.5645	0.8173	0.9690	0.9948	0.9982	(86)
MIT	19.6070	19.8012	20.1081	20.4917	20.7918	20.9486	20.9888	20.9818	20.8661	20.4521	19.9543	19.5752	(87)
Th 2 util rest of h		19.8564	19.8589	19.8708	19.8730	19.8834	19.8834	19.8853	19.8794	19.8730	19.8685	19.8638	
MIT 2	0.9967 18.5952	0.9915 18.7903	0.9751 19.0954	0.9194 19.4732	0.7853 19.7388	0.5716 19.8612	0.3832 19.8808	0.4377 19.8805	0.7361 19.8089	0.9536 19.4454	0.9926 18.9532	0.9976 18.5713	(90)
Living area fr MIT Temperature ad	18.8989	19.0937	19.3993	19.7789	20.0549	20.1876	20.2134	20.2111	20.1263	Living area 19.7476	19.2537	0.3002 18.8726 0.0000	(92)
adjusted MIT		19.0937	19.3993	19.7789	20.0549	20.1876	20.2134	20.2111	20.1263	19.7476	19.2537	18.8726	
8. Space heati													
Utilisation Useful gains Ext temp. Heat loss rate	4.3000		Mar 0.9718 542.7030 6.5000	Apr 0.9173 592.0276 8.9000	May 0.7952 557.2476 11.7000	Jun 0.5995 414.4530 14.6000	Jul 0.4203 277.6236 16.6000	Aug 0.4761 290.2117 16.4000	Sep 0.7562 413.9034 14.1000	Oct 0.9514 437.0745 10.6000	Nov 0.9910 385.6594 7.1000	Dec 0.9968 363.5731 4.2000	(95)
	1167.3526		1026.2423	855.2823 1.0000	655.3800 1.0000	433.7358 0.0000	280.4874 0.0000	295.2550 0.0000	469.6849 0.0000	717.5596 1.0000	957.6920 1.0000	1161.6295 1.0000	
Space heating Space heating	579.7444	446.2293	359.7533	189.5433	73.0105	0.0000	0.0000	0.0000	0.0000	208.6809	411.8634	593.7539 2862.5791 45.9483	(98)
	•									(, (-,		(,
8c. Space cool													
Calculated for	Jan	Feb	Mar	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	
Utilisation Useful loss Total gains	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	729.6725 0.8940 652.3427 884.2646	574.4230 0.9421 541.1724 846.8178	588.7967 0.9214 542.5379 788.3565	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)
Month fracti Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling												577.2730	



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction								fC =	cooled area	/ (4) =	1.0000	(105)
Intermittency factor (Tab.	Le 10b)											
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	41.7459	56.8500	45.7223	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											144.3182	(107)
Space cooling per m2											2.3165	
Energy for space heating											45.9483	
Energy for space cooling											2.3165	
Total											48.2648	
Target Fabric Energy Effic	ciency (TFE	Ξ)									55.5	(109)



CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) CALCULATION OF HEAT DEMAND 1. Overall dwelling dimensions Volume (m2) (m) (m3) 62.3000 (1b) x 2.7000 (2b) = 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)...(ln)Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) secondary other main total m3 per hour Number of chimneys Number of open flues Number of intermittent fans Number of passive vents Number of flueless gas fires 0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0.0000 (6b) 0.0000 (7a) 0.0000 (7b) 0 * 40 = Air changes per hour 0.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 (8) Pressure test Measured/design q50 0.1500 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 3.7000 0.9250 Aug 3.2000 0.8000 Sep 3.3000 0.8250 Wind speed 4.2000 1.0500 4.0000 1.0000 3.7000 0.9250 3.5000 0.8750 3.5000 0.8750 3.8000 (22) 0.9500 (22a) Wind factor Adj infilt rate 0.1457 0.1388 0.1388 0.1283 0.1283 0.1145 0.1179 0.1110 0.1145 0.1214 0.1214 0.1318 (22b) 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) 73.9500 (23c) 0.2690 0.2690 0.2586 0.2586 0.2447 0.2482 0.2413 0.2621 (25) Effective ac 0.2759 0.2447 0.2517 0.2517 A x U K-value Element Gross Openings NetArea U-value W/m2K 1.0000 0.9615 W/K 2.1000 23.3173 m2 2.1000 24.2500 61.1500 27.6600 kJ/m2K kJ/K Front Door Windows (Uw = 1.00) External Wall 1 Corridor Wall (26) (27) (29a) 24.2500 85.4000 0.1600 29.7600 2.1000 0.2257 6.2438 (29a) Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U)
Party Floor 1
Party Ceilings 1 (31) (33) 115.1600 (26)...(30) + (32) = 62.3000 41.4451 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 13.9952 (36) (33) + (36) = Total fabric heat loss 55.4403 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) $$\rm Jan$$ Feb Mar Apr May (38)m 15.3171 14.9320 14.9320 14.3544 14.3544 Heat transfer coeff Jun 13.5842 Oct 13.9693 Nov 13.9693 Dec 14.5469 (38) 70.7574 70.3723 70.3723 69.7947 69.7947 69.0245 69.2170 68.8319 69.0245 69.4096 69.9872 (39) 69.4096 Average = Sum(39)m / 12 = 69.6663 (39) Mar May 1.1203 Jun HLP (average) 1.1296 1.1203 1.1048 1.1079 1.1358 1.1296 1.1079 1.1110 1.1141 1.1141 1.1234 (40) 1.1182 (40) 31 28 31 30 31 30 31 31 30 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) Feb Jan Mar Apr Jun J111 Aug Sep Oct Nov Daily hot water use 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860 91.0681 (44) 130.7901 (45) 1302.5967 (45) Energy content (annual) Total = Sum(45)m = Distribution loss (46) 20.2577 18.2829 15.9395 15.2943 12.2297 14.0338 14.2014 16.5504 18.0660 19.6185 (46)



CALCUL	ATION C			VID 0	9 Jan 20	1/							
CALCUL	ATION)	DEMAI	ND U	9 Jan 20	14							
Water storage Store volume												3.0000	(47)
b) If manufa Hot water st	torage loss	factor from			lay)							0.0240	
Volume factor Temperature Enter (49) or	factor from	m Table 2b										3.4200 0.6000	(53)
Total storage		4.1308	4.5734	4.4259	4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	0.1475 4.5734	
If cylinder co	ontains ded		r storage	4.4259		4.4259	4.5734	4.5734	4.4259		4.4259	4.5734	
Primary loss Total heat red	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	
Solar input	162.8872 0.0000	143.2589 0.0000	149.7218 0.0000	133.2010 0.0000	129.7978 0.0000	114.9234 0.0000	109.3673 0.0000	0.0000	0.0000	138.1715 0.0000	0.0000	158.6259 0.0000	(63)
Output from w		1.40 0500	140 7010		100 7070		100 0570	_		months) = Si		0.0000	
RHI water heat			149.7218	133.2010	129.7978	114.9234	109.3673			138.1715 h/year) = Si			(64)
Heat gains fro	om water hea			56.8828	56.1710	50.8055	49.3779	53.3769	53.0301	58.9553	61.5966	65.7564	
5. Internal ga													
Metabolic gain													
(66) m	122.7517				May 122.7517			Aug 122.7517	Sep 122.7517	Oct 122.7517	Nov 122.7517	Dec 122.7517	(66)
Lighting gains	39.8299	35.3766	28.7701	21.7809	16.2814	13.7455	14.8525	19.3058	25.9122	32.9015	38.4009	40.9369	(67)
Appliances gas Cooking gains	266.7285	269.4963	262.5215	247.6730	228.9295	211.3132	199.5444	196.7766	203.7514	218.5999	237.3434	254.9597	(68)
Pumps, fans		49.3210	49.3210		49.3210 0.0000		49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	
Losses e.g. e	vaporation	(negative v		le 5)				-81.8345		-81.8345	-81.8345	-81.8345	
Water heating		le 5) 88.3742	84.4029	79.0039	75.4987	70.5632	66.3681	71.7431	73.6529	79.2410	85.5509	88.3822	(72)
Total interna		483.4853	465.9328	438.6960	410.9479	385.8601	371.0032	378.0638	393.5547	420.9806	451.5335	474.5171	(73)
6. Solar gain:													
[.Tan]									77	Acces	39	Gains	
[Jan]			A	rea m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	FF data le 6c	Acces facto Table (or	Gains W	
Northeast			A	rea m2 	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b 0.4500	Specific or Tab	data le 6c .7000	facto Table 0	or 6d	W 9.0277	(75)
			A:	rea m2 000 900 000	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b 0.4500 0.4500 0.4500 0.4500	Specific or Tab	data le 6c	facto Table (or 5d 00 00	W	(75) (76) (77)
Northeast East Southeast			3.2 7.4 3.2	rea m2 000 900 000 500	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699	Speci or	g fic data Table 6b 0.4500 0.4500 0.4500	Specific or Tab	data le 6c .7000 .7000	factor Table (0.770 0.770 0.770	or 5d 00 00 00	9.0277 36.5124 28.2700	(75) (76) (77) (78)
Northeast East Southeast South West	147.7691	242.2342	3.21 7.4 3.21 3.7: 6.6	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313	Speci or 	gfic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533	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	factor Table (00 00 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(75) (76) (77) (78) (80)
Northeast East Southeast South West	147.7691	242.2342	3.21 7.4 3.21 3.7: 6.6	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313	Speci or 	gfic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533	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	factor Table (or 56d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(75) (76) (77) (78) (80)
Northeast East Southeast South West West Solar gains Total gains	147.7691 634.8523	242.2342 725.7195	3.2 7.4 3.2 3.7 6.6	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313	Speci or 	gfic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533	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	factor Table (00 00 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(75) (76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains	147.7691 634.8523 nal temperat	242.2342 725.7195 ture (heati	3.2: 7.4 3.2: 3.7: 6.6: 361.7973 827.7301	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831	Speci or 	gfic data Table 6b 	Specific or Tab: 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000	factor Table (00 00 00 00 00 00 00 184.7814	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains	147.7691 634.8523 nal temperat	242.2342 725.7195 ture (heati	3.2: 7.4' 3.2: 3.7: 6.6 361.7973 827.7301 ng season) in the living area, in ving area	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831	Speci or 641.6272 1027.4873	gfic data Table 6b	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data Le 6c .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474	factor Table (0.77) 0.77(0.77) 0.	Dr 6d 00 00 00 00 00 00 00 00 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains	147.7691 634.8523 	242.2342 725.7195 ture (heati	3.2 7.4 3.2 3.7 6.6 361.7973 827.7301	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831	Speci or 	gfic data Table 6b 	Specific or Tab: 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000	factor Table (00 00 00 00 00 00 00 184.7814	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains Total gains Total gains	147.7691 634.8523 nal temperaturing heating actor for get Jan 61.1440 5.0763	242.2342 725.7195 ture (heati- ng periods ains for li Feb 61.4786	3.2: 7.4' 3.2: 3.7: 6.6 361.7973 827.7301 ng season) in the livin ving area, 1 Mar 61.4786	rea m2 000 900 000 500 100 509.8524 948.5484 ang area fro nil,m (see Apr	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325	Speci or 	gfic data Table 6b	Specific or Tab: 0 0 0 0 0 0 543.4568 921.5206	data le 6c 7,000 7,7000 7,7000 7,7000 842,7927 836,3474	factor Table (0.77f 0.77f 0.77	Dr 6d 00 00 00 00 00 00 00 00 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains Total gains 7. Mean intern Temperature di Utilisation fortal tau alpha util living a:	147.7691 634.8523 nal temperaturing heatir actor for ga Jan 61.1440 5.0763 rea 0.9754 20.2355	242.2342 725.7195 ture (heati- ng periods ains for li Feb 61.4786 5.0986 0.9532 20.4069	3.2 7.4 3.2 3.7 6.6 361.7973 827.7301 mg season) in the livir ving area, 1 Mar 61.4786 5.0986 0.8903 20.6669	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808	Speci or 641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988	gfic data Table 6b	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 Sep 62.6791 5.1786 0.4731 20.9929	factor Table (0.77f) 0.77f 0.7	Nov 62.3313 5.1554 0.9449 20.5431	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017	(75) (76) (77) (78) (80) (83) (84) (85)
Northeast East Southeast South West Solar gains Total gains 7. Mean inter Temperature di Utilisation fortal tau alpha util living as	147.7691 634.8523 	242.2342 725.7195 ture (heati ng periods ains for li Feb 61.4786 5.0986 0.9532	3.2 7.4 3.2 3.7 6.6 361.7973 827.7301 361.7973 827.7301 in the living area, 10 Mar 61.4786 5.0986	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 mm Table 9a) May 61.9874 5.1325 0.5447	Speci or	gfic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	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 .442.7927 836.3474 	factor Table (0.77f 0.77f 0.77	Nov 62.3313 5.1554 0.9449	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804	(75) (76) (77) (78) (80) (83) (84) (85)
Northeast East Southeast South West Solar gains Total gains 7. Mean interpreture du Utilisation for tau alpha util living a:	147.7691 634.8523 	242.2342 725.7195 ture (heati ng periods ains for li Feb 61.4786 5.0986 0.9532 20.4069 19.9768	3.2/ 7.4' 3.2/ 3.7' 6.6 361.7973 827.7301 ng season) in the livir ving area, 1 Mar 61.4786 5.0986 0.8903 20.6669 19.9768	m2 000 900 000 500 509 8524 948.5484 ng area fro nil, m (see Apr Apr 61,9874 5.1325 0.7423 20.8929 19.9843	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843	Speci or 641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944	gfic data Table 6b	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 62.6791 5.1786 0.4731 20.9929 19.904 0.3937 19.9907	factor Table (1) 0.77(0	Nov 62.3313 5.1554 0.9449 20.54831 0.9270 19.4508	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818	(75) (76) (77) (78) (80) (83) (84) (85) (85)
Northeast East Southeast South West Solar gains Total gains Total gains Temperature dutilisation for tau alpha util living a: MIT Th 2 util rest of l MIT 2 Living area for	147.7691 634.8523 	242.2342 725.7195 ture (heati ng periods ains for li Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949	3.2/ 7.4' 3.2/ 3.7' 6.6 361.7973 827.7301 ang season) in the livir ving area, 1 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736	Speci or	gfic data Table 6b	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 15.2 19.9949 20.2915	Oct 62.3313 5.1554 0.7953 0.7953 20.8759 19.9893 0.7953 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9970 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(75) (76) (77) (78) (80) (83) (84) (85) (85)
Northeast East Southeast Southeast South West 7. Mean intern Temperature di Utilisation fi tau alpha util living a: MIT Th 2 util rest of li MIT 2 Living area fi	147.7691 634.8523 	242.2342 725.7195 ture (heati- 	3.2 7.4 3.2 3.7 6.6 361.7973 827.7301 in the livir ving area, 1 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703	Speci or	gfic data Table 6b	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 ftha =	factor Table 6 0.77(0.7	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345	(75) (76) (77) (78) (80) (83) (84) (85) (85)
Northeast East Southeast South West Solar gains Total gains Total gains Temperature dutilisation for tau alpha util living a: MIT Th 2 util rest of l MIT 2 Living area for	147.7691 634.8523 	242.2342 725.7195 ture (heati 	3.21 7.4' 3.2' 3.7' 6.6' 361.7973 827.7301 ang season) in the living area, in the fiving area, in the fiv	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 mm Table 9, 12 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736	Speci or	gfic data Table 6b	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 15.2 19.9949 20.2915	Oct 62.3313 5.1554 0.7953 0.7953 20.8759 19.9893 0.7953 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9970 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(75) (76) (77) (78) (80) (83) (84) (85) (85)
Northeast East Southeast South West Total gains Total gains Total gains Total gains The an interpart of the south The south of the south The south of the sout	147.7691 634.8523 	242.2342 725.7195 ture (heati- ng periods ains for li- Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949	3.2 7.4 3.2 3.7 6.6 361.7973 827.7301 in the livin ving area, 1 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	Speci or	Jul 62.5047 5.1670 0.2195 20.9999 19.918 20.2944 20.2944	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 15.2 19.9949 20.2915	Oct 62.3313 5.1554 0.7953 0.7953 20.8759 19.9893 0.7953 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9970 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(75) (76) (77) (78) (80) (83) (84) (85) (85)
Northeast East Southeast Southeast South West 7. Mean intern Temperature di Utilisation for tau alpha util living a: MIT Th 2 util rest of l MIT 2 Living area for MIT Temperature ac adjusted MIT 8. Space heat:	147.7691 634.8523	242.2342 725.7195 ture (heati 	3.21 7.4' 3.22 3.7' 6.6 361.7973 827.7301 and season) in the living area, 11 mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 m2 m000 900 900 000 500 100	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736	Speci or	Jul 62.5047 5.1670 0.2195 20.2944 20.2944	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 fLA = 20.2915	factor Table 6 0.77(0.7	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast Southeast South West 7. Mean intern Temperature du tilisation for tau alpha util living a: MIT Th 2 util rest of l MIT 2 Living area for MIT Temperature an adjusted MIT Temperature and Utilisation Useful gains	147.7691 634.8523 	242.2342 725.7195 ture (heati ng periods ains for li Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949	3.21 7.4' 3.22 3.7' 6.6 361.7973 827.7301 ang season) in the livin ving area, in Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	Speci or	Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 20.2915 20.2915	factor Table 6 0.77(0.7	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(75) (76) (77) (78) (80) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West Total gains Total gains Total gains Total gains Total gains The Man interparture di Utilisation for the second	147.7691 634.8523	242.2342 725.7195 ture (heati ng periods ains for li Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949 ment Feb 0.9343 678.0590 5.6000	3.2/ 7.4/ 3.2/ 3.7/ 6.6/ 361.7973 827.7301 ang season) in the livir ving area, y Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187 Mar 0.8609 712.6230 7.4000	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	Speci or	Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 17.9000	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 fLA = 20.2915 20.2915 Sep 0.4175 349.1423 15.2000	Oct 62.3313 5.1554 0.7953 20.8759 19.8893 0.7953 20.1750 20.1750 Oct 0.7505 538.5687 11.6000	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.927 19.4708 a / (4) = 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 Dec 0.9695 579.2522 5.1000	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (90) (91) (92) (93)
Northeast East Southeast South West Total gains 7. Mean interr Temperature di Utilisation for tau alpha util living a: MIT Th 2 util rest of li MIT 2 Living area for MIT Temperature ac adjusted MIT 8. Space heat: Utilisation Useful gains Ext temp.	147.7691 634.8523 anal temperation actor for get Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717 house 0.9680 19.0027 raction 19.3728 djustment 19.3728 djustment 19.3728 ding requirer	242.2342 725.7195 ture (heati ng periods ains for li Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949 ment Feb 0.9343 678.0590 5.6000	3.21 7.4' 3.22 3.7' 6.6 361.7973 827.7301 ang season) in the livin ving area, in Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187	rea m2	Solar flux Table 6a W/m2 12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	Speci or	Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	Specific or Tab: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937 19.9907 20.2915 20.2915	factor Table 6 0.77(0.7	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating RHI space heating demand 1188.9587 (98) (98)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014) 1. Overall dwelling dimensions Volume (m2) (m) (m3) 62.3000 (1b) x 2.7000 (2b) = 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) secondary other main total m3 per hour Number of chimneys Number of open flues Number of intermittent fans Number of passive vents Number of flueless gas fires 0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0.0000 (6b) 0.0000 (7a) 0.0000 (7b) 0 * 40 = Air changes per hour 0.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 (8) Pressure test Measured/design q50 0.1500 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 4.3000 1.0750 Sep 4.0000 1.0000 Wind speed 5.1000 1.2750 5.0000 4.4000 1.1000 4.3000 4.5000 1.1250 4.7000 (22) 1.1750 (22a) Wind factor Adj infilt rate 0.1769 0.1734 0.1700 0.1526 0.1492 0.1318 0.1318 0.1283 0.1388 0.1492 0.1561 0.1630 (22b) 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) 73.9500 (23c) 0.3037 0.3002 0.2829 0.2794 0.2621 0.2621 0.2586 0.2933 (25) Effective ac 0.3072 0.2690 0.2794 0.2863 A x U K-value Element Gross Openings NetArea U-value W/m2K 1.0000 0.9615 W/K 2.1000 23.3173 m2 2.1000 24.2500 61.1500 27.6600 kJ/m2K Front Door Windows (Uw = 1.00) External Wall 1 Corridor Wall (26) (27) (29a) 24.2500 85.4000 0.1600 29.7600 2.1000 0.2257 6.2438 (29a) Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U)
Party Floor 1
Party Ceilings 1 (31) (33) 115.1600 (26)...(30) + (32) = 62.3000 41.4451 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 13.9952 (36) (33) + (36) = Total fabric heat loss 55.4403 (37) Jan
(38)m 17.0500
Heat transfer coeff Jun 14.5469 Jul 14.5469 Oct 15.5096 Nov 15.8947 Aug 14.3544 Sep 14.9320 Dec 16.2798 (38) 72.4903 72.2978 72.1052 71.1425 70.9499 69.9872 69.9872 69.7947 70.3723 70.9499 71.3350 71.7201 (39) Average = Sum(39)m / 12 = Mar May 1.1388 Jun Aug 1.1203 HLP (average) 1.1574 1.1419 1.1296 1.1636 1.1605 1.1234 1.1234 1.1388 1.1450 1.1512 (40) 1.1412 (40) 31 28 31 30 31 30 31 30 31 30 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) Feb Jan Mar Apr Jun J111 Aug Sep Oct Nov Daily hot water use 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860 91.0681 (44) 130.7901 (45) 1302.5967 (45) Energy content (annual) Total = Sum(45)m = Distribution loss (46) 20.2577 18.2829 15.9395 15.2943 13.1978 12.2297 14.0338 14.2014 16.5504 18.0660 19.6185 (46)



CALCULA	ATION C)E ENIEE	SCA BV	TINGS	09 Jan	201/							
		JI LINLI	MITTA	TINGS	US Jan	12014							
Water storage Store volume b) If manufa		lared loss	factor is n	ot known :								3.0000	(47)
Hot water st Volume facto Temperature	orage loss or from Tab factor fro	factor from le 2a m Table 2b			lay)							0.0240 3.4200 0.6000	(52) (53)
Enter (49) or Total storage			4.5734	4.4259	4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	0.1475 4.5734	
If cylinder co	ontains ded 4.5734	icated sola: 4.1308	r storage 4.5734	4.4259	4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	4.5734	(57)
Primary loss Total heat req	quired for	water heati	ng calculat	ed for each			23.2624			23.2624 138.1715			
	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	(63)
Output from w/		143.2589	149.7218	133.2010	129.7978	114.9234	109.3673			138.1715 h/year) = Su			
Heat gains fro		ating, kWh/r 59.3875		56.8828	56.1710	50.8055	49.3779	53.3769	53.0301		61.5966	65.7564	
5. Internal ga	ains (see T	able 5 and 5	5a)										
Metabolic gain), Watts	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gains	(calculat	ed in Append	122.7517 dix L, equa	122.7517 tion L9 or	122.7517 L9a), also s	see Table 5							
Appliances gai	ns (calcul	ated in Appe	endix L, eq	uation L13	16.2814 or L13a), a 228.9295	lso see Tab	le 5	19.3058	25.9122 203.7514	32.9015 218.5999	38.4009 237.3434	40.9369 254.9597	
Cooking gains	(calculate	d in Append:	ix L, equat	ion L15 or		see Table	5	49.3210	49.3210		49.3210	49.3210	
Pumps, fans Losses e.g. ev	0.0000 raporation	0.0000 (negative va	0.0000 alues) (Tab	0.0000 le 5)	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	
Water heating	gains (Tab				-81.8345 75.4987	-81.8345 70.5632		-81.8345 71.7431		-81.8345 79.2410	-81.8345 85.5509	-81.8345 88.3822	
Total internal	gains				410.9479								
6. Solar gains	3												
[Jan]			A	rea	Solar flux		g		FF	Acces	ss	Gains	
-						Speci		Specific				W	
				m2	Table 6a W/m2	or	fic data Table 6b		data	facto Table 6	or 5d	W	
Northeast East			3.2 7.4	m2 000 900	Table 6a W/m2 11.2829 19.6403	or	fic data Table 6b	or Tab 0 0	data le 6c .7000 .7000	facto Table 6 0.770 0.770	or 5d 00	7.8816 32.1124	(75) (76)
Northeast			3.2 7.4	m2 000 900 000 500	Table 6a W/m2 11.2829	or	fic data Table 6b	or Tab. 0 0 0 0	data le 6c .7000	facto Table 6	or 5d 00 00 00	7.8816	(75) (76) (77) (78)
Northeast East Southeast South West			3.2 7.4 3.2 3.7 6.6	m2 000 900 000 500 100	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	or	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500	or Tab.	data le 6c .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 5d 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(75) (76) (77) (78) (80)
Northeast East Southeast South West	132.3072	240.7592	3.2 7.4 3.2 3.7 6.6	m2 000 900 000 500 100 495.9646	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403	or 597.3924	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754	or Tab.	data le 6c .7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	00 00 00 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(75) (76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains	132.3072 619.3905	240.7592 724.2445	3.2 7.4 3.2 3.7 6.6	m2 	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202	597.3924 983.2525	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786	or Tab.	data le 6c .7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	00 00 00 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395	(75) (76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains	132.3072 619.3905 nal tempera	240.7592 724.2445 ture (heati	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202	597.3924 983.2525	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786	or Tab.	data le 6c .7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	00 00 00 00 00 00 00 00	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains	132.3072 619.3905 al tempera aring heati	240.7592 724.2445 ture (heating periods: ains for live Feb	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 ng season) in the livi	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May	597.3924 983.2525	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786	or Tab 0 0 0 0 0 500.9302 878.9940	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460	factor Table 6 0.770 0.7	Dr. 65d	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West	132.3072 619.3905 all tempera arring heati actor for g Jan 59.6823 4.9788	240.7592 724.2445 ture (heating periods:	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336	m2 000 900 000 500 100 495.9646 934.6606	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May	or 597.3924 983.2525	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786	or Tab.	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460	factor Table 6 0.770 0.7	161.4436	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa	132.3072 619.3905 all tempera arring heati actor for g Jan 59.6823 4.9788	240.7592 724.2445 ture (heating periods ains for live Feb 59.8412	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 g season) in the livi ving area, Mar 60.0010	m2 000 900 000 500 100 495.9646 934.6606	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May 60.9780 5.0652	597.3924 983.2525 Th1 (C) Jun 61.8169	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786	or Tab.	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460	factor Table 6 0.778 0.776 0.776 0.778 0.776 0.778 0.7	Nov 60.6489	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232	(75) (76) (77) (78) (80) (83) (84)
Northeast East Southeast South West	132.3072 619.3905 all tempera aring heati actor for g Jan 59.6823 4.9788 rea 0.9823 20.0945 19.9493	240.7592 724.2445 ture (heating periods sains for live Feb 59.8412 4.9894	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 ng season) in the livi ving area, Mar 60.0010 5.0001	m2 000 900 000 500 100 495.9646 934.6606 ng area frc nii,m (see Apr Apr 60.8130 5.0542	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May 60.9780 5.0652	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786 Jul 61.8169 5.1211	or Tab. 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986	factor Table 6 0.770 0.7	Nov 60.6489 5.04 60.00 60.00 60.00 60.00 80 80.00 80 80.00 80 80 80 80 80 80 80 80 80 80 80 80 8	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215	(75) (76) (77) (78) (80) (83) (84) (85)
Northeast East Southeast South West Solar gains Total gains Total gains Temperature du Utilisation fa tau alpha util living ar	132.3072 619.3905 nal tempera pring heati actor for g Jan 59.6823 4.9788 rea 0.9823 20.0945 19.9493 nouse 0.9771	240.7592 724.2445 ture (heatir- 	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 ng season) in the livi ving area, Mar 60.0010 5.0001 0.9135 20.5666 19.9542 0.8913	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Dom Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818 0.3813	fic data Table 6b 0.4500 0.4500 0.4500 0.4500 0.4500 570.8754 941.8786 Jul 61.8169 5.1211 0.3262 20.9990 19.9818 0.2511	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 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061	Factor Table 6 0.770 0.7	Nov 60,6489 5.0433 0.9643 0.9751	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89)
Northeast East Southeast South West 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Living area fr MIT	132.3072 619.3905 anal tempera pring heati tetor for g Jan 59.6823 4.9788 rea 0.9823 20.0945 19.9493 nouse 0.9771 18.7836 reation 19.1771	240.7592 724.2445 ture (heating periods ains for limple periods ains for limp	3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 in the liviving area, Mar 60.0010 5.0001 0.9135 20.5666 19.9542	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692	597.3924 983.2525 Ph1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818	Jul 61.8169 5.1211 0.3262 20.9990 19.9818	or Tab 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982 19.9843	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614	Factor Table 6 0.770 0.7	Nov 60.6489 5.0433 0.9643 20.9751	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303	(75) (76) (778) (78) (80) (83) (84) (85) (85)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr	132.3072 619.3905 all tempera arring heati actor for g Jan 59.6823 4.9788 a.0.9823 20.0945 19.9493 actor 18.7836 faction 19.1771 tjustment	240.7592 724.2445 ture (heating periods ains for limple periods ains for limp	3.2 7.4 3.2 3.7 6.6 3.63.4008 829.3336 ang season) in the livi ving area, Mar 60.0010 5.0001 0.9135 20.5666 19.9542 0.8913 19.4451	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 om Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818 0.3813 19.9780	Jul 61.8169 5.1211 0.3262 20.9990 19.9818 0.2511 19.9814	Or Tab. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA =	Oct 60.9780 5.0652 0.8580 20.7886 19.9692 0.8148 19.7548 Living area 20.0651	Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002	(75) (76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad	132.3072 619.3905 	240.7592 724.2445 ture (heati)	3.2 7.4 3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 363.4008 829.3336 0.010 0.9135 20.5666 19.9542 0.8913 19.4451 19.7817	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818 0.3813 19.9780 20.2828 20.2828	Jul 61.8169 5.1211 0.3262 20.2869 20.2869	or Tab. 0 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982 19.9843 0.2843 19.9837 20.2882 20.2882	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 gLA = 20.2662	Oct 60.9780 5.0652 0.8580 20.7886 19.9692 0.8148 19.7548 Living area 20.0651	Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265 1/(4) = 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000	(75) (76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT	132.3072 619.3905 all tempera arring heati actor for g Jan 59.6823 4.9788 rea 0.9823 20.0945 19.9493 nouse 0.9771 18.7836 action 19.1771 ijustment 19.1771	240.7592 724.2445 ture (heating periods ains for limple periods ains for limp	3.2 7.4 3.2 3.7 6.6 3.63.4008 829.3336 363.4008 829.3336 363.4008 829.3336 0.9135 0.9135 0.9135 0.8913 19.4451 19.7817	m2 000 900 900 000 500 100 495.9646 934.6606 ang area frc nil,m (see Apr 60.8130 5.0542 0.7987 20.8274 19.9667 0.7560 19.7882 20.1002 20.1002	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Dom Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 20.2389	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818 0.3813 19.9780 20.2828	Jul 61.8169 5.1211 0.3262 20.2869 20.2869	Or Tab. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 gLA = 20.2662	Oct 60.9780 5.0652 0.8580 20.7886 19.9692 0.8148 19.7548 Living area 20.0651	Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265 1/(4) = 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000	(75) (76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West Total gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati	132.3072 619.3905 	240.7592 724.2445 ture (heating periods and stands for live Feb 19894	3.2 7.4 3.2 7.4 3.2 3.7 6.6 363.4008 829.3336 363.4008 829.3336 363.4008 829.3336 0.010 0.9135 20.5666 19.9542 0.8913 19.4451 19.7817 19.7817	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 May May	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818 0.3813 19.9780 20.2828 20.2828	Jul 61.8169 5.1211 0.3262 20.9990 20.2869 Jul	or Tab. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA= 20.2662 20.2662	Factor Table 6 0.770 0.7	Nov 60.6489 5.0433 0.9643 20.3957 19.2265 19.2265 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000 19.1303	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West Total gains 7. Mean intern Temperature du Utilisation fa MIT Th 2 util rest of h MIT 2 util rest of h MIT 2 util rest of MIT Temperature ad adjusted MIT 8. Space heati	132.3072 619.3905 mal tempera arring heati actor for g Jan 59.6823 4.9788 ea 0.9823 20.0945 19.9493 nouse 0.9771 18.7836 eaction 19.1771 dijustment 19.1771 ijustment 19.1771	240.7592 724.2445 ture (heating periods: ains for liver Februs 19894 0.9624 20.2974 19.9517 0.9519 19.0730 19.4405 19.4405	3.2 7.4 3.2 3.7 6.6 3.63.4008 829.3336 363.4008 829.3336 in the livi ving area, Mar 60.0010 5.0001 0.9135 20.5666 19.9542 0.8913 19.4451 19.7817 19.7817	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 m Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 20.2389	597.3924 983.2525 Ph1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818 0.3813 19.9780 20.2828 20.2828	Jul 61.8169 5.1211 0.3262 20.9990 19.9814 20.2869 20.2869	or Tab 0 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982 19.9843 0.2843 19.9837 20.2882 20.2882	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA = 20.2662 20.2662	Oct 60.9780 5.0652 0.8580 20.7886 19.9692 0.8148 19.7548 1.1ving area 20.0651	Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9952 19.2265 1/(4) = 19.5775 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000 19.1303	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains Ext temp. Heat loss rate	132.3072 619.3905 all tempera aring heati ictor for g Jan 59.6823 20.945 19.9453 iouse 0.9771 18.7836 faction 19.1771 ijustment 19.1771 Jan 0.9721 602.0912 4.3000 w 1078.4461	240.7592 724.2445 ture (heating periods and section of the sectio	3.2 7.4 3.2 7.4 3.2 3.7 6.6 3.63.4008 829.3336 363.4008 829.3336 363.4008 829.3336 363.4008 829.3336 363.4008 829.3336 363.4008 829.3336 363.4008 829.3336 363.4008 829.3336 363.4008 829.3336 363.4008 10.9135 20.5666 19.9542 0.8913 19.4451 19.7817 19.7817	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 May 0.5860 586.0263 11.7000 605.8361	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818 0.3813 19.9780 20.2828 20.2828	Jul 61.8169 5.1211 0.3262 20.9990 20.2869 20.2869 258.0335	or Tab 0 0 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982 19.9843 0.2843 19.9837 20.2882 Aug 0.3082 270.9248 16.4000 271.3754	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA= 20.2662 Sep 0.5290 425.0948 14.1000 433.9270	Factor Table 6 0.770 0.7	Nov 60.6489 5.0433 0.9643 20.3957 19.2265 19.2265 19.2265 19.2265 19.5775 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000 19.1303	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ad adjusted MIT 8. Space heati Utilisation Useful gains Ext temp. Heat loss rate Heat loss rate	132.3072 619.3905 all tempera uring heati actor for g Jan 59.6823 4.9788 ea 0.9823 20.0945 19.9493 nouse 0.9771 18.7836 faction 19.1771 ijustment 19.1771 ang require Jan 0.9721 602.0912 4.3000 W 1078.4461 1.0000 kWh	240.7592 724.2445 ture (heating periods: ains for live Feb 0.9457 19.4405 19.4405 ment Feb 0.9457 684.9197 4.9000 1051.2453 1.0000	3.2 7.4 3.2 3.7 6.6 3.63.4008 829.3336 363.4008 829.3356 363.4008 829.5008 363.4008 829.5008 363.4008 829.5008 363.4008 829.5008 363.4008 829.5008 363.4008 829.5008 363.4008 82	m2	Table 6a W/m2 11.2829 19.6403 36.7938 46.7521 19.6403 589.0724 1000.0202 Dem Table 9, Table 9a) May 60.9780 5.0652 0.6301 20.9551 19.9692 0.5697 19.9317 20.2389 May 0.5860 586.0263 11.7000 605.8361 1.0000	597.3924 983.2525 Th1 (C) Jun 61.8169 5.1211 0.4511 20.9934 19.9818 0.3813 19.9780 20.2828 20.2828	Jul 61.8169 5.1211 0.3262 20.2869 20.2869 Jul 0.2737 257.7862 16.6000	or Tab 0 0 0 0 0 0 500.9302 878.9940 Aug 61.9874 5.1325 0.3639 20.9982 19.9843 0.2843 19.9837 20.2882 20.2882 Aug 0.3082 270.9248 16.4000	data le 6c .7000 .7000 .7000 .7000 .7000 .7000 .7000 409.9912 803.5460 Sep 61.4786 5.0986 0.5851 20.9766 19.9768 0.5061 19.9614 fLA = 20.2662 20.2662 Sep 0.5290 425.0948 14.1000	Oct 60.9780 5.0652 0.8580 20.7886 19.9692 0.0651 20.0651	Nov 60.6489 5.0433 0.9643 20.3957 19.9642 0.9525 19.2265 1/(4) = 19.5775 19.5775	7.8816 32.1124 25.7021 38.2715 28.3395 111.2150 585.7321 21.0000 Dec 60.3232 5.0215 0.9861 20.0545 19.9592 0.9819 18.7338 0.3002 19.1303 0.0000 19.1303	(75) (76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (93)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Space heating pe	er m2									(98)	/ (4) =	24.2357	(99)
Colories														
Section Carbon	8c. Space coolin	ng requireme	ent											
Batt		June, July a	and August.	See Table	10b					Com	Oot	Non	Dee	
### Stricts		4.3000 N	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
0.0000	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	0.9680 636.8557 1084.1110	0.9856 510.4310 1038.2602	0.9784 519.0078 963.5666	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)
Internationary factor (rable 100) 1,000	Space cooling	Wh 0.0000	0.0000	0.0000	0.0000	0.0000	322.0238	392.7049	330.7517				1045.4805	(104)
### Space cooling ME. ### Space cooling per not				0.0000	0.0000	0.0000	0.2500	0.2500	0.2500					
### Space cocling per all ### Space per all per a	Space cooling kW	Wh												
P. Narry regultements			0.0000	0.0000	0.0000	0.0000	39.2430	47.0303	40.3007	0.0000	0.0000	0.0000	127.4127	(107)
Particle of Space hast from Remondary/Pupplementary System (Table 11)														
Fraction of pioces heat from community system Fraction of finite from community system precision of the first from community system precision of the first from community system properties of control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging method (Table 4c(3)) for community water heating Factor for control and charging factor for community water heating Factor for control and charging factor for community water heating Factor for control and charging factor for community water heating Factor for factor factor for community water heating Factor for factor													0.0000	(301)
Amnal space heating requirement Efficiency of General Real pump (98) x 1.00 x	Fraction of space Fraction of heat Fraction of tota Factor for contr Factor for contr Distribution los	ce heat from t from commu al space hea rol and char rol and char	n community unity Heat at from com rging metho	system pump munity Heat d (Table 4c d (Table 4c	pump (3)) for c (3)) for c	ommunity s	pace heatin						1.0000 1.0000 1.0000 1.0000	(302) (303a) (304a) (305) (305a)
Annual water heating requirement 1603.010 (64) 100 x 1.00 x	Annual space hea Space heat from Efficiency of se	Heat pump = econdary/sup	= (98) x 1. oplementary	heating sy	stem in %	(from Tabl	e 4a or App	endix E)					1585.3790 0.0000	(307a) (308)
GalancedWithHeatRecovery, Databases: in-use factor = 1.2500, SFF = 0.8250) 169.3034 (330a) 101al electricity for the above, Whi/year	Annual water heat Water heat from Electricity used Cooling System E Space cooling (i	Heat pump = d for heat of Energy Effic if there is	(64) x 1. Histributio Ciency Rati	n o		enter 0)							1711.8580 32.9724 12.1770	(310a) (313) (314)
100. Fuel costs - using Table 12 prices Fuel	(BalancedWit mechanical ve Total electricit Electricity for	thHeatRecove entilation f ty for the a lighting (c	ery, Databa ans (SFP = above, kWh/ calculated	0.82 year	50)	.2500, SFP	= 0.8250)						169.3034 281.3633	(331) (332)
Fuel price Fuel price Fuel cost KMh/year P/KMh E/year P/KMh														
The stating - Community heating scheme	Space heating fr Space heating - Water heating fr Space cooling Mechanical venti Pumps and fans f Energy for light Additional stand	rom Heat pum secondary rom Heat pum ilation fans for heating ting ding charges	up np						Fuel kWh/year 1585.3790 0.0000 1711.8580 10.4634 169.3034 0.0000		p/kWh 4.2400 0.0000 4.2400 13.1900 13.1900 0.0000		£/year 67.2201 0.0000 72.5828 1.3801 22.3311 0.0000 37.1118 120.0000	(340a) (341) (342a) (348) (349) (349) (350) (351)
Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band 12b. Carbon dioxide emissions - Community heating scheme 12b. Carbon dioxide emissions - Community heating scheme 12b. Carbon dioxide emissions - Community heating scheme Energy Emission factor Emissions kylyear kg CO2/kWh kg CO2/year Efficiency of heat source Heat pump Space heating from Heat pump Space heating from Heat pump Space heating from Heat distribution Space heating from Heat distribution 32 .9724 (negative value allowed since DFEE <= TFEE) Space and water heating 359.3659 (376)														
12b. Carbon dioxide emissions - Community heating scheme	Energy cost defl Energy cost fact SAP value SAP rating (Sect	lator (Table								255) x (256	5)] / [(4) +	45.0] =	1.2550 82.4926 82	(357) (358)
Energy Emission factor Emissions kWh/year kg CO2/kWh kg CO2/year 500.0000 (367a)	12b. Carbon diox	kide emissio	ns - Commu	nity heatin	g scheme									
Space heating from Heat pump 659.4474 0.5190 342.2532 (367) Electrical energy for heat distribution 32.9724 0.5190 17.1127 (372) Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)									Energy				kg CO2/year	
Space and water heating 359.3659 (376)	Space heating fr Electrical energ Total CO2 associ	rom Heat pum gy for heat iated with c	mp distributi community s	ystems									342.2532 17.1127	(367) (372)
	Space and water		.nce DFEE <	- TFEE)					10.4634		0.5190			



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Pumps and fans
Energy for lighting
Total kg/year
CO2 emissions per m2
EI value
EI rating
EI band 87.8684 (378) 146.0276 (379) 598.6924 (383) 9.6100 (384) 92.5233 (384a) 93 (385) A 169.3034 281.3633 0.5190 0.5190

Calculation of stars for heating and \mathtt{DHW}

Space heating energy efficiency = 4.452, stars = 4
Space heating environmental impact = 0.1090, stars = 5
Water heating energy efficiency
Water heating environmental impact 1.00 × 4.240 × 1.05 1.00 × 0.519 × 1.05 / 5.0000

4.452, stars = 4 0.1090, stars = 5



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014 1. Overall dwelling dimensions Volume (m2) (m) (m3) 62.3000 (1b) x 2.7000 (2b) = 168.2100 (1b) - (3b) Ground floor Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)...(ln)Dwelling volume 62.3000 (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =168.2100 (5) secondary other main total m3 per hour Number of chimneys Number of open flues 0 * 40 = 0 * 20 = 0 * 10 = 0 * 10 = 0.0000 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires 0.0000 (7a) 0.0000 (7b) 0 * 40 = Air changes per hour 0.0000 / (5) = Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 (8) Pressure test Measured/design q50 0.1500 (18) Infiltration rate Number of sides sheltered 1 (19) - [0.075 x (19)] = (21) = (18) x (20) = (20) = 1 -Infiltration rate adjusted to include shelter factor May 3.7000 0.9250 Aug 3.2000 0.8000 Sep 3.3000 0.8250 Wind speed 4.2000 1.0500 4.0000 1.0000 3.7000 0.9250 3.5000 0.8750 3.5000 0.8750 3.8000 (22) 0.9500 (22a) Wind factor Adj infilt rate 0.1457 0.1388 0.1388 0.1283 0.1283 0.1145 0.1179 0.1110 0.1145 0.1214 0.1214 0.1318 (22b) 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) 73.9500 (23c) 0.2690 0.2690 0.2586 0.2586 0.2447 0.2482 0.2621 (25) Effective ac 0.2759 0.2413 0.2447 0.2517 0.2517 A x U K-value Element Gross Openings NetArea U-value m2 2.1000 24.2500 61.1500 27.6600 W/m2K 1.0000 0.9615 W/K 2.1000 23.3173 kJ/m2K kJ/K Front Door Windows (Uw = 1.00) External Wall 1 Corridor Wall (26) (27) (29a) 24.2500 85.4000 0.1600 29.7600 2.1000 0.2257 6.2438 (29a) Total net area of external elements Aum(A, m2)
Fabric heat loss, W/K = Sum (A x U)
Party Floor 1
Party Ceilings 1 (31) (33) 115.1600 (26)...(30) + (32) = 62.3000 41.4451 62.3000 (32b) Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K Thermal bridges (Sum(L x Psi) calculated using Appendix K) 250.0000 (35) 13.9952 (36) (33) + (36) = Total fabric heat loss 55.4403 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) $$\rm Jan$$ Feb Mar Apr May (38)m 15.3171 14.9320 14.9320 14.3544 14.3544 Heat transfer coeff Jun 13.5842 Nov 13.9693 Dec 14.5469 (38) 70.7574 70.3723 70.3723 69.7947 69.7947 69.0245 69.2170 68.8319 69.0245 69.4096 69.9872 (39) 69.4096 Average = Sum(39)m / 12 = 69.6663 (39) Mar May 1.1203 Jun Aug 1.1048 Sep 1.1079 HLP (average) 1.1296 1.1203 1.1358 1.1296 1.1079 1.1110 1.1141 1.1141 1.1234 (40) 1.1182 (40) 31 28 31 30 30 31 31 31 (41) 4. Water heating energy requirements (kWh/year) Assumed occupancy Average daily hot water use (litres/day) Feb Jan Mar Apr Jun J111 Aug Sep Oct Nov Daily hot water use 91.0681 87.7566 84.4450
Energy conte 135.0514 118.1168 121.8860 91.0681 (44) 130.7901 (45) 1302.5967 (45) Energy content (annual) Total = Sum(45)m = Distribution loss (46) 20.2577



18.2829

15.9395

15.2943

19.6185 (46)

12.2297

14.0338

13.1978

14.2014

16.5504 18.0660

CALCULA	ATION C	OF EPU	COS 13,	LIVIIOO	IONS AN	DEVIIN	ARIEN	ENGI	U9 Jai	12014			
Water storage	loss:												
Store volume b) If manufa		lared less	Factor is n	ot known .								3.0000	(47)
Hot water st	corage loss	factor from			iay)							0.0240	
Volume facto Temperature												3.4200 0.6000	
Enter (49) or Total storage	(54) in (55											0.1475	
-	4.5734		4.5734	4.4259	4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	4.5734	(56)
If cylinder co	4.5734	4.1308	4.5734		4.5734	4.4259	4.5734	4.5734	4.4259	4.5734	4.4259	4.5734	(57)
Primary loss Total heat rec					23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
	162.8872	143.2589	149.7218	133.2010	129.7978		109.3673					158.6259	
•		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000 months) = Si	0.0000 am(63)m =	0.0000	
Output from w/		143.2589	149.7218	133.2010	129.7978	114.9234	109.3673	121.3944	121.6138	138.1715	147.3779	158.6259	(64)
Hash mains for								Total p	er year (kW	n/year) = Su	am (64) m =	1630.3410	(64)
Heat gains fro		59.3875		56.8828	56.1710	50.8055	49.3779	53.3769	53.0301	58.9553	61.5966	65.7564	(65)
5. Internal ga	ains (see Ta	able 5 and 5	5a)										
Metabolic gair													
(66)m		Feb 122.7517	Mar 122.7517	Apr 122.7517	May 122.7517	Jun 122.7517	Jul 122.7517	Aug 122.7517	Sep 122.7517	Oct 122.7517	Nov 122.7517	Dec 122.7517	(66)
Lighting gains	s (calculate	ed in Append	dix L, equa	tion L9 or	L9a), also s	see Table 5		19.3058					
Appliances gai	ins (calcula	ated in Appe	endix L, eq	uation L13		lso see Tab	le 5		25.9122	32.9015	38.4009	40.9369	
Cooking gains					228.9295 L15a), also			196.7766	203.7514	218.5999	237.3434	254.9597	(68)
		49.3210			49.3210		49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	49.3210 0.0000	
Losses e.g. ev	aporation	(negative va	alues) (Tab	le 5)									
Water heating			-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	-81.8345	(71)
Total internal	90.2866	88.3742	84.4029	79.0039	75.4987	70.5632	66.3681	71.7431	73.6529	79.2410	85.5509	88.3822	(72)
Total Intellial		483.4853	465.9328	438.6960	410.9479	385.8601	371.0032	378.0638	393.5547	420.9806	451.5335	474.5171	(73)
6. Solar gains													
[Jan]			A:	rea	Solar flux		g		FF	Acces	SS	Gains	
[odii]				m2	Table 6a	Specia	fic data	Specific	data	facto	or	W	
				m2	Table 6a W/m2	Speci:	fic data Table 6b	Specific or Tab	data le 6c		or	W	
Northeast			3.2	m2 000	12.9236		0.4500		.7000	facto Table 6	or 5d 00	9.0277	
			3.2 7.4 3.2	m2 000 900 000	12.9236 22.3313 40.4699		0.4500 0.4500 0.4500	0 0 0	.7000 .7000 .7000	facto Table 6 0.770 0.770 0.770	or 5d 00 00	9.0277 36.5124 28.2700	(76) (77)
Northeast East			3.2	m2 000 900 000 500	12.9236		0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000	facto Table 6 0.770 0.770 0.770	or 6d 00 00 00	9.0277 36.5124 28.2700 41.7365	(76) (77) (78)
Northeast East Southeast South			3.2 7.4 3.2 3.7	m2 000 900 000 500	12.9236 22.3313 40.4699 50.9848		0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770	or 6d 00 00 00	9.0277 36.5124 28.2700	(76) (77) (78)
Northeast East Southeast South West			3.2 7.4 3.2 3.7 6.6	m2 000 900 000 500	12.9236 22.3313 40.4699 50.9848 22.3313		0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80)
Northeast East Southeast South			3.2 7.4 3.2 3.7 6.6	m2 000 900 000 500	12.9236 22.3313 40.4699 50.9848 22.3313		0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80)
Northeast East Southeast South West			3.2 7.4 3.2 3.7 6.6	m2 000 900 000 500	12.9236 22.3313 40.4699 50.9848 22.3313		0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80)
Northeast East Southeast South West Solar gains Total gains	147.7691 634.8523	242.2342 725.7195	3.2: 7.4' 3.2: 3.7' 6.6: 361.7973 827.7301	m2 	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831	641.6272 1027.4873	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80)
Northeast East Southeast South West West Solar gains Total gains	147.7691 634.8523 nal tempera	242.2342 725.7195 ture (heatin	3.2: 7.4 3.2: 3.7: 6.6: 361.7973 827.7301	m2 000 900 000 500 100 509.8524 948.5484	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831	641.6272 1027.4873	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains	147.7691 634.8523 nal temperat	242.2342 725.7195 ture (heating	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301	m2 000 900 000 500 100 509.8524 948.5484	12.9236 22.3313 40.4699 50.9948 22.3313 590.8352 1001.7831	641.6272 1027.4873	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000	facto Table 6 0.770 0.770 0.770 0.770	or 6d 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains 7. Mean interr Temperature du Utilisation fa	147.7691 634.8523 nal temperal aring heatin	242.2342 725.7195 cure (heating periods: ains for live Feb	3.2: 7.4 3.2: 3.7: 6.6 361.7973 827.7301 ang season) in the livin ying area, i	m2 000 900 000 500 100 509.8524 948.5484 ang area fromil, m (see Apr	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9, 7 Table 9a) May	641.6272 1027.4873 Ph1 (C) Jun	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 0.77.3566	0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474	factor Table 6 0.770 0.7	Dr 6d 00 00 00 00 00 00 00 00 00 00 00 00 00	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West	147.7691 634.8523 anal temperaturing heating heating Jan 61.1440 5.0763	242.2342 725.7195 cure (heating periods:	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 and season) in the living area, in grean,	m2 000 900 000 500 100 509.8524 948.5484	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9, 7 Table 9a) May 61.9874	641.6272 1027.4873	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500	0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474	factor Table 6 0.770 0.770 0.777 0.777 0.777 0.777 0.777 0.777 7.777 0.7	184.7814 636.3148	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains 7. Mean interr Temperature du Utilisation fa	147.7691 634.8523 anal temperaturing heating heating Jan 61.1440 5.0763	242.2342 725.7195 ture (heating periods sains for live Feb 61.4786	3.2: 7.4' 3.2: 3.7: 6.6: 361.7973 827.7301 ang season) in the living area, 1 Mar 61.4786	m2 000 900 000 500 509.8524 948.5484 	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 om Table 9, 7 Table 9a) May 61.9874 5.1325	641.6272 1027.4873 Th1 (C) Jun 62.6791	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566	0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474	factor Table 6 0.770 0.7	Dr 66d 000 000 000 000 000 000 000 000 000	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933	(76) (77) (78) (80) (83) (84)
Northeast East Southeast South West Solar gains Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living ar	147.7691 634.8523 all temperal aring heatin actor for gr Jan 61.1440 5.0763 sea 0.9754	242.2342 725.7195 cure (heating periods: ains for liv Feb 61.4786 5.0986 0.9532	3.2: 7.4' 3.2: 3.7' 6.6 361.7973 827.7301 3827.7301 in the living area, 1 Mar 61.4786 5.0986 0.8903	m2 000 900 000 509.8524 948.5484 ng area frc nil,m (see Apr 61.9874 5.1325 0.7423	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9, 1 Table 9a) May 61.9874 5.1325 0.5447	641.6272 1027.4873 Ph1 (C) Jun 62.6791 5.1786 0.3351	0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474 Sep 62.6791 5.1786 0.4731	factor Table 6 0.77(0.7	Nov 62.3313 5.1554 0.9449	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804	(76) (77) (78) (80) (83) (84) (85)
Northeast East Southeast South West Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living ar	147.7691 634.8523 all temperal arring heatin actor for gr Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717	242.2342 725.7195 ture (heating periods: ains for liv Feb 61.4786 5.0986	3.2: 7.4' 3.2: 3.7.6.6 361.7973 827.7301 in the living area, 1, Mar 61.4786 5.0986	m2 000 900 900 500 100 509.8524 948.5484 ang area from 7, see Apr 61,9874 5.1325	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 Table 9a) May 61.9874 5.1325 0.5447 20.9808	641.6272 1027.4873 Ph1 (C) Jun 62.6791 5.1786 0.3351 20.9988	0.4500 0.	0 0 0 0 0 0 543.4568 921.5206	.7000 .7000 .7000 .7000 .7000 .7000 .7000 442.7927 836.3474 Sep 62.6791 5.1786	factor Table 6 0.770 0.7	Nov 62.3313 5.1554 0.9449 20.5431	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017	(76) (77) (78) (80) (83) (84) (85)
Northeast East Southeast South West Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h	147.7691 634.8523 nal temperal arring heatin actor for gr Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717 nouse 0.9680	242.2342 725.7195 ture (heating periods sains for life Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 ag season) in the living area, 19 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627	m2 000 900 000 500 100 509.8524 948.5484 ang area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 590.8352 005447 20.9808 19.9843 0.4803	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681	0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .5ep 62.6791 5.1786 0.4731 20.9929 19.9944 0.3937	factor Table 6 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.770 0.775 0.755 0.7	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89)
Northeast East Southeast South West Total gains 7. Mean interr Temperature du Utilisation fa tau alpha util living ar	147.7691 634.8523 al temperal aring heatin actor for gr Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717 house 0.9680 19.0027	242.2342 725.7195 ture (heating periods sains for life Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402	3.2: 7.4' 3.2: 3.7: 6.6 361.7973 827.7301 in the living area, 19 Mar 61.4786 5.0986 0.8903 20.6669 19.9768	m2 0000 9000 9000 0000 5000 100 509.8524 948.5484 ang area from from from from from from from from	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9, Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .8ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .0.3937 .19.9907	factor Table 6 0.770 0.770 0.770 0.770 0.770 0.770 0.770 296.5908 717.5714 Oct 62.3313 5.1554 0.7953 20.8759 19.9893	Nov 62.3313 5.1554 0.9449 20.5431 0.9270 19.4508	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90)
Northeast East Southeast South West 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	147.7691 634.8523 all temperal uring heatin actor for gr Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717 nouse 0.9680 19.0027 raction 19.3728	242.2342 725.7195 ture (heating periods sains for life Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 ag season) in the living area, 19 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627	m2 000 900 000 500 100 509.8524 948.5484 ang area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 590.8352 005447 20.9808 19.9843 0.4803	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681	0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .8ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .0.3937 .19.9907	Gacter Table 6 0.77(0.7	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91)
Northeast East Southeast South West Solar gains Total gains Total gains Total gains Themperature du Utilisation for tau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr	147.7691 634.8523 hal temperativity of the second of the s	242.2342 725.7195 ture (heating periods: anins for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 ang season) in the living area, 1 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978	m2 000 900 900 000 500 100 509.8524 948.5484 ng area frc nil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 0m Table 9, 7 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .8ep 62.6791 5.1786 0.4731 .20.9929 19.9944 0.3937 19.9907 fLA =	Cot 62.3313 5.1554 0.7953 0.7395 19.8745 Living area	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South 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 Temp	147.7691 634.8523 hal temperativity of the second of the s	242.2342 725.7195 ture (heating periods: anins for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949	3.2: 7.4' 3.2: 3.7' 6.6 361.7973 827.7301 In the living area, 19 Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 900 000 509.8524 948.5484 ang area fromil,m (see Apr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805 20.1844	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 0	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944	Aug 62.8544 5.1903 0.2389 20.9998 19.9969 0.1641 19.9969 20.2979	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .85ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .3937 .19.9907 .614 = 20.2915	Cot 62.3313 5.1554 0.7953 0.7953 0.7955 19.8745 Living area 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South 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 Temp	147.7691 634.8523 anal temperal partial feature for gray Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717 nouse 0.9680 19.0027 reaction 19.3728	242.2342 725.7195 ture (heating periods: sins for liver periods: sins for liv	3.2: 7.4' 3.2: 3.7: 6.6. 361.7973 827.7301 361.7973 827.7301 in the living area, in Mar 61.4786 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 000 509.8524 948.5484 509.8524 948.5484 20.8929 19.8805 20.1844 20.1844	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 0 m Table 9, 1 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .85ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .3937 .19.9907 .614 = 20.2915	Cot 62.3313 5.1554 0.7953 0.7953 0.7955 19.8745 Living area 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West 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	147.7691 634.8523 mal temperation of the second of the se	242.2342 725.7195 ture (heating periods: ains for liver	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 361.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 000 509 8524 948.5484 100 100 100 100 100 100 100 100 100 1	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 7 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 Ph1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .85ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .3937 .19.9907 .614 = 20.2915	Cot 62.3313 5.1554 0.7953 0.7953 0.7955 19.8745 Living area 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West 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	147.7691 634.8523 mal temperation of the second of the se	242.2342 725.7195 ture (heating periods: ains for liver	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 361.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 000 509 8524 948.5484 100 100 100 100 100 100 100 100 100 1	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 7 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 Ph1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 .836.3474 .85ep .62.6791 .5.1786 .0.4731 .20.9929 .19.9944 .3937 .19.9907 .614 = 20.2915	Cot 62.3313 5.1554 0.7953 0.7953 0.7955 19.8745 Living area 20.1750	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Northeast East Southeast South West 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	147.7691 634.8523 mal temperal actor for grant for gra	242.2342 725.7195 Ture (heating periods: anins for live Feb (heating periods: 10,4786) (heating periods: 10,9532) (heating periods: 10,9532) (heating periods: 10,9549) (heating perio	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 3827.7301 in the living area, 19 4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 000 509.8524 948.5484 509.8524 948.5484 ang area frr 61.9874 5.1325 0.7423 20.8929 19.9843 0.6927 19.8805 20.1844 20.1844	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 0m Table 9, 1 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .51786 .04731 .20.9929 19.9944 .0.3937 .19.9907 .20.2915 .20.2915	factor fa	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(76) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West Total gains 7. Mean interr Temperature du tilisation 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 Utilisation Useful gains	147.7691 634.8523 mal temperation of the second of the se	242.2342 725.7195 ture (heating periods: ains for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949 19.5949 19.5949	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 ang season) in the living area, 10 Mar 61.4786 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187	m2 000 900 000 509 8524 948.5484 100 900 900 100 900 100 900 900 900 90	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 7able 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 20.2944	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .8ep 62.6791 5.1786 0.4731 .20.9929 19.9944 0.3937 19.9907 fLA = 20.2915 .20.2915	factor Table 6 0.770 0.770 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.777 0.775 0.775 0.775 0.775 0.755 0.7	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West	147.7691 634.8523 all temperal arring heatin actor for gr Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717 house 0.9680 19.3728 dijustment 19.3728 dijustment 19.3728 dijustment 19.3728	242.2342 725.7195 ture (heating periods: ains for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949 19.5949	3.2: 7.4' 3.2: 3.7: 6.6 361.7973 827.7301 in the living area, mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187	m2 000 900 000 509 8524 948.5484 100 900 900 100 900 100 900 900 900 90	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 m Table 9, 1 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 20.2736 20.2736	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 20.2944	Aug 62.8544 5.1903 0.2389 20.9998 19.9969 0.1641 19.9969 20.2979 20.2979	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .862.6791 .5.1786 .4731 .20.9929 19.9944 .3937 .19.9907 .61A = 20.2915 .20.2915	Cet 0.7750 296.5908 717.5714 0.7953 0.7953 0.7953 0.7953 0.7953 0.7953 0.7953 0.7750 0	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Northeast East Southeast South West 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 Utilisation Useful gains Ext temp. Heat loss rate	147.7691 634.8523 all temperal all temperal aring heatin actor for gr Jan 61.1440 5.0763 rea 0.9754 20.2355 19.9717 nouse 0.9680 19.0027 raction 19.3728 ijustment 19.3728 Jan 0.9626 611.0979 5.1000 e 1009.9028	242.2342 725.7195 Ture (heating periods: ains for live Feb 61.4786 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949 19.5949 19.5949 19.5949	3.2: 7.4' 3.2: 3.7: 6.6 361.7973 827.7301 361.4786 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 Mar 0.8609 712.66230 7.4000 880.9710	m2 000 900 900 000 509.8524 948.5484 509.8524 948.5484 0.6927 19.8805 20.1844 20.1844 Apr 0.7030 666.8083 9.9000 717.7945	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 0m Table 9, 1 Table 9a) May 61.9874 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736 May 0.4990 49.8940 13.0000 507.6619	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 20.2944 20.2944 17.9000 165.7338	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .51786 .62.6791 .51786 .64731 .64	fact: Table 6 0.77(0.77	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787 19.7787 Nov 0.9225 587.0269 8.0000 817.5526	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345 0.0000 19.3345	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (93)
Northeast East Southeast South 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 Utilisation Useful gains Ext temp. Heat loss rate Heat loss rate Heat loss rate	147.7691 634.8523 mal temperation of the second of the se	242.2342 725.7195 ture (heating periods: ains for live Feb 61.4786 5.0986 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.59	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 ang season) in the living area, in Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187 Mar 0.8609 712.6230 7.4000 880.9710 1.0000	m2 000 900 000 500 100 509.8524 948.5484 100 100 100 100 100 100 100	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 7 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736 May 0.4990 499.8940 13.0000 507.6619 1.0000	641.6272 1027.4873 Ph1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 20.2944 17.9000 165.7338 0.0000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .8ep 62.6791 5.1786 0.4731 .20.9929 19.9944 0.3937 19.9907 fLA = 20.2915 .20.2915 .20.2915	factor Table 6 0.770 0.7	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345	(76) (77) (77) (78) (80) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (93)
Northeast East Southeast South West Total gains Total gains Total gains Total gains Total gains Total gains The Man interr Temperature du Utilisation fatau alpha util living are from MIT The 2 util rest of Parity are from MIT Temperature acadjusted MIT Temperature acadjusted MIT Utilisation Useful gains Ext temp. Heat loss rate Month fracti	147.7691 634.8523 mal temperation of the second of the se	242.2342 725.7195 Ture (heating periods: ains for live Feb 61.4786 0.9532 20.4069 19.9768 0.9402 19.2467 19.5949 19.5949 19.5949 19.5949 19.5949	3.2: 7.4' 3.2: 3.7: 6.6' 361.7973 827.7301 ang season) in the living area, in Mar 61.4786 5.0986 0.8903 20.6669 19.9768 0.8627 19.5978 19.9187 19.9187 Mar 0.8609 712.6230 7.4000 880.9710 1.0000	m2 000 900 900 000 509.8524 948.5484 509.8524 948.5484 0.6927 19.8805 20.1844 20.1844 Apr 0.7030 666.8083 9.9000 717.7945	12.9236 22.3313 40.4699 50.9848 22.3313 590.8352 1001.7831 590.8352 1001.7831 7 Table 9a) May 61.9874 5.1325 0.5447 20.9808 19.9843 0.4803 19.9703 20.2736 20.2736 May 0.4990 499.8940 13.0000 507.6619 1.0000	641.6272 1027.4873 Th1 (C) Jun 62.6791 5.1786 0.3351 20.9988 19.9944 0.2681 19.9939 20.2955 20.2955	0.4500 0.4500 0.4500 0.4500 0.4500 0.4500 606.3533 977.3566 Jul 62.5047 5.1670 0.2195 20.9999 19.9918 0.1481 19.9918 20.2944 20.2944 20.2944 20.2944 17.9000 165.7338	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000 .7000 .442.7927 836.3474 .51786 .62.6791 .51786 .64731 .64	factor Table 6 0.770 0.7	Nov 62.3313 5.1554 0.9449 20.5431 19.9893 0.9270 19.4508 a / (4) = 19.7787 19.7787	9.0277 36.5124 28.2700 41.7365 32.2225 122.9762 597.4933 21.0000 Dec 61.8169 5.1211 0.9804 20.2017 19.9818 0.9744 18.9626 0.3002 19.3345 0.0000 19.3345 0.0000 19.3345	(76) (77) (77) (78) (80) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (97a)

09 Jan 2014

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014 (98) / (4) = Space heating per m2 19.0844 (99) 8c. Space cooling requirement Calculated for June, July and August. See Table 10b Apr May 13.0000 Jul 17.9000 Jan 5.1000 Feb 5.6000 Mar Sep 15.2000 Nov 8.0000 Dec 5.1000 7.4000 17.8000 9.9000 16.0000 11.6000 Heat loss rate W 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 552.1957 0.9876 545.3413 426.7579 0.9935 423.9679 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (100) 0.0000 (101) 0.0000 (102) 422.2238 0.0000 Utilisation 0.0000 0.9952 420.2077 Useful loss Total gains 0.0000 Month fracti 0.0000 Space cooling kWh 0.0000 Useful loss 1135.8139 1079.7279 1.0000 1.0000 0.0000 0.0000 0.0000 0.0000 1013.2730 0.0000 0.0000 0.0000 0.0000 (103) 0.0000 (103a) 0.0000 0.0000 0.0000 0.0000 0.0000 425.1403 490.6830 0.0000 (104) 1354.2664 (104) Space cooling fC = cooled area / (4) = 0.0000 (Table 10b) 0.0000 Space cooling kWh 0.0000 0.0000 0.0000 0.2500 0.2500 0.2500 0.0000 0.0000 (106) 0.0000 0.0000 0.0000 51.8118 59.7995 53.4330 0.0000 0.0000 0.0000 0.0000 (107) Space cooling Space cooling per m2 165.0444 (107) 2.6492 (108) 9b. Energy requirements Fraction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from community system Fraction of heat from community Heat pump Fraction of total space heat from community Heat pump Factor for control and charging method (Table 4c(3)) for community space heating Factor for control and charging method (Table 4c(3)) for community water heating Distribution loss factor (Table 12c) for community heating system Space heating: Annual space heating requirement Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) Space heating fuel for secondary/supplementary system 0.0000 (301) 1.0000 (302) 1.0000 (303a) 1.0000 (304a) 1.0000 (305) 1.0000 (305a) 1.0500 (306) 1188.9587 (98) 1248.4066 (307a) 0.0000 (308) 0.0000 (309) Water heating Water heating requirement Annual water heating requirement Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05 Electricity used for heat distribution Cooling System Energy Efficiency Ratio 1630.3410 (64) 1711.8580 (310a) 29.6026 (313) 12.1770 (314) Space cooling (if there is a fixed cooling system, if not enter 0) Annual totals kWh/year 13.5538 (315) Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8250) mechanical ventilation fans (SFP = 0.8250) Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L) Total delivered energy for all uses 169.3034 (330a)

10b. Fuel costs - using BEDF prices (424)										
Fuel kWh/year 1248.4066 0.0000 1711.8580 13.5538 169.3034 0.0000 281.3633	Fuel price p/kWh 4.8900 0.0000 4.8900 16.1200 0.0000 16.1200	Fuel cost f/year 61.0471 (340 0.0000 (341 83.7099 (342 2.1849 (348 27.2917 (349 0.0000 (345 45.3558 (355 87.0000 (351 306.5893 (355								
	kWh/year 1248.4066 0.0000 1711.8580 13.5538 169.3034 0.0000	kWh/year p/kWh 1248.4066 4.8900 0.0000 0.0000 1711.8580 4.8900 13.5538 16.1200 169.3034 16.1200 0.0000 0.0000								

12b. Carbon dioxide emissions - Community heating scheme				
	Energy	Emission factor	Emissions	
	kWh/year	kg CO2/kWh	kg CO2/year	
Efficiency of heat source Heat pump			500.0000 (3	367a)
Space heating from Heat pump	592.0529	0.5190	307.2755 (3	367)
Electrical energy for heat distribution	29.6026	0.5190	15.3638 (3	372)
Total CO2 associated with community systems			322.6392 (3	373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			322.6392 (3	376)
Space cooling	13.5538	0.5190	7.0344 (3	377)
Pumps and fans	169.3034	0.5190	87.8684 (3	378)
Energy for lighting	281.3633	0.5190	146.0276 (3	379)
Total kg/year			563.5697 (3	383)

13b. Primary energy - Community heating scheme Energy Primary energy factor Wh/year kg CO2/kWh Primary energy kWh/year



169.3034 (331) 281.3633 (332) 3424.4851 (338)

CALCULATION OF EPC COSTS	, EMISSIONS AN	ND PRIMARY ENI	ERGY	09 Jan 2014	
Efficiency of heat source Heat pump Space heating from Heat pump Electrical energy for heat distribution Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			592.0529 29.6026	3.0700 3.0700	500.0000 (367a) 1817.6025 (367) 90.8801 (372) 1908.4826 (373)
Space and water heating Space cooling Pumps and fans Energy for lighting Primary energy kWh/year Primary energy kWh/m2/year			13.5538 169.3034 281.3633	3.0700 3.0700 3.0700	1908.4826 (376) 41.6101 (377) 519.7613 (378) 863.7854 (379) 3333.6394 (383) 53.5095 (384)
SAP 2012 EPC IMPROVEMENTS					
Current energy efficiency rating: Current environmental impact rating:		B 82 A 93			
(For testing purposes):					
A B C C D E Low energy lighting F G H I J K M N Solar water heating O P R S T U Solar photovoltaic panels A2 A3 T2 W X Y J2 Q2 Z1 Z2 Z3 Z4 Z5 V2 Wind turbine		Not considered			
L2 Q3		Not applicable Not considered Not considered			
O3 Recommended measures: SAP	change Cost change	Not considered CO2 change			
(none)					
Typ:	ical annual savings	Energy Environmenta efficiency impact	1		
(none) Total Savings £0	0.00 kg/m	2			
Potential energy efficiency rating: Potential environmental impact rating:		B 82 A 93			
Fuel prices for cost data on this page from da Recommendation texts revision number 4.9c (22		424 TEST (27 Feb 2018)			
Typical heating and lighting costs of this hor					
Electricity £75 Community scheme £232	£75 £0				
Space heating £175 Space cooling £2 Water heating £84 Lighting £45	£175 £0 £2 £0 £84 £0 £45 £0				
Total cost of fuels £307 Total cost of uses £306 Delivered energy 55 kWI Carbon dioxide emissions 0.6 to CO2 emissions per m² 9 kg/r Primary energy 54 kWI	onnes 0.6 tonnes m² 9 kg/m²	£0 £0 0 kWh/m ² 0.0 tonnes 0 kg/m ² 0 kWh/m ²			







CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan	
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 EndTerrace Flat Yes SAP Region Front of dwelling faces Overshading Thermal mass parameter Thames Valley North Average or unknown 250.0 Night ventilation Ventilation rate during hot weather (ach) Yes 6.00 (Windows fully open) Overheating Calculation 333.06 (P1) Summer ventilation heat loss coefficient Transmission heat loss coefficient Summer heat loss coefficient 55.44 (37) 388.50 (P2) Overhangs Orientation Ratio Z overhangs Overhang type 0.000 0.000 0.000 North East East South East 1.000 None None South 0.000 1.000 None Solar shading Orientation Z blinds Solar access Z overhangs Z summer 0.900 (P8) 0.900 (P8) 0.900 (P8) 0.900 (P8) North East 0 90 1 000 1.000 0.90 1.000 East South East South 1.000 0.90 1.000 1.000 0.900 (P8) Solar flux Shading [Jul] Area FF Gains Specific data or Table 6b Table 6a W/m2 Specific data or Table 6c 0.7000 80.7052 3.2000 98.8453 0.4500 0.9000 North East 7.4900 3.2000 3.7500 6.6100 117.5071 119.9223 112.2060 117.5071 0.4500 0.4500 0.4500 0.4500 0.7000 0.7000 0.7000 0.7000 0.9000 0.9000 0.9000 0.9000 224.5646 97.9142 107.3601 198.1805 East South East South West total: 708.7247 Aug 635 378 Jun 750 709 371 (P3) Solar gains Internal gains Total summer gains 386 1080 1013 (P5) 2.92 2.78 Summer gain/loss ratio (P6) Summer external temperature
Thermal mass temperature increment (TMP = 250.0)
Threshold temperature
Likelihood of high internal temperature 16.00 0.25 19.17 Not significant 17.90 0.25 20.93 Slight 17.80 0.25 20.66 Slight (P7)

Slight



Assessment of likelihood of high internal temperature:



Block Compliance



(Design System) version 4.05r02



APPENDIX 3 –ASHP EFFICIENCY DATA

Mitsubishi Electric City Multi YLM Seasonal Efficiency Aug-15

Model		Complete System Efficiency (typical) Outdoor Unit Only Efficiency Complete System Annual Efficiency Examples									
Range		SEER	SCOP	SEER	SCOP	20% H, 80% C NEW OFFICE	60% H, 40% C OLD OFFICE	50% H, 50% C NEW HOTEL	70% H, 30% C OLD HOTEL	10% H, 90% C RETAIL	System includes
	PUHY-EP200YLM-A	9.02	5.53	10.99	6.08	8.32	6.93	7.28	6.58	8.67	5 x PLFY-P40VBM
	PUHY-EP250YLM-A	9.02	6.00	11.39	6.79	8.42	7.21	7.51	6.91	8.72	7 x PLFY-P40VBM
	PUHY-EP300YLM-A	7.75	6.00	9.27	6.77	7.40	6.70	6.88	6.53	7.58	8 x PLFY-P40VBM
	PUHY-EP350YLM-A	7.16	5.90	8.36	6.64	6.91	6.40	6.53	6.28	7.03	9 x PLFY-P40VBM
	PUHY-EP400YLM-A	6.97	4.79	8.19	5.25	6.53	5.66	5.88	5.44	6.75	10 x PLFY-P40VBM
	PUHY-EP450YLM-A	7.03	4.85	7.96	5.23	6.59	5.72	5.94	5.50	6.81	9 x PLFY-P50VBM
Heat	PUHY-EP500YLM-A	7.28	4.90	8.30	5.30	6.80	5.85	6.09	5.61	7.04	10 x PLFY-P50VBM
Pump	PUHY-EP550YSLM-A	8.75	6.07	10.22	6.65	8.21	7.14	7.41	6.87	8.48	11 x PLFY-P50VBM
ligh COP	PUHY-EP600YSLM-A	7.45	6.08	8.43	6.68	7.18	6.63	6.77	6.49	7.31	12 x PLFY-P50VBM
	PUHY-EP650YSLM-A	8.48	5.40	9.82	5.82	7.86	6.63	6.94	6.32	8.17	13 x PLFY-P50VBM
	PUHY-EP700YSLM-A	8.29	5.61	9.57	6.07	7.75	6.68	6.95	6.41	8.02	14 x PLFY-P50VBM
	PUHY-EP750YSLM-A	8.79	6.41	10.31	7.06	8.31	7.36	7.60	7.12	8.55	15 x PLFY-P50VBM
	PUHY-EP800YSLM-A	7.53	6.40	8.59	7.08	7.30	6.85	6.97	6.74	7.42	16 x PLFY-P50VBM
	PUHY-EP850YSLM-A	7.68	6.03	8.79	6.68	7.35	6.69	6.86	6.53	7.52	14 x PLFY-P63VBM
	PUHY-EP900YSLM-A	7.58	6.02	8.68	6.68	7.27	6.64	6.80	6.49	7.42	15 x PLFY-P63VBM
	PUHY-P200YKB-A1	8.12	5.08	9.65	5.57	7.51	5.99	8.83	4.46	1.50	5 x PLFY-P40VBM
	PUHY-P250YKB-A1	8.36	5.65	10.31	6.38	7.82	6.58	9.52	5.10	1.56	7 x PLFY-P40VBM
	PUHY-P300YKB-A1	7.15	5.63	8.42	6.32	6.85	6.19	8.00	5.06	1.37	8 x PLFY-P40VBM
	PUHY-P350YKB-A1	6.66	5.61	7.69	6.31	6.45	6.03	7.41	5.05	1.29	9 x PLFY-P40VBM
	PUHY-P400YKB-A1	6.04	4.65	6.94	5.04	5.76	5.11	6.56	4.03	1.15	10 x PLFY-P40VBM
	PUHY-P450YKB-A1	6.47	4.64	7.27	4.98	6.10	5.17	6.81	3.98	1.22	9 x PLFY-P50VBM
	PUHY-P500YKB-A1	6.83	4.77	7.82	5.14	6.42	5.38	7.28	4.11	1.28	10 x PLFY-PSOVBM
	PUHY-P550YSKB-A1	8.39	5.70	9.77	6.23	7.85	6.51	9.06	4.98	1.57	11 x PLFY-P50VBM
	PUHY-P600YSKB-A1	6.69	5.69	7.47	6.23	6.49	6.05	7.22	4.98	1.30	12 x PLFY-P50VBM
Y Series	PUHY-P650YSKB-A1	6.94	4.83	7.81	5.19	6.52	5.43	7.29	4.15	1.30	13 x PLFY-P50VBM
Heat	PUHY-P700YSKB-A1	6.47	5.05	7.23	5.45	6.19	5.49	6.87	4.36	1.24	14 x PLFY-P50VBM
Pump -	PUHY-P7S0YSKB-A1	7.61	5.48	8.91	5.98	7.18	6.17	8.32	4.78	1.44	15 x PLFY-PSOVBM
tandard	PUHY-P800YSKB-A1	5.93	5.44	6.56	5.96	5.83	5.66	6.44	4.77	1.17	16 x PLFY-P50VBM
	PUHY-P850YSKB-A1	6.01	4.95	6.67	5.41	5.80	5.29	6.42	4.33	1.16	14 x PLFY-P63VBM
	PUHY-P900YSKB-A1	6.08	4.89	6.76	5.35	5.84	5.26	6.48	4.28	1.17	15 x PLFY-P63VBM
	PUHY-P950YSKB-A1	6.71	5.39	7.50	5.92	6.45	5.81	7.18	4.74	1.29	15 x PLFY-P63VBM
	PUHY-P1000YSKB-A1	6.67	5.32	7.46	5.84	6.40	5.75	7.14	4.67	1.28	16 x PLFY-P63VBM
	PUHY-P1050YSKB-A1	6.65	5.66	7.45	6.28	6.45	6.02	7.22	5.02	1.29	17 x PLFY-P63VBM
	PUHY-P1100YSKB-A1	6.40	5.44	7.11	5.98	6.21	5.77	6.88	4.78	1.24	17 x PLFY-P63VBM
	PUHY-P1150YSKB-A1	6.44	5.33	7.16	5.85	6.22	5.70	6.90	4.68	1.24	18 x PLFY-P63VBM
	PUHY-P1200YSKB-A1	5.85	4.56	6.52	4.90	5.59	4.95	6.20	3.92	1.12	19 x PLFY-P63VBM
	PUHY-P1250YSKB-A1	6.44	4.54	7.22	4.88	6.06	5.08	6.75	3.90	1.21	20 x PLFY-P63VBM
	PURY-EP200YLM-A	8.21	5.06	11.17	5.73	7.58	6.32	6.64	6.01	7.90	5 x PLFY-P40VBM + CMB-105G1
	PURY-EP250YLM-A	8.20	5.36	11.88	6.33	7.63	6.50	6.78	6.21	7.92	7 x PLFY-P40VBM + CMB-108GA:
	PURY-EP300YLM-A	6.79	5.41	8.91	6.39	6.51	5.96	6.10	5.82	6.65	8 x PLFY-P40VBM + CMB-108GA
	PURY-EP350YLM-A	6.56	5.38	8.42	6.30	6.32	5.85	5.97	5.73	6.44	9 x PLFY-P40VBM + CMB-1010G
	PURY-EP400YLM-A	6.85	4.59	8.79	5.14	6.40	5.49	5.72	5.27	6.62	10 x PLFY-P40VBM + CMB-10100
	PURY-EP450YLM-A	7.05	4.93	8.72	5.41	6.63	5.78	5.99	5.57	6.84	9 x PLFY-P50VBM + CMB-1010G
Heat	PURY-EP500YLM-A	6.79	4.97	8.23	5.45	6.43	5.70	5.88	5.52	6.61	10 x PLFY-P50VBM + CMB-10100
	PURY-EPSSOYSLM-A	7.88	5.60	10.12	6.33	7.42	6.51	6.74	6.28	7.65	11 x PLFY-P50VBM + CMB-10100
	PURY-EP600YSLM-A	7.06	5.63	8.66	6.33	6.77	6.20	6.35	6.06	6.92	12 x PLFY-P50VBM + CMB-10130
ign cor	PURY-EP650YSLM-A	6.87	5.47	8.34	6.12	6.59	6.03	6.17	5.89	6.73	13 x PLFY-P50VBM + CMB-10130
	PURY-EP700YSLM-A								6.04		14 x PLFY-P50VBM + CMB-10150
	PURY-EP750YSLM-A	6.70 6.80	5.75 4.91	8.18 8.35	6.52	6.51	6.13 5.67	6.23 5.86	5.48	6.61	15 x PLFY-P50VBM + CMB-1016F
	PURY-EP800YSLM-A	6.88	4.78	8.40	5.40 5.23	6.46	5.62	5.83	5.48	6.61 6.67	16 x PLFY-P50VBM + CMB-1016F



	PURY-EP850YSLM-A	7.14	4.83	8.75	5.30	6.68	5.75	5.99	5.52	6.91	14 x PLFY-P63VBM + CMB-1016HA1
	PURY-EP900YSLM-A	7.19	4.93	8.82	5.43	6.74	5.83	6.06	5.61	6.96	15 x PLFY-P63VBM + CMB-1016HA1
	PURY-P200YLM-A1	7.54	4.96	9.79	5.58	7.02	5.93	8.95	4.46	1.40	5 x PLFY-P40VBM + CMB-105G1
1	PURY-P250YLM-A1	7.02	5.32	9.36	6.21	6.68	6.13	8.73	4.97	1.34	7 x PLFY-P40VBM + CMB-108GA1
	PURY-P300YLM-A1	6.09	5.18	7.60	6.11	5.91	5.66	7.30	4.89	1.18	8 x PLFY-P40VBM + CMB-108GA1
1	PURY-P350YLM-A1	5.76	5.29	7.04	6.26	5.67	5.64	6.88	5.01	1.13	9 x PLFY-P40VBM + CMB-1010GA1
	PURY-P400YLM-A1	6.64	4.35	8.36	4.91	6.18	5.15	7.67	3.93	1.24	10 x PLFY-P40VBM + CMB-1010GA1
1	PURY-P450YLM-A1	6.25	4.80	7.45	5.26	5.96	5.33	7.01	4.21	1.19	9 x PLFY-P50VBM + CMB-1010GA1
	PURY-P500YLM-A1	6.15	4.82	7.23	5.33	5.88	5.30	6.85	4.26	1.18	10 x PLFY-P50VBM + CMB-1010GA1
R2 Series	PURY-P400YSLM-A1	7.07	5.19	8.99	5.93	6.69	5.95	8.38	4.74	1.34	10 x PLFY-P40VBM + CMB-1010GA1
Heat	PURY-P450YSLM-A1	7.26	5.54	8.92	6.18	6.92	6.22	8.37	4.94	1.38	9 x PLFY-P50VBM + CMB-1010GA1
Recovery -	PURY-P500YSLM-A1	7.16	5.90	8.69	6.62	6.91	6.46	8.28	5.30	1.38	10 x PLFY-P50VBM + CMB-1010GA1
Standard	PURY-P550YSLM-A1	6.67	5.43	8.03	6.13	6.42	5.95	7.65	4.90	1.28	11 x PLFY-P50VBM + CMB-1013GA1
	PURY-P600YSLM-A1	6.30	5.36	7.45	6.06	6.11	5.78	7.17	4.85	1.22	12 x PLFY-P50VBM + CMB-1013GA1
l	PURY-P650YSLM-A1	6.13	5.30	7.21	5.98	5.96	5.68	6.96	4.78	1.19	13 x PLFY-P50VBM + CMB-1013GA1
	PURY-P700YSLM-A1	5.83	5.67	6.84	6.48	5.80	5.90	6.77	5.18	1.16	14 x PLFY-PSOVBM + CMB-1016HA1
1	PURY-P750YSLM-A1	6.28	4.77	7.48	5.26	5.98	5.31	7.04	4.21	1.20	15 x PLFY-P50VBM + CMB-1016HA1
	PURY-P800YSLM-A1	6.33	4.54	7.55	5.00	5.97	5.14	7.04	4.00	1.19	16 x PLFY-P50VBM + CMB-1016HA1
	PURY-P850YSLM-A1	6.74	4.65	8.11	5.11	6.32	5.34	7.51	4.09	1.26	14 x PLFY-P63VBM + CMB-1016HA1
	PURY-P900YSLM-A1	6.35	4.80	7.51	5.27	6.04	5.34	7.06	4.22	1.21	15 x PLFY-P63VBM + CMB-1016HA1

NOTE:

Complete System Efficiency (typical) - this includes for power input of the outdoor unit, outdoor standby power, indoor units, BC controller Outdoor Unit Only Efficiency - this includes for power input of the outdoor unit, outdoor standby power ONLY

