9 The Green

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CONTENTS

EXECUTIVE SUMMARY	5
INTRODUCTION	7
PLANNING POLICIES	8
PROPOSED SUSTAINABILITY MEASURES	15
ENERGY STRATEGY	22
CONCLUSIONS	25
APPENDIX A – SAP WORKSHEETS	А
APPENDIX R _ RREEAM PRE-ASSESSMENT	В

EXECUTIVE SUMMARY

The sustainability and energy strategy for the 9 The Green development has been developed in line with the relevant policies of the London Plan and of the London Borough of Richmond upon Thames Local Plan.

The proposals incorporate a range of sustainable design and construction measures, primarily addressing the sustainable management of resources, the protection and enhancement of the environment and the effective adaptation and mitigation of the development to climate change.

This report presents the sustainability strategy and assesses the predicted energy performance and carbon dioxide emissions of the proposed development at 9 The Green, located in the London Borough of Richmond upon Thames.

The proposed development comprises the restoration and conversion of an existing Grade II listed building from office space into a single residential dwelling.

This document is divided into three parts:

- 1. Planning policies;
- 2. Proposed sustainability measures; and,
- 3. Energy Strategy.

The Planning Policy section provides an overview of the site and planning policies applicable to this development in accordance with the London Borough of Richmond upon Thames Local Plan and the London Plan.

The second section on proposed sustainability measures outlines the sustainability measures that have been adopted in the team's aim to maximise sustainability within the site.

The third section describes the predicted energy performance and carbon dioxide emissions of the proposed development at 9 The Green. The development will be compared to an existing building baseline modelled in line with Part L 2021 standards.

Key sustainability features of the proposals include:

• The re-use of previously developed land and refurbishment of an existing building;

- The improvement in fabric efficiency through additional internal insulation to the roof and refurbishment of the external walls.
- Upgrades to a more efficient space heating and domestic hot water system.
- The specification of water efficient fittings to limit water consumption to less than 105 litres per person per day;
- The development is not expected to have any significant adverse effects to air, noise, land or watercourses.

The energy strategy outlined in this report has been done using the latest Building Regulations Part L 2021 methodology and SAP 10.2 emissions factors as per current GLA Guidance. These carbon emission factors reflect the grid decarbonisation of recent years and ensure that the assessment of new developments better reflect the actual carbon emissions associated with their expected operation.

The energy strategy for the scheme focuses on the efficiency of the fabric and building services, so that the energy demand is reduced to the extent feasible. Energy efficiency is primarily achieved through the addition of roof insulation and improved air permeability. Highly efficient lighting, a new more efficient space heating and hot water system, as well as appropriate controls further reduce the regulated energy demand and consumption of the development.

The London Plan and the Local Plan does not set specific CO_2 reduction targets for residential conversions such as that at 9 The Green. However, CO_2 emissions have been reduced as far as is feasible. The 45.0% reduction in regulated CO_2 emissions compared to a Part L 2021 compliant scheme, based



on the existing fabric and systems, through roof insulation, cosmetic improvements to the external walls and a more efficient heating and hot water system.

The proposals in their entirety reflect the client and design team's aspirations to deliver a development that pushes the energy efficiency improvements to the allowable level while staying within the boundaries of accepted alterations to a grade II listed building.



INTRODUCTION

The proposed residential development is located within the London Borough of Richmond upon Thames. This section presents the description of the site and of the development proposal.

SITE & PROPOSAL

The site currently comprises a grade II listed three story (plus basement and attic rooms) town house containing office space. The proposal sets out a change of use, restoring the building back into its original use as a single residential dwelling using minimally invasive techniques.

The site is located in a suburban residential area with neighbouring houses either side, overlooking Richmond Green to the northwest, and lies within the Richmond Green Conservation Area.

The location of the development site is shown in Figure 1 below.



Figure 1: Location of the application site.

PLANNING POLICIES

The proposal responds to the energy and sustainability policies of the London Plan and of the policies within the London Borough of Richmond upon Thames Local Plan.

The most relevant applicable energy policies in the context of the proposed development are presented below.

THE LONDON PLAN (2021)

The London Plan (2021) published 2nd March 2021 sets out the Mayor's overarching strategic spatial development strategy for greater London and underpins the planning framework from 2019 up to 2041. This document replaced the London Plan 2016.

The new Plan has a strong sustainability focus with many new policies addressing the concern to deliver a sustainable and zero carbon London.

Policy GG6 Increasing Efficiency and Resilience is an overarching policy references London's target to become zero carbon by 2050 and the need to design buildings and infrastructure for a changing climate, addressing water, flood and urban heat island.

Sustainability is a trend through the whole Plan but is particularly addressed in chapter 9 Sustainable Infrastructure. The following sections outline the key principles of sustainable design and construction to be incorporated in major proposals.

Policy SI1 Improving air quality requires development proposals to be at least air quality neutral and submit an Air Quality Assessment.

"

Development plans, through relevant strategic, site specific and area-based policies should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

Any mitigation required to meet the Air Quality Neutral target should be done on site preferably.

Policy SI2 Minimising greenhouse gas emissions sets the requirements for all major developments to follow the energy hierarchy and achieve net-zero-carbon for both residential and non-residential schemes (via onsite carbon reductions and offset payments) and introduces new targets at Lean stage:

"…

This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

1) be lean: use less energy and manage demand during operation

2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly

3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site

4) be seen: monitor, verify and report on energy performance.

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... "

A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either: 1) through a cash in lieu contribution to the borough's carbon offset fund, or 2) off-site provided that an alternative proposal is identified and delivery is certain.

This policy also sets the requirements to consider whole-life carbon emissions, including embodies carbon and unregulated emissions:



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

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

The policy supporting text provides additional clarifications on the requirements for major developments:

- Developments including major refurbishments should also aim to meet the net-zero carbon target.
- All developments should maximise opportunities for on-site electricity and heat production from solar technologies (photovoltaic and thermal), use innovative building materials and smart technologies.
- Recommendation to use SAP10 carbon factors as per GLA Energy Guidance.
- Recommended carbon offset price of £95 per tonne CO₂.
- Requirement for major developments to monitor and report operational energy performance to the GLA.

Policy SI 4 Managing heat risk requires:

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

B Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure

2) minimise internal heat generation through energy efficient design

3) manage the heat within the building through exposed internal thermal mass and high ceilings

4) provide passive ventilation

5) provide mechanical ventilation

6) provide active cooling systems.

Policy SI5 Water Infrastructure sets the requirements to manage water resources efficiently:

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Development proposals should:

1) through the use of Planning Conditions minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)

2) achieve at least the BREEAM excellent standard for the 'Wat 01' water category or equivalent (commercial development)

3) incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future-proofing. ..."

Policy SI 7 Reducing waste and supporting the circular economy introduces the notion of circular economy whereby materials are retained in use at their highest value for as long as possible. For referable applications a Circular Economy Statement demonstrating how developments promote circular economy and aim to be net zero-waste must be submitted.

Policy SI12 Flood risk management and Policy SI 13 Sustainable drainage sets the requirements for development proposals to ensure that flood risk is minimised, and that sustainable drainage is incorporated. This should be pursued by integrating different strategies including natural flood management. Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. For this green features should be employed, following the drainage hierarchy.

Policy D14 Noise requires that noise impacts are minimised and mitigated to avoid any adverse impacts on health and quality of life and to reflect the principles set in **Policy D13 Agent of Change** that "places the



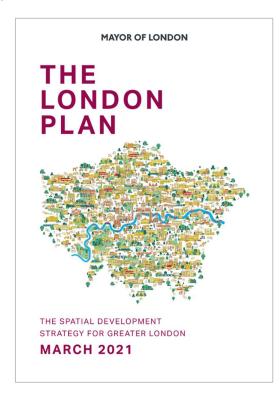
responsibility for mitigating impacts from existing noise and other nuisance-generating activities or uses on the proposed new noise-sensitive development."

Policy G6 Biodiversity and access to nature states:

"

Development proposals should manage impacts on biodiversity and aim to secure net biodiversity gain. This should be informed by the best available ecological information and addressed from the start of the development process.

It is noted that the proposed scheme does not constitute 'major' development, and therefore London Plan policies, intended for major developments, are not applicable in this case.



GLA GUIDANCE ON PREPARING ENERGY ASSESSMENTS

This document (last updated in June 2022) provides guidance on preparing energy assessments to accompany strategic planning applications; it contains clarifications on Policy SI 2, of the new London Plan, carbon reduction targets in the context of zero carbon policy, as well as detailed guidelines on the content of the Energy Assessments undertaken for planning.

The guidance document specifies the emission reduction targets the GLA will apply to applications as follows:

"Major developments are required to achieve net zero-carbon by following the energy hierarchy (Policy SI 2). This means that regulated carbon emissions should be reduced so they are as close as possible to zero. Once on-site reductions have been maximised, the residual emissions should be offset via a payment into the relevant borough's carbon offset fund.

Major developments are required to achieve a minimum 35 per cent on-site carbon reduction over Part L 2021. ..."

"... If the net zero-carbon target cannot be met on site and the GLA and the relevant borough is satisfied that on-site savings have been maximised, then the annual remaining carbon emissions figure is multiplied by the assumed lifetime of the development's services (e.g. 30 years) to give the cumulative shortfall. The cumulative shortfall is multiplied by the carbon dioxide offset price to determine the required cash-in-lieu contribution. ..."

The new guidance also includes changes to technical requirements relating to the use of updated carbon factors, cost estimates, overheating risk analysis, the structure of the heating hierarchy and scrutiny over the performance of heat pumps. The guidance also provides information on how the new stage of the energy hierarchy 'be seen' is expected to be carried out in energy assessments, which includes calculating the unregulated carbon emissions.

The structure of this report and the presentation of the carbon emission information for the development follows the guidance in this document.

It is noted that the proposed scheme does not constitute 'major' development, and therefore GLA guidance intended for major developments, are not applicable in this case.

Energy Assessment Guidance Greater London Authority guidance on preparing energy assessments as part of planning applications (June 2022)

LONDON BOROUGH OF RICHMOND UPON THAMES LOCAL PLAN

Policy LP 3 - Designated Heritage Assets

A. The Council will require development to conserve and, where possible, take opportunities to make a positive contribution to, the historic environment of the borough. Development proposals likely to adversely affect the significance of heritage assets will be assessed against the requirement to seek to avoid harm and the justification for the proposal. The significance (including the settings) of the borough's designated heritage assets, encompassing Conservation Areas, listed buildings, Scheduled Monuments as well as the Registered Historic Parks and Gardens, will be conserved and enhanced by the following means:

- Give great weight to the conservation of the heritage asset when considering the impact of a proposed development on the significance of the asset.
- Resist the demolition in whole, or in part, of listed building. Consent for demolition of Grade II listed buildings will only be granted in exceptional circumstances and for Grade II* and Grade I listed buildings in wholly exceptional circumstances following a thorough assessment of the justification for the proposal and the significance of the asset.
- 3. Resist the change of use of listed buildings where their significance would be harmed, particularly where the current use contributes to the character of the surrounding area and to its sense of place.
- 4. Require the retention and preservation of the original structure, layout, architectural features, materials as well as later features of interest within listed buildings, and resist the removal or modification of features that are both internally and externally of architectural importance or that contribute to the significance of the asset.
- Demolitions (in whole or in part), alterations, extensions and any other modifications to listed buildings should be based on an accurate understanding of the significance of the heritage asset.
- Require, where appropriate, the reinstatement of internal and external features of special architectural or historic significance within listed buildings, and the removal of internal and external features that harm the significance of

- the asset, commensurate with the extent of proposed development.
- Require the use of appropriate materials and techniques and strongly encourage any works or repairs to a designated heritage asset to be carried out in a correct, scholarly manner by appropriate specialists.
- 8. Protect and enhance the borough's registered Historic Parks and Gardens by ensuring that proposals do not have an adverse effect on their significance, including their setting and/or views to and from the registered landscape.
- 9. Protect Scheduled Monuments by ensuring proposals do not have an adverse impact on their significance.
- B. Resist substantial demolition in Conservation Areas and any changes that could harm heritage assets, unless it can be demonstrated that:
- in the case of substantial harm or loss to the significance of the heritage asset, it is necessary to achieve substantial public benefits that outweigh that harm or loss;
- 2. in the case of less than substantial harm to the significance of the heritage asset, that the public benefits, including securing the optimum viable use, outweigh that harm; or
- the building or part of the building or structure makes no positive contribution to the character or distinctiveness of the area.

C. All proposals in Conservation Areas are required to preserve and, where possible, enhance the character or the appearance of the Conservation Area.

Policy LP 22 – Sustainable Design and Construction

- A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:
- Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
- Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum



- water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).
- New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.
- Proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible).
- B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:
- All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.
- 2. All other new residential buildings should achieve a 35% reduction.
- 3. All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy. Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.
- C. This should be achieved by following the Energy Hierarchy:
- 1. Be lean: use less energy
- 2. Be clean: supply energy efficiently
- 3. Be green: use renewable energy
- D. The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025. The following will be required:
- All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.
- Development proposals of 50 units or more, or new non-residential development of 1000sqm or more, will need to provide an assessment of the provision of on-site decentralised energy (DE) networks and combined heat and power (CHP).

3. Where feasible, new development of 50 units or more, or new non-residential development of 1000sqm or more, as well as schemes for the Proposal Sites identified in this Plan, will need to provide on-site DE and CHP; this is particularly necessary within the clusters identified for DE opportunities in the borough-wide Heat Mapping Study. Where on-site provision is not feasible, provision should be made for future connection to a local DE network should one become available.

Applicants are required to consider the installation of low, or preferably ultra-low, NOx boilers to reduce the amount of NOx emitted in the borough.

Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged where appropriate.

E. High standards of energy and water efficiency in existing developments will be supported wherever possible through retrofitting. Householder extensions and other development proposals that do not meet the thresholds set out in this policy are encouraged to complete and submit the Sustainable Construction Checklist SPD as far as possible, and opportunities for micro-generation of renewable energy will be supported in line with other policies in this Plan.

Other pertinent policies to sustainability and energy include:

- LP 10 Local Environmental Impacts, Pollution and Land Contamination
- Policy LP 15 Biodiversity
- LP 20 Climate Change Adaptation
- LP 21 Flood Risk and Sustainable Drainage
- LP 23 Water Resources and Infrastructure
- LP 24 Waste Management
- LP 44 Sustainable Travel Choices
- LP 45 Parking Standard and Servicing







PROPOSED SUSTAINABILITY MEASURES

This part of the report presents the key elements of the proposal that underpin environmental sustainability, demonstrates how the development complies with sustainable development policies and incorporates guidance on sustainable design and construction.

LAND AND SITE LAYOUT

Land use and Reuse of Existing Buildings

The land for this proposal is efficiently used as the scheme will be constructed on previously developed land. The site currently comprises a grade II, three storey (plus basement and attic rooms) building used as office space. This building will be kept in its entirety and is proposed to be restored back to its original use as a single residential dwelling.

Micro-climate

A microclimate is the distinctive climate of a small-scale area and the variables within it, such as temperature, rainfall, wind or humidity may be subtly different to the conditions prevailing over the area as a while. The main characteristics of microclimates within London are temperatures and wind.

The proposed scheme is not of a scale that could potentially have any significant impact on wind conditions around the site or any adverse effects on pedestrian and residents' comfort.



Impacts on Neighbours from Demolition and Construction

The use of the Considerate Constructors Scheme will be encouraged to ensure that contractors carry out their operations in a safe and considerate manner to avoid disturbances to neighbours.

HEALTH AND WELLBEING

Inclusive Design

The development aims to prioritise the future needs of occupants by ensuring the dwelling is designed to comply with Part M of the Building Regulations as far as feasibly possible given its grade II listed status. The proposal will also ensure that sections 1, 2 and 3 of Checklist A8 as part of the BREEAM Domestic Refurbishment assessment will be completed.

Safety and Security

The design team will implement measures where possible to provide a safe and secure dwelling for the residents.

Open Spaces/Amenity

The site benefits from a private garden to the rear of the property, which will allow residents to connect to the natural environment and enhance the occupants wellbeing as nature can significantly improve mood and happiness.

Daylight/Sunlight

By retaining the existing large windows, the proposed development ensures that occupants enjoy satisfactory levels of visual comfort and beneficial effects from daylight exposure.

Physical activity



The presence of amenity providers (shops, pharmacies, public park) within walking distance to the development will encourage residents to walk rather than use personal vehicles. The provision of cycle storage spaces will also encourage the use of alternative means of transportation for longer distances trips.



WATER

Water Efficiency

The development at 9 The Green aims to reduce water consumption to less than 105 litres per person per day, in line with the recommended target set out in the Richmond Local Plan, through the use of water efficient fittings, and these are listed below.

Table 1: Recommended specification for sanitary fittings

Fitting	Fitting specification				
WC	4/2.6 litres dual flush				
Kitchen sink tap	5 litres per min				
Wash basin tap	4 litres per min				
Shower	7.5 litres per min				
Bath	170 litres				
Washing machine	7.5 litres/kg				
Dishwasher	0.85 litres/place setting				



Water Efficient Landscaping

Should any landscaping form part of the current proposal, potable water consumption reduction from irrigation could be improved through a combination of water reuse and use of both native and drought resistant plant species, which will thrive with little to no irrigation and rely only on natural rainfall.

MATERIALS AND WASTE

Responsible Sourcing

100% of any timber used during construction will be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of forestry Certification (PEFC) source.

Healthy Materials

To minimise potential sources of indoor air pollution, low VOC paints, finishes and other products will be prioritised as far as practically possible. Best practice design detailing with specific focus to edges and building element junctions should also be employed to reduce the risk of thermal bridging and condensation issues, limiting the potential for mould growth.

Embodied Carbon

To further reduce carbon emissions over the lifecycle of the building, low embodied carbon materials for any new elements will be used as far as practically possible, whilst also focusing on design practices to reduce waste production.

Circular Economy

Circular economy is based on three key principles: design out waste, keep products and materials in use, and regenerate natural systems. Whilst minimal intervention is expected as part of the propose development due to the building's grade II listed status, these principles will be applied during the design and construction by following the actions noted below:

- Design out the need for building components and materials;
- Use of reclaimed materials and remanufactured components over new;
- Product selection considering its entire lifecycle, such as products which can be remanufactured or reused; products with high recycled content; products designed for disassembly; and recyclable or compostable materials.



Operational Waste

The design team will look to incorporate sustainable methods for waste and recycling management during the proposed development's operation to meet requirements from the local authority policies and all applicable legal requirements.



NATURE CONSERVATION & BIODIVERSITY

The ecology on site could be enhanced through improvements to landscaped areas within the proposed private garden. If this does form part of the proposal, the recommended planting strategy for these areas is simple low level flora, with hedge planting and small ornamental trees. Native plant species should be introduced to these areas where possible. This will help to attract invertebrates, birds and other fauna to the area.



CLIMATE CHANGE ADAPTATION

Overheating

The potential risk of overheating will be mitigated by incorporating both passive and active design measures.

The space heating and hot water to the development will be provided by a new high efficiency gas boiler. All heat sources and pipe work will be sufficiently insulated to avoid excess heat loss into internal space.

Efficient lighting will replace the existing fixtures to further minimise internal heat gains and reduce energy expenditure.

Internal blinds on all windows should be included in the base build to reduce the solar gains into occupied rooms where required.

During peak summer periods the thermal mass of the buildings will absorb and store excess heat. The buildings will release heat in the cooler evenings to allow for cooler internal spaces, dampening the peak diurnal weather conditions.

The dwellings have allowed for passive ventilation as the main method for providing fresh air and dissipating heat.

Surface Water and Flooding

The buildings' fabric and structure will be designed to minimise risk of infiltration and damage via flooding, where possible. The site falls within an area with very low flooding risk to flooding.



AIR, NOISE, AND LIGHT

Air Quality

Air pollution risks from construction and demolition activities on site will be minimal in line with the SPG 'The control of dust and emissions from construction and demolition' under the following categories:

- demolition;
- earthworks:
- construction;
- trackout; and,
- non-road mobile machinery (NRMM).

During the operational phase of the development, combustion of fossil fuels and associated combustion emissions for heating will be reduced via improved levels of insulation to the roof and air tightness for the buildings' fabric, and the specification of a new highly efficient gas boiler (for further details please refer to the Energy Strategy section of this report).

An ultra-low NOx boiler (maximum NO_x emissions of under 40mg/kWh dry NO_x at 0% excess O_2) should be proposed to further reduce impacts on air quality from the combustion of fuels on site. This is also required to ensure the relevant credits are achieved for the BREEAM Domestic Refurbishment assessment.

Noise

The development will incorporate design and building fabric measures internally to mitigate potential noise levels from the proposed development and ensure the impact of any external sources on internal ambient noise levels are within acceptable limits.

Light Pollution

The lighting design of the proposed development will follow the recommendations of the Institution of Lighting Engineers' Guidance Notes for the Reduction of Obtrusive Light (2005), to minimise light pollution.

Water Pollution

As there is no change in impermeable surfaces, and therefore no increase in surface water runoff, there will be no increase in water pollution to surrounding watercourses. In addition, the contractor will adopt best practice policies to mitigate water pollution from the minor construction activities taking place on this on site.



The development will discharge domestic sewage via a connection to the public foul sewer or combined sewer network where it is reasonable to do so.



TRANSPORT

Alternative means of transportation

The development is proposing to reduce the site parking permits from the allowance of five business permits down to two, due to the change of use from office space to residential. In order to underpin the reduction of emissions from transport, the development will encourage cycling by providing two secure cycle parking spaces to the rear of the building.

Public Transport Accessibility

The site has excellent accessibility to public transport, with numerous bus routes within a few minutes' walk and Richmond Underground Station just over 300m away. The site has a PTAL 6a rating.

Proximity to Amenities

The site is a short walk to Richmond High Street. This provides the residents with access to banks, cash points, coffee shops, grocery shops and post offices and numerous food outlets within a short walking distance. The site is situated directly opposite Richmond Green, an extensive open green space which hosts local cricket matches and community fairs.

BREEAM DOMESTIC REFURBISHMENT

In addition to the above measures, which will be incorporated for the development in its entirety, the dwelling will be assessed and certified under the BREEAM Domestic Refurbishment scheme in line with Policy LP 22.

A BREEAM pre-assessment has been undertaken at pre-application stage which has shown that a score of 61.35% and a Very Good rating is feasible. Although this does not meet the required target of 'Excellent' as

set out in the Richmond Local Plan, this is unlikely to be feasible due to the proposed development involving the change of use of a grade II listed building and being situated within a conservation area. This means that there are restrictions on what updates and changes can be implemented and as a result, limitations on what credits can be achieved.

The results for the pre-assessment are summarised in the table below and include a breakdown of the currently targeted score for each issue and category.

Table 2: BREEAM Pre-Assessment Breakdown

BREEAM Category	Total Credits	Score Assessment			
BREEAM Category	Available	Sub-total	Weighting	Score (%)	
Management	11	1.0	12.0	1.09	
Health & Wellbeing	12	8.0	17.0	11.33	
Energy	29	20.5	43.0	30.40	
Water	5	4.5	11.0	9.90	
Materials	48	11.0	8.0	1.83	
Waste	5	3.0	3.0	1.80	
Pollution	8	4.0	6.0	3.00	
Innovation	10	2.0	10.0	2.00	
BREE	Total	Points Scor	red: 61.35%		

ENERGY STRATEGY

This section describes the predicted energy performance and carbon dioxide emissions of the proposed 9 The Green development based on the information provided by the design team.

The overall regulated CO₂ savings *on site* against a Part L 2021 compliant scheme are estimated at 45%.

METHODOLOGY

This section of the energy strategy assesses an existing building, therefore it is not possible to compare it with the Part L notional building (TER), as this is only applicable to new builds. Instead, a baseline model was created to reflect the existing building in its expected current state for the purposes of comparing this building with the energy performance of the refurbished building once the proposed improvements have been incorporated.

BASELINE MODEL

GLA BASELINE INPUTS

The baseline model has been designed in line Part L 2021 using the GLA guidance for the residential 'notional refurbishment' specification of existing buildings. Given the grade II listed status of the building, where relevant existing U-values have been included based on the 'Appendix S: Reduced Data SAP for existing dwellings' of the Government's Standard Assessment Procedure for Energy Rating of Existing Dwellings. The inputs used can be seen in the table below.

Element	Unit	Specification	
External Wall	W/m ² K	2.1	
Roof	W/m ² K	2.3	
Floor	W/m ² K	1.2	
Window Glazing	W/m ² K	4.8 (0.85 g-value)	
Roof Window Glazing	W/m ² K	5.1 (0.85 g-value)	
Air Permeability	m³/h m² @50 Pa	15	
Thermal Bridging	W/m²K	Default	
HVAC Type	-	Naturally ventilated	

Heating / Hot Water	Per cent	Gas boiler with 80% summer efficiency			
Cooling	SEER	None			
Lighting (fixed)	Per cent	100% fluorescent lighting			

REFURBISHED MODEL

INPUTS

Due to the heritage constraints associated with a grade II listed building, the refurbishment options are very limited. Following discussions with the team, the assessment includes upgraded insulation to the roof and re-pointing to the exterior, along with installing a new, more efficient gas boiler, improved pipework insulation, and both high efficiency lighting and heating controls.

These inputs can be seen in the table below.

Element	Unit	Input
External Wall (repointed and refurbished)	W/m²K	1.6
Roof (with 300mm PIR insulation added)	W/m²K	0.3
Floor	W/m²K	1.2
Window Glazing	W/m²K	4.8 (0.85 g-value)
Roof Window Glazing	W/m²K	5.1 (0.85 g-value)
Air permeability	m³/h m² @50 Pa	10
Thermal Bridging	W/m²K	Default, with 20% improvement on roof junctions
HVAC	-	Naturally ventilated

Heating System	Per cent	Gas boiler with 84% summer efficiency		
Cooling	-	None		
Lighting (fixed)	Per cent	100% low energy lighting		

ENERGY EFFICIENCY MEASURES

The proposals incorporate a range of passive and active design measures that will reduce the energy demand for space conditioning, hot water, and lighting.

PASSIVE DESIGN MEASURES

ENHANCED U-VALUES

The heat loss of different building fabric elements is dependent upon their U-value, which is a measure of the thermal transmittance through the element. An element with low U-value provides better levels of insulation and reduced heating demand.

Due to the grade II listed status of the building, there is limited scope to improve the u-values of the building elements. The proposed development will aim to increase the levels of insulation in the roof, in addition to improving the external walls though re-pointing and general refurbishments, in order to reduce the demand for space heating).

The tables on the previous page demonstrate the existing and improved performance of the proposed building fabric.

AIR PERMEABILITY IMPROVEMENT

Heat loss may also occur due to air infiltration. Although this cannot be eliminated altogether, good construction detailing, and the use of best practice construction techniques can minimise the amount of air infiltration.

The proposed development will aim to improve upon the default value of $15 \text{m}^3/\text{m}^2$ at 50Pa used in the baseline model by targeting air permeability rates of $10 \text{m}^3/\text{m}^2$ at 50Pa. This is expected to be achievable through improved roof insulation, re-pointing of external walls and expected internal cosmetic refurbishments including sealing of edges and air gaps.

THERMAL BRIDGING

Thermal bridging can cause significant heat loss within buildings, especially older buildings, whereby junctions between insulated building fabric elements provide less thermal resistance than the surrounding envelope. While repeating thermal bridges such as timber studs, rafters and wall ties are accounted for within u-value calculations, linear thermal bridges such as floor junctions, corners, roof junctions and window reveals must be included separately within the SAP calculations.

Heat loss from linear thermal bridges is known as the Psi-value (Ψ). Psi-values can be obtained through the modelling of specific junctions based on the proposed construction details is measured in W/mK. The cumulative impact of the total heat loss expected from all the thermal bridges combined is known as the y-value. The Building Regulations Part L 2021 uses a reference y-value of 0.20 for the notional building. However, as the existing building is expected to have poor thermal bridging performance, the baseline model has been calculated using the default psi-values.

The proposed development aims to improve on the default values by 20%, only where insulation has been added (i.e. at roof junctions), and this figure has been used within the calculations accordingly.

REDUCING THE NEED FOR ARTIFICIAL LIGHTING

As the existing building's windows are to be retained, large areas of glazing across all building elevations are present, which will optimise daylight in occupied spaces. Good internal daylight levels will translate to less dependency on artificial lighting and will indirectly deliver energy and carbon savings, together with pleasant, healthy spaces for occupants.

ACTIVE DESIGN MEASURES

HIGH EFFICACY LIGHTING

The development intends to incorporate low energy lighting fittings throughout the residential spaces, replacing the existing fluorescent lighting. All light fittings will be specified as low energy lighting and will primarily accommodate LEDs.



HEAT GENERATION

As there is no scope to introduce air source heat pumps due to space, noise and planning restrictions, a new efficient gas boiler has been included for supply of space heating and hot water in the SAP calculations.

CONTROLS

Advanced lighting and space conditioning controls will be incorporated, specifically heating controls that incorporate time and temperature zone control.

MONITORING

Apart from the above design measures, the development will incorporate monitoring equipment and systems to enable occupiers to monitor and reduce their energy use.

Smart meters will be installed to monitor the heat and electricity consumption of each dwelling; the display board will demonstrate real-time and historical energy use data and will be installed at an accessible location within the dwellings.

DISTRICT ENERGY

The size and location of this development does not lend itself to incorporation into an existing or proposed heat network. The proposal includes the conversion of a grade II listed building to create a single dwelling therefore connecting to a district energy network would not be viable. Therefore, no regulated carbon savings are achieved through the use of district energy.

CO₂ EMISSIONS

The regulated CO_2 emissions for the baseline and proposed building are set out in the table below. By means of fabric improvements and building systems upgrades, the carbon emissions are shown to reduce by 45.0%.

Element	CO₂ Emissions (tonnes per year)	Reduction (%)			
Baseline	19.09	-			
Proposed	10.50	45.0			

CONCLUSIONS

The sustainability strategy for the scheme at 9 The Green has been developed in line with the relevant policies of the London Plan and of the Richmond upon Thames Local Plan and aims at the efficient management of resources, environmental protection and the effective adaptation and mitigation of the development to climate change.

The energy strategy has shown the cumulative CO₂ savings on site are estimated at 45.0% over the existing building baseline assessment which has been modelled in line with Part L 2021.

SUSTAINABILITY

The proposed 9 The Green development will meet the targets set out by Richmond upon Thames Council.

Key sustainability features of the proposals include:

- The re-use of previously developed land and refurbishment of an existing building;
- The improvement in fabric efficiency though additional internal insulation to the roof and refurbishment of the external walls.
- Upgrades to a more efficient space and water heating system.
- The specification of water efficient fittings to limit water consumption to less than 105 litres per person per day;
- The development is not expected to have any significant adverse effects to air, noise, land or watercourses.

The BREEAM pre-assessment undertaken in support of the application indicates that a score of 61.35% can be obtained, corresponding to a rating of 'Very Good'. Although this does not meet the required target of 'Excellent' as set out in the Richmond Local Plan, this is unlikely to be feasible due to the proposed development involving the change of use of a grade Il listed building and being situated within a conservation area. This means that there are restrictions on what updates and changes can be implemented and as a result, limitations on what credits can be achieved.

The sustainability measures incorporated reflect the client and design team's aspirations in integrating sustainability measures and demonstrates that the project is designed to exceed the planning policy sustainability requirements.

ENERGY STRATEGY

The Regulated CO_2 emissions for the development have been reduced against an existing building baseline assessment which has been modelled in line with Part L 2021 through on-site measures alone by 45.0% (8.59 tonnes per annum).

The tables in the following pages detail the CO_2 emissions and savings of the proposed development against the existing scheme.

Overall, the proposed development has been designed to meet energy policies set out by the GLA and the London Borough of Richmond upon Thames, which demonstrates the client and the design team's aspirations to deliver a development that pushes the energy efficiency improvements to the allowable level while staying within the boundaries of accepted alterations to a grade II listed building.



DOMESTIC CUMULATIVE SAVINGS

Table 3: CO_2 emissions before after energy efficient measures have been incorporated.

	Carbon dioxide emissions for domestic buildings (tonnes CO2 per annum)
	Regulated
Existing	19.09
Proposed	10.5

 $\label{thm:condition} \mbox{Table 4: Regulated CO_2 savings before after energy efficient measures have been incorporated.}$

	Regulated domestic carbon dioxide savings Tonnes CO ₂ per annum % over baseline						
Existing	-	-					
Proposed	8.59	45.0					

APPENDIX A – SAP WORKSHEETS





Property Reference	re .	ΩТ	he Green Base	aline					Is	sued on Da	ate	05/01/2024	
Assessment Refe		000		SIIIIE				Prop Type R		Sueu on Di	ate	03/01/2024	
Property													
SAP Rating					45 E		DER			TER			
Environmental					37 F		% DER < TER			TEIX		N/A	
CO ₂ Emissions (t/	year)				19.09		DFEE			TFEE			
Compliance Chec	k				See BREL		% DFEE < TF	EE					
% DPER < TPER							DPER			TPER	₹		
Assessor Details		Mr. Jack	Sewell							Asse	ssor ID	AY12-00	01
Client													
	FOR Exist	ting dwellin	ng (SAP)	(Version 10		2022)							
1. Overall dwell								 Area		y height		Volume	
Basement floor Ground floor First floor Second floor Third floor Total floor area Dwelling volume	a TFA = (16	a) + (1b) + (1c))+(1d)+(1e)	(1n)	35	9.5000		78.3000 75.0000 70.9000 62.2000	(1a) x (1b) x (1c) x (1d) x	3.0000 3.0000 3.0000 2.0000	(2a) = (2b) = (2c) = (2d) = (2e) =	234.9000 225.0000 212.7000	(1a) - (3a (1b) - (3b (1c) - (3c (1d) - (3c (1e) - (3c (4)
2. Ventilation r	rate										m 0 * 80 =	3 per hour	
Number of open f Number of chimme Number of flues Number of blocke Number of interm Number of passiv Number of fluele	flues eys / flues attached t attached t ed chimneys mittent ext ve vents	to solid fue to other heas s tract fans	el boiler	ire							0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 5 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50		and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+	(6g)+(7a)+(7b)+(7c) =		50.0000	Air change / (5) = B	0.0530 Yes lower Door 15.0000 0.8030	(8)
Shelter factor Infiltration rat	ie adjusted	d to include	e shelter f	actor					(20) = 1 - (21)		(19)] = x (20) =	0.8500 0.6826	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Effective ac	0.8703 0.8787	0.8532 0.8640	0.8361 0.8496	0.7508 0.7819	0.7338 0.7692	0.6484 0.7102	0.6484 0.7102	0.6314 0.6993		0.7338 0.7692		0.8020 0.8216	
3. Heat losses a	and heat lo	oss paramete	er										
Element Window (Uw = 4.8 External Door T W8 T W9 T W10 Basement Floor Ground Floor External Wall Main Roof			3	Gross m2 55.2000 62.2000	Openings m2 58.3800 2.8500	Net 51. 7 0. 0. 7 3 4 296	tArea m2 .1100 .2700 .9500 .9500 .1000 .4000 .8200	U-value W/m2K 4.0268 3.0000 4.2359 4.2359 4.2359 1.2000 1.2000 2.1000 2.3000			-value kJ/m2K	A x K kJ/K	
Exposed Ceiling Total net area of Fabric heat loss	s, W/K = St	um (A x U)	Aum(A, m2)	16.7000		16	.7000 .6000	2.3000				250.0000	(30) (31) (33)
List of Thermal K1 Eleme	Bridges	Om / II	, <u>-</u> KU/III						Length Ps:	i-value	Tot		(55)

SAP 10 Online 2.12.4 Page 1 of 15



E2 Other lintels (including other steel lintels) E3 Sill E4 Jamb E5 Ground floor (normal) E20 Exposed floor (normal) E20 Exposed floor E6 Intermediate floor within a dwelling E11 Eaves (insulation at rafter level) E15 Flat roof with parapet E16 Corner (normal) E17 Corner (inverted - internal area greater than external area) E18 Party wall between dwellings E25 Staggered party wall between dwellings P1 Party wall - Ground floor P2 Party wall - Intermediate floor within a dwelling P4 Party wall - Roof (insulation at ceiling level) Thermal bridges (Sum(L x Psi) calculated using Appendix K) Point Thermal bridges Total fabric heat loss									.7400 .2800 .2800 .8000 .8000 .0000 .8500 .3300 .0500 .8000 .8000 .8000 .6000 .9000	1.0000 0.1000 0.1000 0.3200 0.3200 0.1400 0.1500 0.3000 0.1800 0.2400 0.2400 0.3200 0.0000 0.4800	37.74 3.42 13.66 19.45 1.01 7.92 15.65 3.94 6.91 6.99 6.90 6.90 9.55 2.83 4.67 0.00 3.66 (36a) = + (36a) =	280 000 000 660 776 200 995 550 440 900 920 220 220	
Ventilation h	eat loss ca	alculated mo	onthly (38)m Mar	= 0.33 x	(25) m x (5) May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38) m Heat transfer	273.4941			243.3592	239.4167	221.0639	221.0639	217.6652	228.1331	239.4167	247.3923	255.7304	(38)
Average = Sum			1532.7474	1511.6756	1507.7332	1489.3803	1489.3803	1485.9816	1496.4495	1507.7332	1515.7087	1524.0468 1511.6567	(39)
HLP	Jan 4.2888	Feb 4.2760	Mar 4.2636	Apr 4.2049	May 4.1940	Jun 4.1429	Jul 4.1429	Aug 4.1335	Sep 4.1626	Oct 4.1940	Nov 4.2162	Dec 4.2394	(40)
HLP (average) Days in mont	4.2000	4.2760	4.2030	30	4.1940	30	4.1429	4.1333	30	31	30	4.2049	(40)
bays in mone	31	20	31	30	31	30	31	31	30	91	30	31	
4. Water heat	ing energy	requirement)									
Assumed occup	ancy											3.2093	(42)
Hot water usa	107.2899	105.6775	103.3280	98.8326	95.5151	91.8155	89.7126	92.0444	94.6004	98.5727	103.1646	106.8788	(42a)
Hot water usa	35.4508	34.9243	34.1829	32.8158	31.7922	30.6572	30.0441	30.7803	31.5819	32.7965	34.1917	35.3309	(42b)
Average daily	49.9960	48.1780	46.3600 s/day)	44.5419	42.7239	40.9058	40.9058	42.7239	44.5419	46.3600	48.1780	49.9960 177.2371	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot wat	192.7367			176.1904	170.0312	163.3785	160.6626	165.5486	170.7243	177.7291	185.5343	192.2058	
Energy conte Energy conten Distribution	t (annual)			241.1958	228.8947	200.8930	194.3075	204.9837	210.5201	241.1767 Total = S	264.3276 um(45)m =	300.9478 2943.9172	(45)
Water storage	45.7872		42.3904	36.1794	34.3342	30.1339	29.1461	30.7476	31.5780	36.1765	39.6491	45.1422	(46)
Store volume b) If manuf		clared loss	factor is n	ot known :								300.0000	(47)
Hot water s Volume fact Temperature Enter (49) or Total storage	or from Tak factor from (54) in (5	ole 2a om Table 2b	om Table 2 (kWh/litre/c	lay)							0.1425 0.7368 0.7800 24.5688	(52) (53)
If cylinder c	761.6330	687.9266		737.0642	761.6330	737.0642	761.6330	761.6330	737.0642	761.6330	737.0642	761.6330	(56)
Primary loss	761.6330 128.3772		761.6330	737.0642 124.2360	761.6330 128.3772	737.0642 41.9160	761.6330 43.3132	761.6330 43.3132	737.0642 41.9160	761.6330 128.3772	737.0642 124.2360	761.6330 128.3772	
Combi loss Total heat re						0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	,
WWHRS	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1131.1869 0.0000	0.0000	0.0000	(63a)
PV diverter Solar input	0.0000	0.0000				0.0000	0.0000	0.0000		0.0000		0.0000	(63c)
FGHRS Output from w	/h	0.0000	0.0000		0.0000		0.0000			0.0000			
Electric show		1072.7001	11/2.0120	1102.4900	1110.9049	919.0132	999.2337			Th/year) = S			
	0.0000	0.0000	0.0000		0.0000 al Energy u	0.0000 sed by inst	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 n/year) = Su	0.0000 m(64a)m =	0.0000	
Heat gains fr			/month 196.6671	179.5864	178.8093	100.3297	99.2578	102.8077	103.5307	182.8930	187.2777	202.7669	(65)
5. Internal q													
Metabolic gai													
(66) m	Jan	Feb	Mar 192.5568	Apr 192.5568	May 192.5568	Jun 192.5568	Jul 192.5568	Aug 192.5568	Sep 192.5568	Oct 192.5568	Nov 192.5568	Dec 192.5568	(66)
Lighting gain	73.3237	65.1255	52.9636	40.0969	29.9729	25.3044	27.3423	35.5405	47.7024	60.5691	70.6931	75.3616	(67)
Appliances ga	753.4903	761.3092	741.6059	699.6599	646.7106	596.9457	563.6997	555.8809	575.5842	617.5302	670.4795	720.2443	(68)
Cooking gains	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	
Pumps, fans Losses e.g. e	vaporation	(negative v	10.0000 values) (Tab -128.3712	le 5)	10.0000	0.0000	0.0000	0.0000	0.0000	10.0000	10.0000	10.0000	
Water heating	gains (Tak	ole 5)	264.3375				133.4110	138.1823	143.7927	245.8239	260.1079	272.5362	
Total interna	l gains		1190.5576							1055.5738			
6. Solar gain													
[Jan] Area Solar flux g FF m2 Table 6a Specific data Specific data								Acce fact		Gains W			

SAP 10 Online 2.12.4 Page 2 of 15



					W/m2 or Table 6b or			ole 6c	Table 6d				
North Northeast Southeast Southwest West Northwest Southeast			2.3 1.9 19.2 0.8 2.4 24.3 2.8	000 800 200 300 000 800 500	10.6334 11.2829 36.7938 36.7938 19.6403 11.2829 39.9751		0.8500 0.8500 0.8500 0.8500 0.8500 0.8500 0.8500	0 0 0 0 0	7000 7000 7000 7000 7000 7000	0.77 0.77 0.77 0.77 0.77 0.77	00 00 00 00	10.0844 9.2117 291.5940 12.5922 19.4361 113.4243 61.0091	(75) (77) (79) (80) (81)
Solar gains Total gains													
	rnal tempera												
Temperature		ng periods	in the livi	ng area fro	om Table 9,							21.0000	(85)
Utilisation tau			Mar	Apr		Jun 16.7622	Jul 16.7622	Aug 16.8005	Sep 16.6830	Oct 16.5582	Nov 16.4710	Dec 16.3809	
alpha util living	2.0795 area 0.9965	2.0827 0.9943	2.0859 0.9898	2.1010 0.9798			2.1175	2.1200	2.1122	2.1039 0.9870	2.0981		(96)
MIT	16.4459	16.7068	17.2638	18.0807	0.9592 18.9518	0.9248	0.8727	0.9001	0.9614	18.3954	0.9950 17.3046	0.9970 16.4256	
Th 2 util rest of		18.2477	18.2513	18.2685	18.2718	18.2874	18.2874	18.2903	18.2813	18.2718		18.2583	(88)
MIT 2 Living area	0.9950 14.4956 fraction	0.9917 14.7573	0.9847 15.3141	0.9673 16.1328	0.9251 16.9898	0.8227 17.7660	0.5913 18.1707	0.6697 18.1216	0.9076 17.5153 ft.A =	0.9767 16.4521 Living are		14.4808	(90)
MIT Temperature	14.6082 adjustment	14.8699	15.4267	16.2453	17.1031	17.8815	18.2925	18.2406	17.6285	16.5643	15.4741	14.5931 0.0000	(92)
adjusted MIT	14.6082	14.8699	15.4267	16.2453	17.1031	17.8815	18.2925	18.2406	17.6285	16.5643	15.4741	14.5931	(93)
	ting require												
Utilisation Useful gains Ext temp.	1734.4051	2134.6571	0.9742 2548.2278		May 0.8966 3126.4785 11.7000	Jun 0.7923 2687.0665 14.6000	Jul 0.5923 1911.9801 16.6000		Sep 0.8790 2206.3843 14.1000	Oct 0.9627 2050.9849 10.6000			(95)
Heat loss ra	15893.3449	15326.0716	13682.4152	11103.7490	8146.4876	4887.3617	2520.7035	2735.1466	5280.2675	8992.5614	12692.7068	15839.6324	(97)
Space heatin	g kwn 10534.2512 g requiremen				3734.8868	0.0000	0.0000	0.0000	0.0000	5164.5329	7886.8497	10577.1225 60910.9625	(98a)
Solar heatin	g kWh 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heatin Space heatin					3734 8868	0.0000	0.0000	0.0000	0 0000	5164 5329	7886 8497	0.0000	(98c)
	g requiremen						0.0000	0.0000	0.0000			60910.9625 169.4324	
	equirements											0.0000	(201)
Fraction of Fraction of Efficiency o Efficiency o Efficiency o	space heat f f main space f main space	rom main sy heating sy heating sy	ystem(s) ystem 1 (in ystem 2 (in	%) %)	≈m (Table II	.)						0.0000 1.0000 75.0000 0.0000 0.0000	(202) (206) (207)
Space heatin	Jan a roquiromon	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heatin	10534.2512	8864.6306			3734.8868	0.0000	0.0000	0.0000	0.0000	5164.5329	7886.8497	10577.1225	(98)
Space heatin			/stem)		75.0000	0.0000	0.0000	0.0000	0.0000	75.0000	75.0000		
Space heatin	14045.6683 g efficiency 0.0000				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heatin			stem 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heatin	g fuel (seco 0.0000	ndary) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heatin		t.											
Efficiency o	1195.2580 f water heat	1072.7001 er	1172.6128			979.8732		1009.9299				1190.9580 70.0000	(216)
(217)m Fuel for wat			73.6075 1593.0614	73.2315	72.4495	65.0000	65.0000	65.0000	65.0000	72.9980	73.5976	73.8599	
Space coolin	g fuel requi		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Pumps and Fa Lighting	64.1798	12.6575 51.4874	14.0137 46.3587	13.5616 33.9644	14.0137 26.2351	13.5616 21.4343	14.0137 23.9325	14.0137 31.1084	13.5616 40.4067	14.0137 53.0158	13.5616 59.8812	14.0137	(231)
Electricity (233a)m Electricity	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
(234a)m Electricity	0.0000 generated by	0.0000 hydro-elec	0.0000 ctric genera	0.0000 tors (Appen	0.0000 ndix M) (neg	0.0000 gative quant		0.0000	0.0000	0.0000	0.0000		(234a)
(235a)m Electricity									0.0000	0.0000	0.0000	0.0000	
(235c)m Electricity (233b)m	0.0000 generated by 0.0000	0.0000 PVs (Apper 0.0000		ative quant	0.0000 ity) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Electricity (234b) m		wind turbi	nes (Append	ix M) (nega	tive quanti		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Electricity (235b) m	generated by 0.0000	hydro-elec 0.0000	ctric genera 0.0000	tors (Appen	ndix M) (neg 0.0000	ative quant 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Electricity (235d)m	used or net 0.0000	electricity 0.0000	generated 0.0000			(N) (negati 0.0000	ve if net g 0.0000		0.0000	0.0000	0.0000	0.0000	(235d)

SAP 10 Online 2.12.4 Page 3 of 15



Annual totals kWh/year Space heating fuel - main system 1 Space heating fuel - main system 2 Space heating fuel - secondary Efficiency of water heater Water heating fuel used Space cooling fuel Electricity for pumps and fans: central heating pump Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L) Energy saving/generation technologies (Appendices M ,N and Q) PV generation Wind generation Hydro-electric generated - Micro CHP (Appendix N) Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses				81214.6166 0.0000 0.0000 70.0000 18527.5756 0.0000 165.0000 517.9680 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 100425.1602	(213) (215) (219) (221) (230c) (231) (232) (233) (234) (235a) (235) (236) (237)	
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost		p/kWh 3.6400 3.6400 16.4900 16.4900		Fuel cost £/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372	(240) (473) (247) (247a) (249) (250) (251))
11a. SAP rating - Individual heating systems Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band		(255) x (256)] / [(4) +	45.0] =	0.3600 3.4133 44.6702 45 E	(257) (258)	
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Total CO2, kg/year CO2 emissions per m2 EI value EI rating EI band		Emission factor kg CO2/kWh 0.2100 0.2100 0.1387		Emissions kg CO2/year 17055.0695 0.0000 3890.7909 20945.8604 22.8875 74.7588 21043.5067 58.5400 36.9610	(261) (373) (264) (265) (267) (268) (272) (273)	
SAP 10 WORKSHEET FOR Existing dwelling (SAP) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY						
1. Overall dwelling characteristics Basement floor Ground floor First floor Second floor Third floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)(1n) 359.5000 Dwelling volume	Area (m2) 73.1000 78.3000 75.0000 70.9000 62.2000	(m) (1a) x 2.0000 (1b) x 3.0000 (1c) x 3.0000 (1d) x 3.0000	(2a) = (2b) = (2c) = (2d) = (2e) =	234.9000 225.0000 212.7000 124.4000	(1b) - (1c) - (1d) - (1e) - (4)	- (3b) - (3c) - (3d)
Number of open chimneys Number of open flues Number of chimneys / flues attached to closed fire Number of flues attached to solid fuel boiler Number of flues attached to other heater Number of blocked chimneys Number of intermittent extract fans			0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 5 * 10 =	0.0000 0.0000 0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6f)	

SAP 10 Online 2.12.4 Page 4 of 15



Number of passiv		ires									0 * 10 = 0 * 40 =	0.0000	
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 te		and fans	= (6a)+(6b))+(6c)+(6d)-	+(6e)+(6f)+	-(6g)+(7a)+((7b) + (7c) =		50.0000	Air change) / (5) = B	0.0530 Yes lower Door 15.0000 0.8030	(17)
Shelter factor Infiltration rat			ide shelter	factor						- [0.075 > (21) = (18)		0.8500 0.6826	(20)
Wind speed Wind factor Adj infilt rate	Jan 4.2000 1.0500	Feb 4.0000 1.0000	Mar 4.0000 1.0000	Apr 3.7000 0.9250	May 3.7000 0.9250	Jun 3.3000 0.8250	Jul 3.4000 0.8500	Aug 3.2000 0.8000	Sep 3.3000 0.8250	Oct 3.5000 0.8750	Nov 3.5000 0.8750	Dec 3.8000 0.9500	
Effective ac	0.7167 0.7568	0.6826 0.7329	0.6826 0.7329	0.6314 0.6993		0.5631 0.6585	0.5802 0.6683		0.5631 0.6585	0.5972 0.6783	0.5972 0.6783	0.6484 0.7102	
3. Heat losses a	and heat 1	loss parame	eter										
Element Window (Uw = 4.6 External Door T W8 T W9 T W10 Basement Floor Ground Floor External Wall Main Roof Exposed Ceiling Total net area of	80) of externa	al elements	: Aum(A, m2)	Gross m2 355.2000 62.2000 16.7000	Opening: m: 58.380(2.850(2 51 6 6 73 4 0 296 0 56	etArea m21100270095009500950095001000400035007000350070006000 (26)(U-value W/m2K 4.0268 3.0000 4.2359 4.2359 1.2000 2.1000 2.3000 2.3000 (30) + (32)	A 3 205.81 21.81 4.02 4.02 4.02 87.77 5.22 623.33 136.56 38.41	M/K .21 .00 .441 .441 .441 .000 .000 .000 .000 .000	(-value kJ/m2K	A x K kJ/K	(27) (26) (27a) (27a) (27a) (28a) (28a) (29a) (30) (30) (31) (33)
E3 \$ill E4 Jamb E5 Grour E20 Exp E22 Bass E6 Inter E11 Eave E15 Flat E16 Corr E17 Corr E18 Part E25 Stac P1 Party F2 Party	ent r lintels Ind floor cosed floor ement floor ement floor floor floor expected floor fl	(normal) c (normal) or floor withi ation at ra th parapet al) cted - inte etween dwel cty wall be Ground floc Intermediat Roof (insul	lings tween dwell or e floor wit ation at ce	g reater thar ings hin a dwell iling level	.)	rea)		37 34 136 66 3 36 111 26 23 38 25 39 11	.7400 .2800 .8000 .8000 .8000 .1800 .0000 .8500 .3300 .0500 .8000 .8000 .8000 .8000 .8000 .9000 .5000	Psi-value 1.0000 0.1000 0.1000 0.3200 0.3200 0.1400 0.1500 0.3000 0.1800 0.0000 0.2400 0.2400 0.3200 0.4800 (33) + (36)	Tot 37.74 3.42 13.66 19.45 1.01 7.92 15.65 3.94 6.91 6.98 0.00 9.55 2.83 4.67 0.00 3.60	00 80 00 60 76 00 90 95 55 40 00 20 20 20 20 00 00 137.3851 0.0000	
Ventilation heat	Jan	Feb	onthly (38)m Mar 228.1331	Apr	(25) m x (5) May 217.6652	Jun 204.9768	Jul 208.0129	Aug	Sep 204.9768	Oct 211.1397	Nov 211.1397	Dec	(20)
Heat transfer co	oeff 503.8813	1496.4495			1485.9816							221.0639 1489.3803 1484.1917	
HLP HLP (average) Days in mont	Jan 4.1833 31	Feb 4.1626 28	Mar 4.1626 31	Apr 4.1335 30	May 4.1335 31	Jun 4.0982 30	Jul 4.1066 31	Aug 4.0900	Sep 4.0982 30	Oct 4.1153	Nov 4.1153 30	Dec 4.1429 4.1285 31	(40)
4. Water heating	g energy 1	requirement	s (kWh/year)									
Assumed occupand Hot water usage	for mixe	showers	103.3280	98.8326	95.5151	91.8155	89.7126	92.0444	94.6004	98.5727	103.1646	3.2093	
Hot water usage	35.4508	34.9243	34.1829	32.8158	31.7922	30.6572	30.0441	30.7803	31.5819	32.7965	34.1917	35.3309	(42b)
Hot water usage Average daily ho	49.9960	48.1780	46.3600	44.5419	42.7239	40.9058	40.9058	42.7239	44.5419	46.3600	48.1780	49.9960 177.2371	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	/
Energy conte 3 Energy content	192.7367 305.2478 (annual)	188.7798 268.8199	183.8708 282.6026	176.1904 241.1958	170.0312 228.8947	163.3785 200.8930	160.6626 194.3075	165.5486 204.9837	170.7243 210.5201	177.7291 241.1767 Total = 8	185.5343 264.3276 Sum (45) m =	192.2058 300.9478 2943.9172	
Distribution los Water storage lo	45.7872	= 0.15 x (40.3230	42.3904	36.1794	34.3342	30.1339	29.1461	30.7476	31.5780	36.1765	39.6491	45.1422	(46)
Store volume b) If manufact	turer decl											300.0000	
Hot water stor Volume factor Temperature fa Enter (49) or (5	rage loss from Tabl actor from 54) in (55	factor fro le 2a n Table 2b			lay)							0.1425 0.7368 0.7800 24.5688	(52) (53)
Total storage lo	761.6330		761.6330	737.0642	761.6330	737.0642	761.6330	761.6330	737.0642	761.6330	737.0642	761.6330	(56)
	761.6330 128.3772	687.9266		737.0642 124.2360	761.6330 128.3772	737.0642 41.9160	761.6330 43.3132	761.6330 43.3132	737.0642 41.9160	761.6330 128.3772	737.0642 124.2360	761.6330 128.3772	

SAP 10 Online 2.12.4 Page 5 of 15



Combi loss Total heat rec						0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
WWHRS	0.0000	0.0000	1172.6128 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1131.1869 0.0000	0.0000		
PV diverter 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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
		1072.7001	1172.6128	1102.4960	1118.9049	979.8732	999.2537			1131.1869 h/year) = S			
Electric shows	er(s) 0.0000	0.0000	0.0000			0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains fro					al Energy u 178.8093	100.3297	antaneous e	lectric sho		1/year) = Su 182.8930		0.0000	
	204.1907	102.1433	190.0071	179.3004	170.0093	100.3297	99.2376	102.0077	103.3307	102.0930	107.2777	202.7669	(63)
5. Internal ga		able 5 and	5a)										
Metabolic gair), Watts Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66) m Lighting gains	192.5568	192.5568	192.5568	192.5568	192.5568	192.5568	192.5568			192.5568	192.5568	192.5568	(66)
Appliances gai	73.3237	65.1255	52.9636	40.0969	29.9729	25.3044	27.3423	35.5405	47.7024	60.5691	70.6931	75.3616	(67)
	753.4903	761.3092	741.6059	699.6599	646.7106	596.9457	563.6997	555.8809	575.5842	617.5302	670.4795	720.2443	(68)
Pumps, fans	57.4650	57.4650 10.0000	57.4650 10.0000	57.4650	57.4650 10.0000	57.4650 0.0000	57.4650 0.0000	57.4650 0.0000	57.4650 0.0000	57.4650 10.0000	57.4650 10.0000	57.4650 10.0000	
Losses e.g. ev	/aporation	(negative v		le 5)	-128.3712	-128.3712	-128.3712	-128.3712	-128.3712	-128.3712	-128.3712	-128.3712	
Water heating	gains (Tab	le 5)	264.3375		240.3350	139.3468	133.4110	138.1823	143.7927	245.8239	260.1079	272.5362	
Total internal		1229.1351	1190.5576	1120.8329			846.1036	851.2542		1055.5738			
6. Solar gains													
[Jan]				irea	Solar flux		g		FF	Acce	:SS	Gains	
			m2		Table 6a W/m2	Table 6a Specific data W/m2 or Table 6b		Specific or Tab	data le 6c	Table	.or .6d	W	
North			2 3		11 9814		0.8500		7000	0.77	00	11.3628	
Northeast Southeast			1.9 19.2	800 200	12.9236 40.4699		0.8500 0.8500	0	.7000 .7000	0.77 0.77	00	10.5511 320.7273	(77)
Southwest West			0.8	300 000	40.4699 22.3313		0.8500 0.8500	0 0 0	.7000 .7000	0.77 0.77	00	13.8503 22.0992	(79) (80)
Northwest Southeast			24.3	1800 1500	12.9236 44.7612		0.8500 0.8500 0.8500 0.8500 0.8500 0.8500		.7000 .7000	0.7700 0.7700 0.7700 0.7700 0.7700 0.7700 1.0000		129.9170 68.3134	
Solar gains Total gains													
Total gains	1809.7436	2172.1489	2613.7480										
Total gains 7. Mean intern Temperature du	1809.7436	2172.1489 ture (heati	2613.7480 .ng season) in the livi	3183.8952	3509.6404	3593.6223	3391.7513	3077.2756					(84)
7. Mean interr Temperature du Utilisation fa	1809.7436 nal tempera uring heati actor for g Jan	2172.1489 ture (heati ng periods ains for li Feb	ng season) in the livi ving area,	3183.8952 ng area frc nil,m (see Apr	3509.6404 om Table 9, Table 9a) May	3593.6223 Th1 (C) Jun	3391.7513	3077.2756	2647.3449 Sep	2212.3230 Oct	1853.1039 Nov	1680.8535 21.0000 Dec	(84)
Total gains 7. Mean interr Temperature du Utilisation fatau alpha	nal tempera arring heati actor for g Jan 16.6006 2.1067	2172.1489 ture (heati ng periods ains for li Feb	2613.7480 ng season) in the livi ving area,	3183.8952 ng area frc nil,m (see Apr	3509.6404 om Table 9, Table 9a) May	3593.6223 Th1 (C) Jun	3391.7513	3077.2756	2647.3449 Sep	2212.3230	1853.1039 Nov	21.0000	(84)
7. Mean intern Temperature du Utilisation fa	nal tempera arring heati actor for g Jan 16.6006 2.1067	ture (heati	ng season) in the livi ving area, Mar 16.6830	3183.8952 	3509.6404 om Table 9, Table 9a) May 16.8005	3593.6223 Th1 (C) Jun 16.9452	Jul 16.9104	3077.2756	2647.3449 Sep 16.9452	2212.3230 Oct 16.8746	Nov 16.8746	21.0000 Dec 16.7622	(84)
7. Mean intern Temperature du Utilisation fatau alpha util living ar	1809.7436 anal tempera rring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786	2613.7480 Ing season) in the livi ving area, Mar 16.6830 2.1122 0.9886 17.5790	3183.8952 	3509.6404 m Table 9, Table 9a) May 16.8005 2.1200 0.9457 19.3445	3593.6223 Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815	Jul 16.9104 2.1274 0.7750 20.6224	Aug 16.9792 2.1319 0.8097 20.5702	Sep 16.9452 2.1297 0.9416 19.8258	Oct 16.8746 2.1250 0.9830 18.7285	Nov 16.8746 2.1250 0.9937 17.6328	21.0000 Dec 16.7622 2.1175 0.9966 16.7532	(84) (85) (86) (87)
Total gains 7. Mean interr Temperature du Utilisation fatau alpha util living ar	1809.7436	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786 18.2813	2613.7480 ng season) in the livi ving area, Mar 16.6830 2.1122 0.9886 17.5790 18.2813	3183.8952 	3509.6404 m Table 9, Table 9a) May 16.8005 2.1200 0.9457 19.3445 18.2903	3593.6223 Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815 18.3014	Jul 16.9104 2.1274 0.7750 20.6224 18.2987	Aug 16.9792 2.1319 0.8097 20.5702 18.3040	Sep 16.9452 2.1297 0.9416 19.8258 18.3014	Oct 16.8746 2.1250 0.9830 18.7285 18.2960	Nov 16.8746 2.1250 0.9937 17.6328 18.2960	21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874	(84) (85) (86) (87) (88)
7. Mean interr Temperature du Utilisation fa tau alpha util living ar MIT Th 2 util rest of h	1809.7436 nal tempera uring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786	2613.7480 Ing season) in the livi ving area, Mar 16.6830 2.1122 0.9886 17.5790	3183.8952 	3509.6404 m Table 9, Table 9a) May 16.8005 2.1200 0.9457 19.3445	3593.6223 Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815	Jul 16.9104 2.1274 0.7750 20.6224	Aug 16.9792 2.1319 0.8097 20.5702	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020	21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198	(84) (85) (86) (87) (88) (89) (90)
Total gains 7. Mean interr Temperature du Utilisation fatau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT 2 Living area fr	1809.7436 al tempera arring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150 raction 14.9269	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786 18.2813 0.9909	2613.7480	3183.8952 	3509.6404 mm Table 9a, May 16.8005 2.1200 0.9457 19.3445 18.2903 0.8910	3593.6223 Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815 18.3014 0.6605	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 fLA =	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020	21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314	(84) (85) (86) (87) (88) (89) (90) (91)
Total gains 7. Mean interr Temperature du Utilisation fatau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr	1809.7436 nal tempera uring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150 raction 14.9269 ijjustment	2172.1489 ture (heati	2613.7480 Ing season) in the livi ving area, Mar 16.6830 2.1122 0.9886 17.5790 18.2813 0.9823 15.6405 15.7525	3183.8952	3509.6404 m Table 9, Table 9a) May 16.8005 2.1200 0.9457 19.3445 18.2903 0.8910 17.3757 17.4894	3593.6223 Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815 18.3014 0.6605 18.1041	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701 18.2965 18.4308	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319 18.2987	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 fLA = 17.9604	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020 ea / (4) = 15.8135	1680.8535 21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314 0.0000	(84) (85) (86) (87) (88) (89) (90) (91) (92)
Total gains 7. Mean interr Temperature du Utilisation fatau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature acadjusted MIT	1809.7436 al tempera arring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150 raction 14.9269 jjustment 14.9269	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786 18.2813 0.9909 15.0420 15.1538	2613.7480	3183.8952	3509.6404 mm Table 9a, May 16.8005 2.1200 0.9457 19.3445 18.2903 0.8910 17.3757 17.4894	3593.6223 Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815 18.3014 0.6605 18.1041 18.2241	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701 18.2965 18.4308	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319 18.2987 18.4299	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 fLA = 17.9604	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924 Living are 16.9042	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020 ea / (4) = 15.8135	1680.8535 21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314 0.0000	(84) (85) (86) (87) (88) (89) (90) (91) (92)
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	1809.7436 nal tempera nring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150 raction 14.9269 gljustment 14.9269	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786 18.2813 0.9909 15.0420 15.1538	2613.7480 Ing Season) in the livi ving area, Mar 16.6830 2.1122 0.9886 17.5790 18.2813 0.9823 15.6405 15.7525	3183.8952	3509.6404 m Table 9, Table 9a) May 16.8005 2.1200 0.9457 19.3445 18.2903 0.8910 17.3757 17.4894 17.4894	3593.6223 Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815 18.3014 0.6605 18.1041 18.2241 18.2241	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701 18.2965 18.4308	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319 18.2987 18.4299	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 fLA = 17.9604	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924 Living are 16.9042	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020 ea / (4) = 15.8135	1680.8535 21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314 0.0000	(84) (85) (86) (87) (88) (89) (90) (91) (92)
Total gains 7. Mean interr Temperature du Utilisation fatau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr mIT Temperature ad adjusted MIT	1809.7436 nal tempera uring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 100se 0.9941 14.8150 raction 14.9269 justment 14.9269	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786 18.2813 0.9909 15.0420 15.1538 15.1538	2613.7480 ng season) in the livi ving area, Mar 16.6830 2.1122 0.9886 17.5790 18.2813 0.9823 15.6405 15.7525	3183.8952	3509.6404 m Table 9, Table 9a) May 16.8005 2.1200 0.9457 19.3445 18.2903 0.8910 17.3757 17.4894 17.4894	Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815 18.3014 0.6605 18.1041 18.2241	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701 18.2965 18.4308	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319 18.2987 18.4299	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 fLA = 17.9604	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924 Living are 16.9042	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 0.5.7020 (4) = 15.8135	21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314	(84) (85) (86) (87) (88) (89) (90) (91) (92)
Total gains 7. Mean interr Temperature du Utilisation fatau alpha util living ar MIT Th 2 util rest of h MIT 2 Living area fr MIT Temperature ac adjusted MIT 8. Space heati	1809.7436 nal tempera nring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150 raction 14.9269 ijustment 14.9269	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786 18.2813 0.9909 15.0420 15.1538 15.1538	2613.7480 ng season) in the livi ving area, Mar 16.6830 2.1122 0.9886 17.5790 18.2813 0.9823 15.6405 15.7525 15.7525	3183.8952	3509.6404 mm Table 9, Table 9a) May 16.8005 2.1200 0.9457 19.3445 18.2903 0.8910 17.3757 17.4894 17.4894	3593.6223 Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815 18.3014 0.6605 18.1041 18.2241 18.2241	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701 18.2965 18.4308	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319 18.2987 18.4299	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 fLA = 17.9604 17.9604	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924 Living are 16.9042	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020 az / (4) = 15.8135 15.8135	1680.8535 21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314 0.0000 14.9314	(84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Total gains 7. Mean interr Temperature du Utilisation fatau 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.	1809.7436 nal tempera nring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150 reaction 14.9269 dijustment 14.9269 ing require Jan 0.9895 1790.6811 5.1000	2172.1489 ture (heati	2613.7480	3183.8952	3509.6404 mm Table 9, Table 9a) May 16.8005 2.1200 0.9457 19.3445 18.2903 0.8910 17.3757 17.4894 17.4894	3593.6223 Th1 (C) Jun 16.9452 2.1297 0.8758 20.1815 18.3014 0.6605 18.1041 18.2241 18.2241	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701 18.2965 18.4308	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319 18.2987 18.4299	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 fLA = 17.9604 17.9604	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924 Living are 16.9042	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020 az / (4) = 15.8135 15.8135	21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314 0.0000 14.9314	(84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
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Total gains 7. Mean interr 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 ad adjusted MIT 8. Space heatin Utilisation Useful gains Ext temp. Heat loss rate 1 Space heating	1809.7436 nal tempera nring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150 raction 14.9269 dijustment 14.9269 dijustment 14.9269 1790.6811 5.1000 W 4778.5406 kWh 9662.9674 requiremen kWh 9662.9674 requiremen	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786 18.2813 0.9909 15.0420 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538	2613.7480	3183.8952	May 0.8596 3017.0562 13.0000 6671.1797 2718.6679 10 per year	Jun 0.6486 2330.7049 16.0000 0.000000	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701 18.2965 18.4308 18.4308 18.4308 Jul 0.2231 756.6374 17.9000 783.6005 0.0000 0.0000	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319 18.2987 18.4299 18.4299 18.4299 18.4299 0.2843 17.8000 926.1329 0.0000 0.0000 0.0000	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 17.9604 17.9604 17.9604 17.9604 0.8136 0.0000 0.0000	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924 1.2437 0.0000 4274.2437	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020 2a / (4) = 15.8135 15.8135 Nov 0.9828 1821.1893 8.0000 11559.7172 7011.7401	1680.8535 21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314 0.0000 14.9314 Dec 0.9909 1665.6319 5.1000 14642.7067 9654.9436 53906.7648 0.0000 0.0000 9654.9436 53906.7648	(84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98a) (98b)
Total gains 7. Mean intern 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 ac adjusted MIT 8. Space heatin Utilisation Useful gains Ext temp. Heat loss rate 1 Space heating Space heating Solar heating Solar heating Space heating	1809.7436 nal tempera nring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150 raction 14.9269 14.9269 15.1000 raction 16.9269 17.90.6811 5.1000 raction 18.9269 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9895 17.90.6811 7.90.9960 10.99.9895 17.90.6811 7.90.9960 10.99.995 17.90.6811 7.90.9960 10.99.995 17.90.6811 7.90.9960 10.99.995 17.90.6811 7.90.9960 10.99.995 17.90.6811 7.90.9960 10.99.995 17.90.6811 7.90.9960 10.99.995 17.90.6811 7.90.9960 10.99.995 17.90.6811 7.90.9960 10.99.995 17.90.6811 7.90.9960 10.99.995 17.90.6811 7.90.9960 10.90.90.9960 10.90.90.90.900 10.90.90.900 10.90.900 10.90.900 10.90.900 10.90.	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786 18.2813 0.9909 15.0420 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538	2613.7480 ng season) in the livi ving area, Mar 16.6830 2.1122 0.9886 17.5790 18.2813 0.9823 15.6405 15.7525 15.7525	Apr 0.9373 2984.1936 9.9900 9930.9907 5001.6940 (h/year) 5001.6940 (tion - tota	May 0.8596 3017.0562 13.0000 6671.1797 2718.6679 0.0000 2718.6679 c.luding micr	Jun 0.6605 18.1041 18.2241 18.2241 Jun 0.6486 2330.7049 16.0000 0.0000 0.0000 0.0000 0.0000 0.0000	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701 18.2965 18.4308 18.4308 Jul 0.2231 756.6374 17.9000 783.6005 0.0000 0.0000	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319 18.2987 18.4299 18.4299 18.4299 18.4299 0.0000 0.0000 0.0000 0.0000	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 17.9604 17.9604 17.9604 17.9604 0.8136 0.0000 0.0000	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924 1.2437 0.0000 4274.2437	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020 2a / (4) = 15.8135 15.8135 Nov 0.9828 1821.1893 8.0000 11559.7172 7011.7401	1680.8535 21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314 0.0000 14.9314 Dec 0.9909 1665.6319 5.1000 14642.7067 9654.9436 53906.7648 0.0000 0.0000 9654.9436 53906.7648	(84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98a) (98b)
Total gains 7. Mean interr 7. Mean interr Temperature du Utilisation fa tau alpha util living ar MIT Th 2 Living area fr MIT Z Living area fr MIT 8. Space heatin Utilisation Useful gains Ext temp. Heat loss rate face heating Space heating Space heating Space heating Space heating Space heating Space heating	1809.7436 nal tempera nring heati actor for g Jan 16.6006 2.1067 rea 0.9960 16.7535 18.2750 nouse 0.9941 14.8150 raction 14.9269 right 16.811 5.1000 w 4.778.5406 kWh 9662.9674 requirement kWh 0.0000 contributi kWh 79662.9674 requirement per m2	2172.1489 ture (heati- ng periods ains for li Feb 16.6830 2.1122 0.9938 16.9786 18.2813 0.9909 15.0420 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538 15.1538	2613.7480	Apr 0.9373 2984.1936 9.9000 9930.9907 5001.6940 h/year) 5001.6940 tition - tota	May 0.8596 3017.0562 13.0000 6671.1797 2718.6679 10 per year cluding micr	Jun 0.6486 2330.7049 16.0000 0.000000	Jul 16.9104 2.1274 0.7750 20.6224 18.2987 0.1701 18.2965 18.4308 18.4308 Jul 0.2231 756.6374 17.9000 783.6005 0.0000 0.0000	Aug 16.9792 2.1319 0.8097 20.5702 18.3040 0.2319 18.2987 18.4299 18.4299 18.4299 18.4299 0.0000 0.0000 0.0000 0.0000	Sep 16.9452 2.1297 0.9416 19.8258 18.3014 0.8393 17.8460 17.9604 17.9604 17.9604 17.9604 0.8136 0.0000 0.0000	Oct 16.8746 2.1250 0.9830 18.7285 18.2960 0.9676 16.7924 1.2437 0.0000 4274.2437	Nov 16.8746 2.1250 0.9937 17.6328 18.2960 0.9900 15.7020 2a / (4) = 15.8135 15.8135 Nov 0.9828 1821.1893 8.0000 11559.7172 7011.7401	1680.8535 21.0000 Dec 16.7622 2.1175 0.9966 16.7532 18.2874 0.9950 14.8198 0.0577 14.9314 0.0000 14.9314 Dec 0.9909 1665.6319 5.1000 14642.7067 9654.9436 53906.7648 0.0000 0.0000 9654.9436 53906.7648	(84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98a) (98b) (98c) (99)

SAP 10 Online 2.12.4 Page 6 of 15



Fraction of space heat from main system(s) Efficiency of main space heating system 1 (in %) Efficiency of main space heating system 2 (in %) Efficiency of secondary/supplementary heating system, %				1.0000 75.0000 0.0000 0.0000	(206) (207)
Jan Feb Mar Apr May Jun Jul Space heating requirement	Aug	Sep Oct	Nov	Dec	
9662.9674 8170.9659 7411.5421 5001.6940 2718.6679 0.0000 0.000 Space heating efficiency (main heating system 1)	0.0000	0.0000 4274.2437	7011.7401	9654.9436	(98)
75.0000 75.0000 75.0000 75.0000 75.0000 0.0000 0.0000 Space heating fuel (main heating system)	0.0000	0.0000 75.0000	75.0000	75.0000	(210)
12883.9566 10894.6212 9882.0562 6668.9253 3624.8905 0.0000 0.000 Space heating efficiency (main heating system 2)	0.0000	0.0000 5698.9916	9348.9868	12873.2582	(211)
0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 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	(212)
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	(213)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	(215)
Water heating Water heating requirement					
1195.2580 1072.7001 1172.6128 1102.4960 1118.9049 979.8732 999.253	7 1009.9299	989.5003 1131.1869	1125.6278	1190.9580	
Efficiency of water heater (217)m 73.7614 73.6954 73.4687 72.9878 71.8011 65.0000 65.000	00 65.0000	65.0000 72.6778	73.4497	70.0000 73.7644	
Fuel for water heating, kWh/month 1620.4375 1455.5867 1596.0709 1510.5215 1558.3403 1507.4972 1537.313	33 1553.7383	1522.3081 1556.4411	1532.5143	1614.5421	(219)
Space cooling fuel requirement (221)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000			0.0000	0.0000	
Pumps and Fa 14.0137 12.6575 14.0137 13.5616 14.0137 13.5616 14.0137 Lighting 64.1798 51.4874 46.3587 33.9644 26.2351 21.4343 23.932		13.5616 14.0137 40.4067 53.0158	13.5616 59.8812	14.0137 65.9636	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net (235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		0.0000 0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000		0.0000 0.0000	0.0000	0.0000	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000			0.0000	0.0000	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net (235d)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	generation)	0.0000 0.0000	0.0000	0.0000	
Annual totals kWh/year	0.0000	0.0000 0.0000			
Space heating fuel - main system 1 Space heating fuel - main system 2				71875.6864	(213)
Space heating fuel - secondary Efficiency of water heater				0.0000 70.0000	
Water heating fuel used Space cooling fuel				18565.3113 0.0000	
Electricity for pumps and fans:					
central heating pump Total electricity for the above, kWh/year				165.0000 165.0000	(231)
Electricity for lighting (calculated in Appendix L)				517.9680	(232)
Energy saving/generation technologies (Appendices M ,N and Q) PV generation				0.0000	(233)
Wind generation Hydro-electric generation (Appendix N)				0.0000	
Electricity generated - Micro CHP (Appendix N) Appendix Q - special features				0.0000	(235)
Energy saved or generated Energy used				-0.0000 0.0000	
Total delivered energy for all uses				91123.9657	
10a. Fuel costs - using BEDF prices (533)					
	Fuel	Fuel price		Fuel cost	
Space heating - main system 1	kWh/year 71875.6864	p/kWh		£/year 3450.0329	
Total CO2 associated with community systems Water heating (other fuel)	18565.3113			0.0000 891.1349	(473)
Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot	0.0000	21.5100		0.0000	(247a)
Energy for lighting Additional standing charges	517.9680			111.4149	(250)
Total energy cost				4586.0743	
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP					
	Energy			Emissions	
Space heating - main system 1	kWh/year 71875.6864			g CO2/year 15093.8941	(261)
Total CO2 associated with community systems Water heating (other fuel)	18565.3113	0.2100		0.0000 3898.7154	(264)
Space and water heating Pumps, fans and electric keep-hot	165.0000			18992.6095 22.8875	(267)
Energy for lighting Total CO2, kg/year	517.9680	0.1443		74.7588 19090.2558	
13a. Primary energy - Individual heating systems including micro-CHP					
		Primary energy factor kg CO2/kWh		ary energy kWh/year	
Space heating - main system 1 Total CO2 associated with community systems	71875.6864	1.1300		81219.5256 0.0000	(275) (473)
Water heating (other fuel) Space and water heating	18565.3113	1.1300		20978.8018 02198.3274	(278)

SAP 10 Online 2.12.4 Page 7 of 15



Pumps, fans and electric keep-hot Energy for lighting Total Primary energy kWh/year 794.4766 (282) 103242.4160 (286) SAP 10 EPC IMPROVEMENTS Current energy efficiency rating: Current environmental impact rating: Solar water heating Cancelled by user U Solar photovoltaic panels V2 Wind turbine Cancelled by user Not applicable Recommended measures: SAP change Cost change Energy Environmental efficiency impact Typical annual savings Recommended measures Total Savings 0.00 kg/m² Potential energy efficiency rating: Potential environmental impact rating: F 37 Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023) Recommendation texts revision number 6.1 (11 Jun 2019) Typical heating and lighting costs of this home (per year, Thames Valley): Current Potential £147 fΩ Electricity £147 £4439 Mains gas £4439 Space heating Water heating Lighting £3584 £3584 f.O f.891 £891 £111 £111 £4586 Total cost of fuels Total cost of uses £4586 £.0 £4586 253 kWh/m² 19 tonnes 53 kg/m² £4586 253 kWh/m² 19 tonnes 53 kg/m² £0 0 kWh/m² 0.0 tonnes 0 kg/m² Delivered energy Carbon dioxide emissions CO2 emissions per m² Primary energy SAP 10 WORKSHEET FOR Existing dwelling (SAP) (Vecalculation of energy rating for improved DWELLING (Version 10.2, February 2022) 1. Overall dwelling characteristics Storey height Volume (m2) (m) (m3) 2.0000 (2a) 146.2000 (1a) - (3a) Basement floor 73.1000 (1a) (1a) -(1b) -(1c) -(1d) -Ground floor First floor 78.3000 (1a) 78.3000 (1b) 75.0000 (1c) 3.0000 (2a) 3.0000 (2c) 234.9000 (3c) Second floor 70.9000 (1d) 3.0000 (2d) 212.7000 (3d) Third floor
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
Dwelling volume 62.2000 (1e) 2.0000 (2e) 124.4000 359.5000 $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) =$ m3 per hour 0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 5 * 10 = 0 * 10 = 0 * 40 = Number of open chimneys
Number of open flues
Number of chimneys / flues attached to closed fire
Number of flues attached to solid fuel boiler
Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans 0.0000 (6a) 0.0000 (6b) 0.0000 (6c) 0.0000 0.0000 0.0000 50.0000 (6d) (6e) (6f) (7a) Number of passive vents Number of flueless gas fires 0.0000 Air changes per hour Infiltration due to chimneys, flues and fans = (6a) + (6b) + (6c) + (6d) + (6e) + (6f) + (6g) + (7a) + (7b) + (7c) = (6a) + (6b) + (6c) + (6d) + (6e) + (6e)50.0000 / (5) 0.0530 (8) Infiltration due to cnimes Pressure test Pressure Test Method Measured/design AP50 Infiltration rate Number of sides sheltered Yes Blower Door 15.0000 (17) 0.8030 (18) 2 (19) - [0.075 x (19)] = (21) = (18) x (20) = 0.8500 (20) 0.6826 (21)

SAP 10 Online 2.12.4 Page 8 of 15

(20) = 1

Shelter factor

Infiltration rate adjusted to include shelter factor



Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	1.1750	
Effective ac	0.8703 0.8787	0.8532 0.8640	0.8361 0.8496	0.7508 0.7819		0.6484 0.7102	0.6484 0.7102		0.6826 0.7329				
3. Heat losses a													
Element				Gross	Openings	Ne	tArea	U-value	Ах	U F	<pre><-value</pre>	Α×Κ	
Window (Uw = 4.8 External Door T W8 T W9 T W10 Basement Floor Ground Floor External Wall Main Roof Exposed Ceiling Total net area of Fabric heat loss	of external	l elements um (A x U)		m2 355.2000 62.2000 16.7000	58.3800 2.8500	51 7 0 0 0 73 4 0 296 0 59	m2 .1100 .2700 .9500 .9500 .9500 .1000 .4000 .8200 .3500 .7000	W/m2K 4.0268 3.0000 4.2359 4.2359 4.2359 1.2000 1.2000 2.1000 2.3000 2.3000 30) + (32)	W, 205.81: 21.81: 4.02: 4.02: 87.72: 5.28: 623.32: 136.50: 38.41:	/K 21 000 41 41 41 41 00 00 00 20 50 00	kJ/m2K	kJ/K	
		MP = Cm /	TFA) in kJ/	m2K								250.0000	(35)
Thermal mass parameter (TMF = Cm / TFA) in kJ/m2K List of Thermal Bridges Length Psi-value E2 Other lintels (including other steel lintels) 37.7400 1.0000 E3 Sill 34.2800 0.1000 E3 Sill 34.2800 0.1000 E4 Jamb 136.6000 0.1200 E5 Ground floor (normal) 60.8000 0.3200 E20 Exposed floor (normal) 3.1800 0.3200 E20 Exposed floor (normal) 3.1800 0.3200 E22 Basement floor 36.0000 0.2200 E6 Intermediate floor within a dwelling 111.8500 0.1400 E1 Eaves (insulation at rafter level) 26.3300 0.1500 E15 Flat roof with parapet 23.0500 0.3000 E16 Corner (normal) 38.8000 0.1800 E17 Corner (inverted - internal area greater than external area) 25.8000 0.0000 E18 Party wall between dwellings 39.8000 0.2400 E15 Flat ry wall between dwellings 11.8000 0.2400 E25 Staggered party wall between dwellings 11.8000 0.2400 E17 carner (inverted - internal area) 25.8000 0.0000 E25 Staggered party wall between dwellings 11.8000 0.2400 E25 Staggered party wall between dwellings 11.8000 0.3200 E25 E25 Staggered party wall between dwellings 11.8000 0.3200 E25 E25 Staggered party wall between dwellings E25 Staggered party wall between dwellings E25 Staggered pa										Tot 37.7', 3.4' 13.6' 19.4' 1.0: 7.9' 15.6' 3.9' 6.9' 0.00 9.55' 2.8' 4.6' 0.00 3.6'	400 600 660 650 776 200 590 445 550 840 900 520 320 720	(36)	
Point Thermal br Total fabric hea	idges		-						(:	33) + (36)	(36a) = + (36a) =	0.0000	
	Jan 273.4941	Feb	Mar	Apr		Jun 221.0639	Jul 221.0639	Aug 217.6652	Sep 228.1331	Oct 239.4167	Nov 247.3923	Dec 255.7304	(38)
Heat transfer co 15 Average = Sum(39	41.8106	1537.2337	1532.7474	1511.6756	1507.7332	1489.3803	1489.3803	1485.9816	1496.4495	1507.7332	1515.7087	1524.0468 1511.6567	(39)
HLP HLP (average)	Jan 4.2888	Feb 4.2760	Mar 4.2636	Apr 4.2049	May 4.1940	Jun 4.1429	Jul 4.1429	Aug 4.1335	Sep 4.1626	Oct 4.1940	Nov 4.2162	Dec 4.2394 4.2049	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30		
Assumed occupanc	 :у		s (kWh/year)								3.2093	(42)
Hot water usage 1 Hot water usage	07.2899		103.3280	98.8326	95.5151	91.8155	89.7126	92.0444	94.6004	98.5727	103.1646	106.8788	(42a)
	35.4508	34.9243 uses	34.1829	32.8158	31.7922	30.6572	30.0441	30.7803	31.5819	32.7965	34.1917	35.3309	(42b)
Average daily ho	49.9960 t water us	48.1780 se (litres	46.3600 /day)	44.5419	42.7239	40.9058	40.9058	42.7239	44.5419	46.3600	48.1780	49.9960 177.2371	
Daily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
_ 1	92.7367 805.2478 (annual)	188.7798 268.8199	183.8708 282.6026	176.1904 241.1958	170.0312 228.8947	163.3785 200.8930	160.6626 194.3075	165.5486 204.9837	170.7243 210.5201	177.7291 241.1767 Total = S	185.5343 264.3276 Sum(45)m =		
	45.7872	40.3230	42.3904	36.1794	34.3342	30.1339	29.1461	30.7476	31.5780	36.1765	39.6491	45.1422	(46)
Store volume b) If manufact Hot water stor Volume factor Temperature fa Enter (49) or (5 Total storage lo	curer declarage loss from Table actor from (55)	factor from 2 2a Table 2b			ay)							300.0000 0.1425 0.7368 0.7800 24.5688	(51) (52) (53)
	61.6330	687.9266 cated sola	761.6330 r storage	737.0642	761.6330	737.0642	761.6330	761.6330	737.0642	761.6330	737.0642	761.6330	(56)
	0.0000	687.9266 115.9536 0.0000	761.6330 128.3772 0.0000	737.0642 124.2360 0.0000	761.6330 128.3772 0.0000	737.0642 41.9160 0.0000	761.6330 43.3132 0.0000	761.6330 43.3132 0.0000	737.0642 41.9160 0.0000	761.6330 128.3772 0.0000	737.0642 124.2360 0.0000	128.3772	(59)
WWHRS PV diverter Solar input FGHRS Output from w/h	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	1172.6128 0.0000 0.0000 0.0000 0.0000	1102.4960 0.0000 0.0000 0.0000 0.0000	1118.9049 0.0000 0.0000 0.0000 0.0000	979.8732 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	1009.9299 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	1125.6278 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	(63a) (63b) (63c) (63d)
		1072.7001	1172.6128	1102.4960	1118.9049	979.8732	999.2537	1009.9299 Total pe	989.5003 er year (kW)				
Electric shower(0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy us	0.0000 sed by inst	0.0000 antaneous e	0.0000 electric sho	0.0000 wer(s) (kWh	0.0000 /year) = Su	0.0000 um(64a)m =	0.0000	
Heat gains from 2			month 196.6671	179.5864	178.8093	100.3297	99.2578	102.8077	103.5307	182.8930	187.2777	202.7669	(65)

SAP 10 Online 2.12.4 Page 9 of 15



5. Internal ga													
Metabolic gair (66)m	Jan 192.5568	Feb 192.5568			May 192.5568			Aug 192.5568	Sep 192.5568	Oct 192.5568	Nov 192.5568	Dec 192.5568	(66)
Lighting gain:	73.3237	65.1255	52.9636	40.0969	29.9729	25.3044	27.3423	35.5405	47.7024	60.5691	70.6931	75.3616	(67)
Appliances ga	753.4903	761.3092	741.6059	699.6599	646.7106	596.9457	563.6997	555.8809	575.5842	617.5302	670.4795	720.2443	(68)
Cooking gains	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	57.4650	
Pumps, fans Losses e.g. e					10.0000	0.0000	0.0000	0.0000	0.0000	10.0000	10.0000	10.0000	
Water heating	gains (Tab	le 5)			-128.3712					-128.3712		-128.3712	
Total interna	l gains	271.0499	264.3375	249.4256	240.3350	139.3468	133.4110	138.1823	143.7927	245.8239	260.1079	272.5362	
	1232.9225	1229.1351	1190.5576	1120.8329	1048.6690	883.2475	846.1036	851.2542	888.7298	1055.5738	1132.9311	1199.7927	(73)
6. Solar gain:													
[Jan]					Solar flux		g		FF	Acce	99	Gains	
				m2	Table 6a W/m2	Speci or	fic data Table 6b		data le 6c	fact Table	or	W	
North Northeast				000 800	10.6334 11.2829		0.8500 0.8500	0	.7000 .7000	0.77 0.77		10.0844 9.2117	
Southeast Southwest			19.2	200 300	10.6334 11.2829 36.7938 36.7938 19.6403		0.8500 0.8500	0	.7000 .7000	0.77		291.5940 12.5922	
West Northwest			2.4	000 800	19.6403 11.2829		0.8500 0.8500	0	.7000 .7000	0.77 0.77	00	19.4361 113.4243	
Southeast			2.8		39.9751		0.8500		.7000	1.00	00	61.0091	(82)
Solar gains Total gains													
7. Mean inter	nal tempera	ture (heati	ing season)										
Temperature de Utilisation fa	uring heati	ng periods	in the livi	ng area fro	om Table 9,		_ _					21.0000	(85)
tau alpha	Jan 16.1922 2.0795	Feb 16.2404 2.0827	Mar 16.2879 2.0859	Apr 16.5150 2.1010	May 16.5582 2.1039	Jun 16.7622 2.1175	Jul 16.7622 2.1175	Aug 16.8005 2.1200	Sep 16.6830 2.1122	Oct 16.5582 2.1039	Nov 16.4710 2.0981	Dec 16.3809 2.0921	
util living a	rea 0.9965	0.9943	0.9898	0.9798	0.9592	0.9248	0.8727	0.9001	0.9614	0.9870	0.9950	0.9970	(86)
MIT Th 2 util rest of 1	16.4459 18.2440	16.7068 18.2477	17.2638 18.2513	18.0807 18.2685	18.9518 18.2718	19.7657 18.2874	20.2790 18.2874	20.1821 18.2903	19.4766 18.2813	18.3954 18.2718	17.3046 18.2652	16.4256 18.2583	
MIT 2	0.9950 14.4956	0.9917 14.7573	0.9847 15.3141	0.9673 16.1328	0.9251 16.9898	0.8227 17.7660	0.5913 18.1707	0.6697 18.1216	0.9076 17.5153	0.9767 16.4521	0.9922 15.3619	0.9957 14.4808	
Living area f		14.8699	15.4267	16.2453	17.1031	17.8815	18.2925	18.2406	fLA = 17.6285	Living are 16.5643	a / (4) =	0.0577	(91)
Temperature adjusted MIT	djustment	14.8699	15.4267	16.2453	17.1031	17.8815	18.2925	18.2406	17.6285	16.5643	15.4741	0.0000 14.5931	
8. Space heat:													
									_	_		_	
Utilisation Useful gains Ext temp.	Jan 0.9909 1734.4051 4.3000	Feb 0.9854 2134.6571 4.9000	Mar 0.9742 2548.2278 6.5000	Apr 0.9492 2958.1194 8.9000	May 0.8966 3126.4785 11.7000	Jun 0.7923 2687.0665 14.6000	Jul 0.5923 1911.9801 16.6000	Aug 0.6605 1909.3545 16.4000	Sep 0.8790 2206.3843 14.1000	Oct 0.9627 2050.9849 10.6000	Nov 0.9863 1738.7489 7.1000		(95)
Heat loss rate	e W	15326.0716			8146.4876			2735.1466		8992.5614			
Space heating	10534.2512 requiremen		8283.8354 ber year (kW		3734.8868	0.0000	0.0000	0.0000	0.0000	5164.5329	7886.8497	10577.1225 60910.9625	(98a)
Solar heating	0.0000 contributi	0.0000 on - total			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating	10534.2512 requiremen		8283.8354 Lar contribu			0.0000 (kWh/year)	0.0000	0.0000	0.0000	5164.5329		60910.9625	
Space heating	per mz									(980) / (4) =	169.4324	(99)
9a. Energy re	quirements	- Individua	al heating s	ystems, ind	cluding micr	o-CHP							
Fraction of sp Fraction of sp Efficiency of Efficiency of Efficiency of	pace heat f pace heat f main space main space	rom seconda rom main sy heating sy heating sy	ary/suppleme ystem(s) ystem 1 (in ystem 2 (in	ntary syste %) %)								0.0000 1.0000 75.0000 0.0000 0.0000	(202) (206) (207)
Space heating	Jan reguiremen	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	10534.2512	8864.6306	8283.8354		3734.8868	0.0000	0.0000	0.0000	0.0000	5164.5329	7886.8497	10577.1225	(98)
Space heating	75.0000	75.0000	75.0000		75.0000	0.0000	0.0000	0.0000	0.0000	75.0000	75.0000	75.0000	(210)
	14045.6683	11819.5074	11045.1139		4979.8490	0.0000	0.0000	0.0000	0.0000	6886.0439	10515.7996	14102.8300	(211)
Space heating Space heating	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)

SAP 10 Online 2.12.4 Page 10 of 15



	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary) 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating Water heating requirement											
1195.2580 1072.7001 117	2.6128	1102.4960	1118.9049	979.8732	999.2537	1009.9299	989.5003	1131.1869	1125.6278	1190.9580	
Efficiency of water heater (217)m 73.8521 73.7851 7 Fuel for water heating, kWh/month	3.6075	73.2315	72.4495	65.0000	65.0000	65.0000	65.0000	72.9980	73.5976	70.0000 73.8599	
1618.4478 1453.8174 159 Space cooling fuel requirement	3.0614	1505.4932	1544.3937	1507.4972	1537.3133	1553.7383	1522.3081	1549.6145	1529.4347	1612.4558	(219)
(221)m 0.0000 0.0000	0.0000 4.0137	0.0000 13.5616	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Lighting 64.1798 51.4874 4	6.3587	33.9644	14.0137 26.2351	13.5616 21.4343	14.0137 23.9325	14.0137 31.1084	13.5616 40.4067	14.0137 53.0158	13.5616 59.8812		
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric (235a)m 0.0000 0.0000 Electricity used or net electricity gen	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
	0.0000	0.0000			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Space heating fuel - main system 1 Space heating fuel - main system 2										81214.6166 0.0000	
Space heating fuel - secondary Efficiency of water heater										0.0000	
Water heating fuel used Space cooling fuel										18527.5756	
Electricity for pumps and fans:											
central heating pump Total electricity for the above, kWh/ye	ar									165.0000 165.0000	
Electricity for lighting (calculated in		ix L)								517.9680	
Energy saving/generation technologies (. PV generation	Appendio	ces M ,N an	d Q)							0.0000	(233)
Wind generation Hydro-electric generation (Appendix N)										0.0000	
Electricity generated - Micro CHP (Appe Appendix Q - special features	ndix N)									0.0000	(235)
Energy saved or generated Energy used										-0.0000 0.0000	(237)
Total delivered energy for all uses										100425.1602	(238)
10a. Fuel costs - using Table 12 prices											
						Fuel		Fuel price		Fuel cost	
10a. Fuel costs - using Table 12 prices								Fuel price p/kWh 3.6400		£/year 2956.2120	(240)
10a. Fuel costs - using Table 12 prices	tems					Fuel kWh/year 81214.6166		p/kWh 3.6400 3.6400		£/year 2956.2120 0.0000 674.4038	(240) (473) (247)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot	tems					Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000		p/kWh 3.6400 3.6400 16.4900 16.4900		£/year 2956.2120 0.0000 674.4038 0.0000 27.2085	(240) (473) (247) (247a) (249)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges	tems					Fuel kWh/year 81214.6166 18527.5756 0.0000		p/kWh 3.6400 3.6400 16.4900		£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000	(240) (473) (247) (247a) (249) (250) (251)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting	tems					Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000		p/kWh 3.6400 3.6400 16.4900 16.4900		£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129	(240) (473) (247) (247a) (249) (250) (251)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges	tems					Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000		p/kWh 3.6400 3.6400 16.4900 16.4900		£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000	(240) (473) (247) (247a) (249) (250) (251)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost	tems					Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000 517.9680		p/kWh 3.6400 3.6400 16.4900 16.4900		£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000	(240) (473) (247) (247a) (249) (250) (251)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost	etems er(s)					Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000 517.9680		p/kWh 3.6400 3.6400 16.4900 16.4900		£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000	(240) (473) (247) (247a) (249) (250) (251) (255)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost	etems er(s)					Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000 517.9680	255) x (256	p/kWh 3.6400 3.6400 16.4900 16.4900	45.0] =	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372	(240) (473) (247) (247a) (249) (250) (251) (255)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF)	etems er(s)					Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000 517.9680		p/kWh 3.6400 3.6400 16.4900 16.4900	45.0] =	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702	(240) (473) (247) (247a) (250) (250) (251) (255) (256) (257) (258)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12)	etems er(s)					Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000 517.9680		p/kWh 3.6400 3.6400 16.4900 16.4900	45.0] =	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45	(240) (473) (247) (247a) (250) (250) (251) (255) (256) (257) (258)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band	tems					Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000 517.9680		p/kWh 3.6400 3.6400 16.4900 16.4900	45.0] =	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45	(240) (473) (247) (247a) (250) (250) (251) (255) (256) (257) (258)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12)	tems r(s) stems	ing system	s including	y micro-CHP		Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000 517.9680	255) x (256	p/kWh 3.6400 3.6400 16.4900 16.4900 17.4900 18.4900	45.0] =	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E	(240) (473) (247) (247a) (249) (250) (251) (255) (255)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band	tems r(s) stems	ing system	s including	y micro-CHP		Fuel kWh/year 81214.6166 0.0000 165.0000 517.9680	255) x (256	p/kWh 3.6400 3.6400 16.4900 16.4900 17.4900 18.4900 19.4900	·	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E	(240) (473) (247) (247a) (249) (250) (251) (255) (255)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band 12a. Carbon dioxide emissions - Individ Space heating - main system 1 Total CO2 associated with community sys	r(s)	ing system	s including	y micro-CHP		Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000 517.9680	255) x (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 17.4900 18.4900 19.4900	1	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 Emissions kg CO2/year 17055.0695 0.0000	(240) (473) (247) (247a) (249) (250) (251) (255) (256) (257) (258)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Space and water heating	r(s)	ing system	s including	y micro-CHP		Fuel kWh/year 81214.6166 18527.5756 0.0000 517.9680	255) × (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900)] / [(4) +	1	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E	(240) (473) (247) (247a) (249) (250) (251) (255) (255) (257) (258)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel)	r(s)	ing system	s including	y micro-CHP		Fuel kWh/year 81214.6166 18527.5756 0.0000 165.0000 517.9680	255) x (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 17.4900 18.4900 19.4900	,	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E	(240) (473) (247) (247a) (250) (251) (251) (255) (256) (257) (258)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting	r(s)	ing system	s including	y micro-CHP		Fuel kWh/year 81214.6166 0.0000 165.0000 517.9680	255) x (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900)] / [(4) +	,	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E	(240) (473) (247a) (247a) (250) (251) (255) (255) (257) (258) (261) (373) (264) (265) (268) (273)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Total CO2, kg/year CO2 emissions per m2	r(s)	ing system	s including	y micro-CHP		Fuel kWh/year 81214.6166 0.0000 165.0000 517.9680	255) x (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900)] / [(4) +	,	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 Emissions kg CO2/year 17055.0695 0.0000 3890.7909 20945.8604 22.8875 74.7858 21043.5067 58.5400 36.9610	(240) (473) (247) (247a) (249) (250) (251) (255) (256) (257) (258) (261) (373) (264) (265) (267) (267) (267) (267) (273)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy	r(s)	ing system	s including	y micro-CHP		Fuel kWh/year 81214.6166 0.0000 165.0000 517.9680	255) x (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900)] / [(4) +	,	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E Emissions kg CO2/year 17055.0695 0.0000 3890.7909 20945.8604 422.8875 74.7588 21043.5067 58.5400 36.9610	(240) (473) (247) (247a) (249) (250) (251) (255) (256) (257) (258) (261) (373) (264) (265) (267) (267) (267) (267) (273)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy	tems r(s) stems	ting system	s including	g micro-CHP		Fuel kWh/year 81214.6166 18527.5756 165.0000 517.9680	255) x (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900)] / [(4) +	,	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E Emissions kg CO2/year 17055.0695 0.0000 3890.7909 20945.8604 422.8875 74.7588 21043.5067 58.5400 36.9610	(240) (473) (247) (247a) (249) (250) (251) (255) (256) (257) (258) (261) (373) (264) (265) (267) (267) (267) (267) (273)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Total CO2, kg/year CO2 emissions per m2 EI value EI rating EI band	tems r(s) stems	ting system	s including	g micro-CHP		Fuel kWh/year 81214.6166 18527.5756 165.0000 517.9680	255) x (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900)] / [(4) +	,	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E Emissions kg CO2/year 17055.0695 0.0000 3890.7909 20945.8604 422.8875 74.7588 21043.5067 58.5400 36.9610	(240) (473) (247) (247a) (249) (250) (251) (255) (256) (257) (258) (261) (373) (264) (265) (267) (267) (267) (267) (273)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Total CO2, kg/year CO2 emissions per m2 EI value EI rating EI band	stems stems tems	ting system	s including	y micro-CHP		Fuel kWh/year 81214.6166 0.0000 165.0000 517.9680	255) x (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900)] / [(4) +	,	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E Emissions kg CO2/year 17055.0695 0.0000 3890.7909 20945.8604 422.8875 74.7588 21043.5067 58.5400 36.9610	(240) (473) (247) (247a) (249) (250) (251) (255) (256) (257) (258) (261) (373) (264) (265) (267) (267) (267) (267) (273)
Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Energy for instantaneous electric showe Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost 11a. SAP rating - Individual heating sy Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band Space heating - main system 1 Total CO2 associated with community sys Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Total CO2, kg/year CO2 emissions per m2 EI value EI rating EI band	tems r(s) rstems ual heat tems (SAP) PRIMARN	(Version 1	s including	y micro-CHP		Fuel kWh/year 81214.6166 0.0000 165.0000 517.9680	255) x (256 Emiss	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900)] / [(4) +	,	£/year 2956.2120 0.0000 674.4038 0.0000 27.2085 85.4129 92.0000 3835.2372 0.3600 3.4133 44.6702 45 E Emissions kg CO2/year 17055.0695 0.0000 3890.7909 20945.8604 422.8875 74.7588 21043.5067 58.5400 36.9610	(240) (473) (247) (247a) (249) (250) (251) (255) (256) (257) (258) (261) (373) (264) (265) (267) (267) (267) (267) (273)

SAP 10 Online 2.12.4 Page 11 of 15



1. Overall dwell	ling char	acteristics							0.5			77-3	
Basement floor Ground floor First floor Second floor Third floor Total floor area	a TFA = (1a)+(1b)+(1	c)+(1d)+(1e)(1n)		359.5000		Area (m2) 73.1000 78.3000 75.0000 70.9000 62.2000	(1a) x (1b) x (1c) x (1d) x (1e) x	2.0000 3.0000 3.0000 3.0000 2.0000	(2a) = (2b) = (2c) = (2d) = (2e) =	Volume (m3) 146.2000 234.9000 225.0000 212.7000 124.4000	(1b) - (1c) - (1d) - (1e) - (4)
Dwelling volume								(3a)+(3b)+(3c	:) + (3a) + (3e)(3n) =	943.2000	(5)
2. Ventilation											1	m3 per hour	
Number of open of Number of open of Number of chimmen Number of flues Number of blocken Number of intern Number of passif Number of flueld	flues eys / flu attached attached ed chimne mittent e ve vents	to solid f to other h ys xtract fans	uel boiler eater	fire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 5 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 50.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 te		and fans	= (6a)+(6b	v)+(6c)+(6d)	+(6e)+(6f)+	-(6g)+(7a)+((7b) + (7c) =		50.000	0 / (5) =	es per hour 0.0530 Yes 3lower Door 15.0000 0.8030 2	(8)
Shelter factor Infiltration rat	te adjust	ed to inclu	de shelter	factor					(20) = 1		x (19)] = x (20) =	0.8500 0.6826	
Wind speed Wind factor	Jan 4.2000 1.0500	Feb 4.0000 1.0000	Mar 4.0000 1.0000	Apr 3.7000 0.9250	May 3.7000 0.9250	Jun 3.3000 0.8250	Jul 3.4000 0.8500	Aug 3.2000 0.8000		Oct 3.5000 0.8750		Dec 3.8000 0.9500	
Adj infilt rate Effective ac	0.7167 0.7568	0.6826 0.7329	0.6826 0.7329	0.6314 0.6993	0.6314 0.6993	0.5631 0.6585	0.5802 0.6683	0.5460 0.6491		0.5972 0.6783		0.6484 0.7102	
3. Heat losses	and heat	loss parame	ter										
Element				Gross m2	Opening	gs Ne n2	etArea m2	U-value W/m2K	A ×	I/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 4.8 External Door T W8 T W9 T W10 Basement Floor Ground Floor External Wall	30)			355.2000	58.380	7 0 0 0 73 4	1100 7.2700 0.9500 0.9500 0.9500 8.1000 1.4000 5.8200	4.0268 3.0000 4.2359 4.2359 4.2359 1.2000 1.2000 2.1000	205.81 21.81 4.02 4.02 4.02 87.72 5.28 623.32	00 41 41 41 41 00			(27) (26) (27a) (27a) (27a) (28a) (28a) (28a) (29a)
Main Roof Exposed Ceiling Total net area	of extern	al elements		62.2000 16.7000	2.850	00 59 16	9.3500 5.7000	2.3000	136.50 38.41	50			(30) (30) (31)
Fabric heat loss	s, W/K =	Sum (A x U)		m2K				(30) + (32)	= 1130.93	13		250.0000	(33)
List of Thermal K1 Eleme E2 Othe: E3 Sill E4 Jamb E5 Groun E20 Expr E22 Bass E6 Inte: E11 Eave E15 Flar E16 Corn E17 Corn E18 Parr E25 Star P1 Part; P2 Part; Thermal bridges Point Thermal b	Bridges ent r lintels and floor posed floo ment floo mediate ss (insult troof wi mer (norm ener (inverty wall by wall - y wall - y wall - x y y wall - x y	(including (normal) r (normal) or floor withi ation at ra th parapet al) rrted - inte etween dwel rty wall be Ground floo Intermediat Roof (insul Psi) calcu	other stee n a dwellin fter level) rnal area g lings tween dwell r e floor wit ation at ce lated using	g reater thar ings hin a dwell iling level Appendix F	ing	irea)		3 3 13 6 3 11 2 2 3 3 2 3 1 1 1 6	7.7400 4.2800 6.6000 0.8000 3.1800 6.0000 1.8500 6.3000 3.0500 8.8000 9.8000 1.8000 4.6000 5.9000 7.5000	Psi-value 1.0000 0.1000 0.1000 0.3200 0.3200 0.2200 0.1400 0.1500 0.3000 0.2400 0.2400 0.2400 0.2400 0.3200 0.4800 333) + (36)	To' 37.7. 3.4: 13.6 19.4: 1.0: 7.9; 15.6: 3.9; 6.9: 0.0: 9.5; 2.8: 4.6: 0.0: 3.6: (36a) = + (36a) =	280 280 560 560 560 560 560 576 200 390 395 550 840 320 320 320 320 320 320 320 320 320 32	(36)
Ventilation head	t loss ca Jan 235.5649	lculated mo Feb 228.1331	nthly (38)m Mar 228.1331	= 0.33 x (Apr 217.6652	25) m x (5) May 217.6652	Jun 204.9768	Jul 208.0129	Aug 202.0313	Sep 204.9768	Oct 211.1397	Nov 211.1397	Dec 221.0639	(38)
Heat transfer co	peff 503.8813	1496.4495							1473.2932				
HLP	Jan 4.1833	Feb 4.1626	Mar 4.1626	Apr 4.1335	May 4.1335	Jun 4.0982	Jul 4.1066	Aug 4.0900	Sep 4.0982	Oct 4.1153	Nov 4.1153	Dec 4.1429	(40)
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	4.1285 31	

SAP 10 Online 2.12.4 Page 12 of 15



4. Water heating energy												
Assumed occupancy											3.2093	(42)
Hot water usage for mixer 107.2899 Hot water usage for baths	105.6775	103.3280	98.8326	95.5151	91.8155	89.7126	92.0444	94.6004	98.5727	103.1646	106.8788	(42a)
35.4508 Hot water usage for other	34.9243	34.1829	32.8158	31.7922	30.6572	30.0441	30.7803	31.5819	32.7965	34.1917	35.3309	
49.9960 Average daily hot water u	48.1780	46.3600 /day)	44.5419	42.7239	40.9058	40.9058	42.7239	44.5419	46.3600	48.1780	49.9960 177.2371	
Jan Daily hot water use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte 305.2478 Energy content (annual)	188.7798 268.8199	183.8708 282.6026	176.1904 241.1958	170.0312 228.8947	163.3785 200.8930	160.6626 194.3075	165.5486 204.9837	170.7243 210.5201	177.7291 241.1767 Total = S	185.5343 264.3276 um(45)m =	192.2058 300.9478 2943.9172	
Distribution loss (46)m 45.7872 Water storage loss:	40.3230	42.3904	36.1794	34.3342	30.1339	29.1461	30.7476	31.5780	36.1765	39.6491	45.1422	(46)
Store volume b) If manufacturer decl	lared loss	factor is n	ot known :								300.0000	(47)
Hot water storage loss Volume factor from Table Temperature factor from Enter (49) or (54) in (55	le 2a n Table 2b	m Table 2 (kWh/litre/d	lay)							0.1425 0.7368 0.7800 24.5688	(52) (53)
Total storage loss 761.6330 If cylinder contains dedi	687.9266	761.6330	737.0642	761.6330	737.0642	761.6330	761.6330	737.0642	761.6330	737.0642	761.6330	(56)
761.6330 Primary loss 128.3772	687.9266 115.9536	761.6330 128.3772	737.0642 124.2360	761.6330 128.3772	737.0642 41.9160	761.6330 43.3132	761.6330 43.3132	737.0642 41.9160	761.6330 128.3772	737.0642 124.2360	761.6330 128.3772	
Combi loss 0.0000 Total heat required for w	0.0000 water heati				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS 0.0000	0.0000	0.0000	1102.4960	1118.9049	979.8732	0.0000	0.0000	0.0000	1131.1869	0.0000	1190.9580	(63a)
PV diverter 0.0000 Solar input 0.0000 FGHRS 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	(63c)
Output from w/h		1172.6128		1118.9049	979.8732		1009.9299	989.5003	1131.1869 h/year) = S	1125.6278	1190.9580	(64)
Electric shower(s) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water hea	ating, kWh/ 182.1455		Tot 179.5864	178.8093	sed by inst 100.3297	antaneous e 99.2578	lectric sho	wer(s) (kWh	/year) = Su: 182.8930	m(64a)m =	0.0000	
204.1907	102.1433	190.0071	179.3004	170.0093	100.3297	99.2376	102.0077	103.3307	102.0930	107.2777	202.7669	(65)
5. Internal gains (see Ta		Ja) 										
Jan	Feb	Mar 192.5568	Apr 192.5568	May 192.5568	Jun 192.5568	Jul 192.5568	Aug 192.5568	Sep 192.5568	Oct 192.5568	Nov 192.5568	Dec 192.5568	(66)
Lighting gains (calculate 73.3237	65.1255	52.9636	40.0969	29.9729	25.3044	27.3423	35.5405	47.7024	60.5691	70.6931	75.3616	(67)
Appliances gains (calcula 753.4903	761.3092	741.6059	699.6599	646.7106	596.9457	563.6997	555.8809	575.5842	617.5302	670.4795	720.2443	(68)
Cooking gains (calculated 57.4650 Pumps, fans 10.0000	57.4650 10.0000	57.4650 10.0000	57.4650 10.0000	57.4650 10.0000	57.4650 0.0000	57.4650 0.0000	57.4650 0.0000	57.4650 0.0000	57.4650 10.0000	57.4650 10.0000	57.4650 10.0000	
Losses e.g. evaporation	(negative v	alues) (Tab	le 5)	-128.3712		-128.3712	-128.3712		-128.3712	-128.3712	-128.3712	
	le 5) 271.0499	264.3375	249.4256	240.3350	139.3468	133.4110	138.1823	143.7927	245.8239	260.1079	272.5362	(72)
Total internal gains 1232.9225	1229.1351	1190.5576	1120.8329	1048.6690	883.2475	846.1036	851.2542	888.7298	1055.5738	1132.9311	1199.7927	(73)
6. Solar gains												
[Jan]								FF	Acce	ss	Gains	
			m2	Table 6a W/m2	Speci or						W	
North Northeast		2.3	000	11.9814 12.9236 40.4699 40.4699 22.3313 12.9236 44.7612		0.8500 0.8500	0	.7000 .7000	0.77 0.77 0.77 0.77 0.77 0.77	00	11.3628 10.5511	(74) (75)
Southeast Southwest		19.2 0.8	200 300	40.4699 40.4699		0.8500 0.8500	0	.7000 .7000	0.77 0.77	00 00	320.7273 13.8503	(77) (79)
West Northwest		2.4	000 800	22.3313 12.9236		0.8500	0	.7000	0.77	00	22.0992 129.9170	(80)
Southeast			500	44./612		0.8500		.7000	1.00	00	68.3134	(82)
Solar gains 576.8211 Total gains 1809.7436												
7. Mean internal temperat												
Temperature during heating											21.0000	(85)
Utilisation factor for ga	Feb	ving area, Mar	nil,m (see Apr	Table 9a) May 16.8005	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau 16.6006 alpha 2.1067 util living area	16.6830 2.1122	16.6830 2.1122	16.8005 2.1200	16.8005 2.1200	16.9452 2.1297	16.9104 2.1274	16.9792 2.1319	16.9452 2.1297	16.8746 2.1250	16.8746 2.1250	16.7622 2.1175	
	0.9938	0.9886	0.9752	0.9457	0.8758	0.7750	0.8097	0.9416	0.9830	0.9937	0.9966	(86)
Th 2 18.2750				19.3445 18.2903								
util rest of house 0.9941	0.9909	0.9823	0.9582	0.8910	0.6605	0.1701	0.2319	0.8393	0.9676	0.9900	0.9950	
MIT 2 14.8150 Living area fraction MIT 14.9269				17.3757 17.4894				fLA =	Living are	a / (4) =	0.0577	(91)
Temperature adjustment		_0.,020	_0.5051	_,.1034	-0.2211	-0.1000	-0.2233	_,.5004	_0.5042	-0.0100	0.0000	

SAP 10 Online 2.12.4 Page 13 of 15



15.7525 16.5831 14.9269 15.1538 17.4894 18.2241 18.4308 18.4299 17.9604 16.9042 15.8135 14.9314 (93) adjusted MIT 8. Space heating requirement May 0.8596 3017.0562 Sep 0.8107 2146.2513 Apr 0.9373 2984.1936 9.9000 Oct 0.9503 2102.4388 Dec 0.9909 (94) 1665.6319 (95) 5.1000 (96) Jul 0.2231 utilisation 0.9895
Useful gains 1790.6811
Ext temp. 5.1000
Heat loss rate W Aug 0.2843 0.9708 2537.3221 7.4000 0.9841 2137.6316 5.6000 0.6486 0.9828 1821.1893 756.6374 13.0000 16.0000 15.2000 8.0000 17.8000 14778.5406 14296.8071 12499.0723 9930.9907 6671.1797 3276.6806 783.6005 926.1329 4066.8136 7847.3900 11559.7172 14642.7067 (97) Space heating kWh 9662.9674 8170.9659 7411.5421 5001.6940 2718.6679 0.0000 0.0000 0.0000 4274.2437 7011.7401 9654.9436 (98a) Space heating requirement - total per year (kWh/year) Space heating required Solar heating kWh 0.0000 53906.7648 0.0000 0.0000 0.0000 0.0000 0.0000 Solar heating contribution - total per year (kWh/year) 0.0000 Space heating kWh 9662.9674 8170.9659 7411.5421 5001.6940 2718.6679 0.0000 Space heating requirement after solar contribution - total per year (kWh/year) Space heating per m2 9654.9436 (98c) 53906.7648 149.9493 (99) 0.0000 4274.2437 7011.7401 0.0000 0.0000 (98c) / (4) =9a. Energy requirements - Individual heating systems, including micro-CHP Fraction of space heat from secondary/supplementary system (Table 11)
Fraction of space heat from main system(s)
Efficiency of main space heating system 1 (in %)
Efficiency of main space heating system 2 (in %)
Efficiency of secondary/supplementary heating system, % 1.0000 (202) 75.0000 (206) 0.0000 (208) Feb Jul May Sep Oct Space heating requirement 9662.9674 8170.9659 7411.5421 5001.6940 2718.6679 0.0000 0.0000 4274.2437 7011.7401 9654.9436 (98) Space heating efficiency (main heating system 1) 75.0000 75.0000 75.0000 75.0000 75.0000 75.0000
Space heating fuel (main heating system)
12883.9566 10894.6212 9882.0562 75 0000 75 0000 0.0000 0.000 0 0000 0 0000 75 0000 75 0000 75.0000 (210) 6668.9253 3624.8905 0.0000 0.0000 0.0000 5698.9916 9348.9868 12873.2582 (211) 0.0000 12883.9566 10894.6212 9882.0562 66
Space heating efficiency (main heating system 2)
0.0000 0.0000 0.0000
Space heating fuel (main heating system 2)
0.0000 0.0000 0.0000
Space heating fuel (main heating system 2) 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0.0000 (212) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (213) Space heating fuel (secondary) 0.0000 0.0000 0.0000 (215) 0 0000 0 0000 0.0000 0 0000 0.0000 0 0000 0 0000 0 0000 0 0000 Water heating requirement 1195.2580 1072.7001 Efficiency of water heater 73.7614 73.6954 989.5003 1131.1869 1125.6278 1190.9580 (64) 70.0000 (216) 1072.7001 1172.6128 1102.4960 1118.9049 979.8732 999.2537 1009.9299 73.4687 72.9878 71.8011 65.0000 65.0000 65.0000 72.6778 73.4497 73.7644 (217) 65.0000 (21/)m /3.0934 Fuel for water heating, kWh/month 1620.4375 1455.5867 Space cooling fuel requirement (221)m 0.0000 0.0000 1455.5867 1596.0709 1510.5215 1558.3403 1507.4972 1537.3133 1553.7383 1522.3081 1556.4411 1532.5143 1614.5421 (219) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (221) (221)m 0.0000 0.0000 0.0000 0.0000 0.0000 (
Pumps and Fa 14.0137 12.6575 14.0137 13.5616 14.0137 13.5616 14.0137 13.5616 14.0137 13.5616 14.0137 13.5616 14.0137 13.01 14.0137 (231) 65.9636 (232) 13 5616 14 0137 0.0000 0.0000 (233a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233a) Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234a) Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235a) (233a)m 0.0000 0.0000 0.0000 0.0000 0.0000 (2000) (235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235c) Electricity generated by PVs (Appendix M) (negative quantity) (233b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233b) Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234b) 0 0000 0 0000 0 0000 0 0000 0 0000 0.0000 (235b) 0.0000 0.0000 0.0000 (235d) (235d)m 0.0000 0.0000
Annual totals kWh/year
Space heating fuel - main system 1
Space heating fuel - main system 2
Space heating fuel - secondary
Effficiency of water heater
Water heating fuel used
Space cooling fuel 71875 6864 (211) 0.0000 (213) 0.0000 (215) 70.0000 18565.3113 (219) 0.0000 (221) Electricity for pumps and fans: central heating pump
Total electricity for the above, kWh/year
Electricity for lighting (calculated in Appendix L) 165.0000 (230c) 165.0000 (231) 517.9680 (232) Energy saving/generation technologies (Appendices M ,N and Q) PV generation Wind generation 0.0000 (234)Wind generation Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (App. Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 0 0000 (235) (Appendix N) -0.0000 (236) 0.0000 (237) 91123.9657 (238) 10a. Fuel costs - using BEDF prices (533) kWh/year £/year 3450.0329 0.0000 Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot 71875.6864 (240) (473) 4.8000 891.1349 0.0000 (247) (247a) 18565.3113 4.8000 21.5100 21.5100 165.0000 35.4915 (249)

SAP 10 Online 2.12.4 Page 14 of 15



Energy for lighting Additional standing charges Total energy cost	517.9680	21.5100	111.4149 (250) 98.0000 (251) 4586.0743 (255)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Total CO2, kg/year	Energy kWh/year 71875.6864 18565.3113 165.0000 517.9680	Emission factor kg CO2/kWh 0.2100 0.2100 0.1387 0.1443	Emissions kg CO2/year 15093.8941 (261) 0.0000 (373) 3898.7154 (264) 18992.6095 (265) 22.8875 (267) 74.7588 (268) 19090.2558 (272)
13a. Primary energy - Individual heating systems including micro-CHP			
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Total Primary energy kWh/year	Energy Pr	imary energy factor kg CO2/kWh 1.1300 1.1300 1.5128 1.5338	Primary energy kWh/year 81219.5256 (275) 0.0000 (473) 20978.8018 (278) 102198.3274 (279) 249.6120 (281) 794.4766 (282) 103242.4160 (286)

SAP 10 Online 2.12.4 Page 15 of 15



Property Reference	••	ОТ	he Green Prop	anad .					le	sued on Da	ata	05/01/2024	
Assessment Refe			001 Copy	Joseu				Prop Type R		Sued On Di	ate	03/01/2024	
Property				hmond, TW10				. тор туро п					
0.4.0.0.4.4.4					 		DED			TED.			
SAP Rating Environmental					67 D 59 D		DER % DER < TER			TER		N/A	
CO ₂ Emissions (t/y	vear)				10.5		DFEE			TFEE		IN/A	
Compliance Chec					See BREL		% DFEE < TFI	EE					
% DPER < TPER							DPER			TPEF	₹		
Assessor Details		Mr. Jack	Sewell							Asse	ssor ID	AY12-000)1
Client													
SAP 10 WORKSHEET CALCULATION OF E	FOR Conve	ersion (As I ING											
1. Overall dwell													
Basement floor Ground floor First floor Second floor Third floor Total floor area Dwelling volume	TFA = (1e	a) + (1b) + (1c)+(1d)+(1e)	(1n)	35	9.5000		78.3000 75.0000 70.9000 62.2000	(1a) x (1b) x (1c) x (1d) x	3.0000 3.0000 3.0000 2.0000	(2a) = (2b) = (2c) = (2d) = (2e) =	234.9000 225.0000 212.7000	(1a) - (3a (1b) - (3b (1c) - (3c (1d) - (3c (1e) - (3e (4) (5)
2. Ventilation r	ate chimneys										0 * 80 =	3 per hour 0.0000	
Number of open f Number of chimne Number of flues Number of flues Number of blocke Number of interm Number of passiv Number of fluele	eys / flues attached t attached t d chimneys attent ext e vents	to solid fue to other heas s tract fans	el boiler	ire							0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 5 * 10 = 0 * 10 = 0 * 40 =	0.0000	(6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	thod AP50 e	eys, flues a	and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+	(6g)+(7a)+(7b)+(7c) =		50.0000	Air change / (5) = B	0.0530 Yes lower Door 10.0000 0.5530	(17)
Shelter factor Infiltration rat	e adjusted	d to include	e shelter f	actor					(20) = 1 - (21)		(19)] = x (20) =	0.8500 0.4701	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Effective ac	0.5993 0.6796	0.5876 0.6726	0.5758 0.6658	0.5171 0.6337	0.5053 0.6277	0.4466 0.5997		0.4348 0.5945		0.5053 0.6277		0.5523 0.6525	
3. Heat losses a	nd heat lo	oss paramete	er										
Element Window (Uw = 4.8 External Door T W8 T W9 T W10 Basement Floor Ground Floor	0)			Gross m2	Openings m2	51. 7. 0. 0. 0. 73. 4.	tArea m2 .1100 .2700 .9500 .9500 .9500 .1000 .4000	U-value W/m2K 4.0268 3.0000 4.2359 4.2359 4.2359 1.2000 1.2000	4.0241 4.0241 87.7200 5.2800		-value kJ/m2K	A x K kJ/K	(27) (26) (27a) (27a) (27a) (28a) (28a)
External Wall Main Roof Exposed Ceiling Total net area of Fabric heat loss				55.2000 62.2000 16.7000	58.3800 2.8500	59 16	.8200 .3500 .7000 .6000 (26)(3	1.6000 0.3000 0.3000 30) + (32)	474.9120 17.8050 5.0100 = 830.4213				(29a) (30) (30) (31) (33)
Thermal mass par List of Thermal K1 Eleme	Bridges	MP = Cm / T	FA) in kJ/m	2K					Length Ps:	i-value	Tot	250.0000 al	(35)

SAP 10 Online 2.12.4 Page 1 of 15



E3 Sill 34.2800 0.1000 E4 Jamb 136.6000 0.1000 E4 Jamb 136.6000 0.1000 E5 Ground floor (normal) 60.8000 0.3200 E20 Exposed floor (normal) 3.1800 0.3200 E22 Basement floor 36.0000 0.2200 E6 Intermediate floor within a dwelling 111.8500 0.1400 E11 Eaves (insulation at rafter level) 26.3300 0.1200 E15 Flat roof with parapet 23.0500 0.2400 E16 Corner (normal) 38.8000 0.1800 E17 Corner (inverted - internal area greater than external area) 25.8000 0.0000 E18 Party wall between dwellings 39.8000 0.2400 E25 Staggered party wall between dwellings 11.8000 0.2400 E19 Party wall - Intermediate floor within a dwelling 65.9000 0.0000 E25 Staggered party wall between dwellings 11.8000 0.2400 E18 Party wall - Intermediate floor within a dwelling 65.9000 0.0000 E25 Staggered party wall - Intermediate floor within a dwelling 65.9000 0.0000 E25 Staggered party wall - Intermediate floor within a dwelling 65.9000 0.0000 E25 Staggered party wall - Intermediate floor within a dwelling 65.9000 0.0000 E25										1.0000 0.1000 0.1000 0.3200 0.3200 0.1400 0.1200 0.2400 0.02400 0.2400 0.2400 0.2400 0.2400 0.2400 0.2400 0.3200 0.4800	37.74 3.42 13.66 19.45 1.01 7.92 15.65 3.15 5.53 6.98 0.00 9.55 2.83 4.67 0.00 3.60 (36a) = + (36a) =	.80 00 00 60 .76 .00 .99 .99 .20 .40 .00 .220 .220	
Ventilation h	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer		209.3575		197.2362	195.3664	186.6622	186.6622	185.0503	190.0149	195.3664	199.1489		
Average = Sum			11/2.0034	1102.0097	1100.9999	1132.2937	1132.2937	1130.0030	1133.0403	1100.9999	1104.7023	1162.8607	(39)
HLP	Jan 3.2744	Feb 3.2684	Mar 3.2625	Apr 3.2347	May 3.2295	Jun 3.2053	Jul 3.2053	Aug 3.2008	Sep 3.2146	Oct 3.2295	Nov 3.2400	Dec 3.2510	(40)
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	3.2347 31	
4. Water heat	ing energy		s (kWh/year)									
Assumed occup	ancy											3.2093	(42)
Hot water usa	68.2754	67.2493	65.7542	62.8935	60.7823	58.4280	57.0899	58.5737	60.2002	62.7281	65.6502	68.0138	(42a)
Hot water usa	33.6782	33.1781	32.4737	31.1750	30.2026	29.1243	28.5419	29.2413	30.0028	31.1566	32.4821	33.5644	(42b)
Hot water usa	47.4962	45.7691	44.0420	42.3148	40.5877	38.8606	38.8606	40.5877	42.3148	44.0420	45.7691	47.4962	
Average daily					.,	-	- 1					137.3510	(43)
Daily hot wat		Feb 146.1965	Mar 142.2699	Apr 136.3834	May 131.5727	Jun 126.4129	Jul 124.4923	Aug 128.4027	Sep 132.5179	Oct 137.9267	Nov 143.9014	Dec 149.0744	(44)
Energy conte Energy conten				186.7020	177.1221	155.4394	150.5627	158.9894	163.4079	187.1652	205.0139 um(45)m =	233.4145 2281.3544	
Distribution			(45) m 32.7995	28.0053	26.5683	23.3159	22.5844	23.8484	24.5112	28.0748	30.7521	35.0122	(46)
Water storage Store volume		31.2273	32.7333	20.0033	20.3003	23.3133	22.5011	23.0101	24.0112	20.0740	30.7321	300.0000	
b) If manuf		clared loss s factor fro			dav)							0.0330	
Volume fact Temperature Enter (49) or	or from Ta factor fr (54) in (ble 2a om Table 2b										0.7368 0.5400 3.9420	(52) (53)
Total storage	122.2022	110.3762		118.2602	122.2022	118.2602	122.2022	122.2022	118.2602	122.2022	118.2602	122.2022	(56)
If cylinder c	122.2022 23.2624	110.3762		118.2602 22.5120	122.2022 23.2624	118.2602 22.5120	122.2022 23.2624	122.2022 23.2624	118.2602 22.5120	122.2022 23.2624	118.2602 22.5120	122.2022 23.2624	
Combi loss Total heat re	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
		339.5693			322.5867	296.2117	296.0273 0.0000	304.4540	304.1801 0.0000	332.6298 0.0000	345.7861 0.0000	378.8791 0.0000	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS Output from w	0.0000	0.0000	0.0000		0.0000		0.0000			0.0000			
		339.5693	364.1281	327.4742	322.5867	296.2117	296.0273			332.6298 Th/year) = S			
Electric show	ver(s) 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 fr	om water h	eating, kWh/		Tot	al Energy u			electric sho			m(64a)m =	0.0000	
		174.3304		174.6962	175.2648	164.3014	166.4338	169.2357	166.9509	178.6041	180.7849	193.9820	(65)
5. Internal g	ains (see	Table 5 and	5a)										
Metabolic gai	ns (Table	5), Watts											
(66) m	192.5568	Feb 192.5568						Aug 192.5568	Sep 192.5568	Oct 192.5568	Nov 192.5568	Dec 192.5568	(66)
Lighting gain	57.9672	51.4859	41.8712	31.6992	23.6955	20.0047	21.6158	28.0971	37.7118	47.8838	55.8875	59.5782	(67)
Appliances ga	753.4903	761.3092	741.6059	699.6599	646.7106	596.9457	563.6997	555.8809	575.5842	617.5302	670.4795	720.2443	(68)
Cooking gains		57.4650	57.4650	57.4650	57.4650		57.4650 0.0000	57.4650 0.0000	57.4650 0.0000	57.4650 3.0000	57.4650 3.0000	57.4650	
Pumps, fans Losses e.g. e	vaporation		values) (Tab	le 5)								3.0000	
Water heating	gains (Ta						223.7013	227.4673	231.8762	240.0593	251.0901	260.7285	
Total interna	l gains	1196.8659								1030.1239			
	1170.3013	1190.0039	1102.2030	10,0.0432	1030.02/0	500.7574	550.0074	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	500.0228	1000.1209	1102.10/0	1100.201/	(12)
6. Solar gain													
[Jan]			A	rea.	Solar flux		g		FF	Acce	ss	Gains	
				m2	Table 6a	a Speci	fic data	Specific	data	fact	or	W	

SAP 10 Online 2.12.4 Page 2 of 15



					W/m2		Table 6b		le 6c	Table	6d		
North Northeast Southeast Southwest West Northwest Southeast			2.3 1.9 19.2 0.8 2.4 24.3 2.8	0000 800 200 300 0000 800	10.6334 11.2829 36.7938 36.7938 19.6403 11.2829 39.9751		0.8500 0.8500 0.8500 0.8500 0.8500 0.8500 0.8500	0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000 .7000	0.77 0.77 0.77 0.77 0.77 0.77 0.77	00 00 00 00 00	10.0844 9.2117 291.5940 12.5922 19.4361 113.4243 61.0091	(75) (77) (79) (80) (81)
Solar gains Total gains													
7. Mean inter	nal tempera	ture (heati	ng season)										
Temperature of Utilisation 1	during heati	ng periods	in the livi	ng area fro	m Table 9,							21.0000	(85)
tau	Jan 21.2080	Feb 21.2472	Mar 21.2858	Apr 21.4687	May 21.5033		Jul 21.6657			Oct 21.5033		Dec 21.3609	
alpha util living a	2.4139 area 0.9975	2.4165 0.9954	2.4191 0.9911	2.4312 0.9803	2.4336 0.9563	2.4444 0.9092	2.4444	2.4464 0.8762	2.4402 0.9557	2.4336 0.9882	2.4289 0.9961	2.4241 0.9979	(96)
MIT	17.1415	17.3868	17.8901	18.6146	19.3823	20.0854	20.5042	20.4163	19.8081	18.8386	17.8760	17.1102	
Th 2 util rest of		18.6218	18.6245	18.6372	18.6396	18.6509	18.6509	18.6530	18.6465	18.6396			
MIT 2 Living area 1	0.9964 14.4405	0.9934 14.7557	0.9867 15.4007	0.9686 16.3283	0.9225 17.2917	0.8053 18.1304	0.5832 18.5307	0.6599 18.4772	0.9012 17.8341	0.9792 16.6214 Living are		0.9970 14.4046 0.0577	(90)
MIT Temperature a	14.5965 adjustment	14.9076	15.5444	16.4603	17.4125	18.2433	18.6447	18.5892		16.7494	15.5322	14.5609 0.0000	(92)
adjusted MIT	14.5965	14.9076	15.5444	16.4603	17.4125	18.2433	18.6447	18.5892	17.9481	16.7494	15.5322	14.5609	(93)
8. Space heat	ing require												
Utilisation Useful gains Ext temp.	1702.4982	2105.7293					Jul 0.5820 1927.8269 16.6000		Sep 0.8679 2246.3907 14.1000	Oct 0.9633 2027.8604 10.6000		Dec 0.9936 1590.8718 4.2000	(95)
Heat loss rat													
Space heating	7751.1005		6015.5642		2638.5486	0.0000	0.0000	0.0000	0.0000	3803.0161	5839.6972	7825.5682 44579.7088	(98a)
Space heating Solar heating	g kWh		0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating Space heating	g kWh											0.0000	
Space heating							0.0000	0.0000	0.0000	3803.0161		7825.5682 44579.7088 124.0048	
opace meacing	y per mz									(500	, , (4) -	124.0040	(33)
9a. Energy re- Fraction of s Fraction of s Efficiency of Efficiency of	space heat f space heat f main space main space	rom seconda rom main sy heating sy heating sy	ry/supplemerstem(s) rstem(s) rstem 1 (in rstem 2 (in	*ntary syste %) %)								0.0000 1.0000 84.0000 0.0000 0.0000	(202) (206) (207)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	7751.1005	6486.8967	6015.5642		2638.5486	0.0000	0.0000	0.0000	0.0000	3803.0161	5839.6972	7825.5682	(98)
Space heating	84.0000	84.0000	84.0000		84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	
Space heating	g efficiency	(main heat		2)		0.0000	0.0000	0.0000	0.0000			9316.1526	
Space heating	0.0000 g fuel (main 0.0000	0.0000 heating sy 0.0000	0.0000 rstem 2) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating	g requiremen	t 339.5693	364.1281	327.4742	322.5867	296.2117	296.0273	304.4540	304.1801	332.6298	345.7861	378.8791	(64)
Efficiency of (217) m	83.4700	83.4391	83.3571	83.1903	82.7813	74.0000	74.0000	74.0000	74.0000	83.0968	83.3702	74.0000 83.4790	
Fuel for wate	457.8371	406.9665	436.8293	393.6446	389.6854	400.2860	400.0369	411.4243	411.0542	400.2918	414.7599	453.8613	(219)
(221)m Pumps and Fa	0.0000	0.0000 6.5973	0.0000 7.3041	0.0000 7.0685	0.0000 7.3041	0.0000 7.0685	0.0000 7.3041	0.0000 7.3041	0.0000 7.0685	0.0000 7.3041	0.0000 7.0685	0.0000 7.3041	(221) (231)
Lighting Electricity	50.7383 generated by	40.7042 PVs (Appen	36.6496 dix M) (neg	26.8511 pative quant	20.7405 ity)	16.9452	18.9202	24.5932	31.9441	41.9124	47.3400	52.1485	(232)
(233a) m Electricity of (234a) m	0.0000 generated by 0.0000	0.0000 wind turbi 0.0000	0.0000 nes (Append 0.0000	0.0000 lix M) (nega 0.0000	0.0000 tive quanti 0.0000	0.0000 ty)	0.0000	0.0000	0.0000	0.0000	0.0000		(233a) (234a)
Electricity (235a)m	generated by 0.0000	hydro-elec 0.0000	tric genera 0.0000	tors (Appen 0.0000	dix M) (neg 0.0000	ative quant 0.0000	ity) 0.0000	0.0000	0.0000	0.0000	0.0000		(234a) (235a)
Electricity (235c)m	used or net 0.0000	electricity 0.0000	generated 0.0000	by micro-CH 0.0000	IP (Appendix 0.0000				0.0000	0.0000	0.0000		(235c)
Electricity (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity of (234b) m Electricity of	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 ity)	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(235b) m Electricity v	0.0000 used or net	0.0000 electricity	0.0000 generated	0.0000 by micro-CH	0.0000 IP (Appendix	0.0000 N) (negati	0.0000 ve if net g		0.0000	0.0000	0.0000		(235b)
(235d) m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

SAP 10 Online 2.12.4 Page 3 of 15



Annual totals kWh/year Space heating fuel - main system 1 Space heating fuel - main system 2 Space heating fuel - secondary Efficiency of water heater Water heating fuel used Space cooling fuel Electricity for pumps and fans: central heating pump main heating flue fan Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L) Energy saving/generation technologies (Appendices M ,N and Q) PV generation Wind generation Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N) Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses								53071.0819 0.0000 0.0000 74.0000 4976.6775 0.0000 41.0000 45.0000 46.0000 409.4873 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 58543.2467	(213) (215) (219) (221) (230) (230) (231) (232) (233) (234) (235) (235) (236) (237)	(a)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost				Tuel prii p/kW 3.640 3.641 16.490 16.490	Vh 00 00 00 00			Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 2286.6443	(240) (473) (247) (247) (247) (250) (251)))))
11a. SAP rating - Individual heating systems Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band]	(255)	х (256)] / [(4)) + 4	5.0]	=	0.3600 2.0351 67.0113 67 D	(257)	
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Total CO2, kg/year CO2 emissions per m2 EI value EI rating EI band			k	on facto g CO2/kW 0.210 0.210 0.138 0.144	√h 00 00 37		k	Emissions kg CO2/year 11144.9272 0.0000 1045.1023 12190.0295 11.9293 59.1017 12261.0604 34.1100 59.2471 59	(261) (373) (264) (265) (267) (268) (272) (273)	
SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY										
1. Overall dwelling characteristics 1. Overall dwelling characteristics Basement floor Ground floor First floor Second floor Third floor Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)(ln) Dwelling volume 359.5000	78.3000 75.0000 70.9000 62.2000	(1a) (1b) (1c) (1d) (1e)	x x x x		n) 00 (2 00 (2 00 (2 00 (2	b) c) d) e)	= = =	124.4000	(1a) (1b) (1c) (1d) (1e) (4)	- (3b) - (3c) - (3d)
Number of open chimneys Number of open flues Number of chimneys / flues attached to closed fire Number of flues attached to solid fuel boiler Number of flues attached to other heater Number of blocked chimneys					0 0 0	* 80 * 20 * 10 * 20 * 35 * 20	= = = = =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e)	

SAP 10 Online 2.12.4 Page 4 of 15



Number of inter Number of pass Number of flue	ive vents										5 * 10 = 0 * 10 = 0 * 40 =	50.0000 0.0000 0.0000	(7b) (7c)
Infiltration do Pressure test Pressure Test I Measured/design Infiltration random Number of side:	Method n AP50 ate		and fans	= (6a)+(6b)+(6c)+(6d)+	(6e)+(6f)+	(6g)+(7a)+(7b)+(7c) =		50.0000	Air change / (5) = B	0.0530 Yes lower Door 10.0000 0.5530	(8)
Shelter factor Infiltration ra	ate adjuste	ed to inclu	de shelter	factor					(20) = 1 -	[0.075 x 21) = (18)		0.8500 0.4701	
Wind speed Wind factor Adj infilt rate	Jan 3.8000 0.9500	Feb 3.5000 0.8750	Mar 3.5000 0.8750	Apr 3.3000 0.8250		Jun 3.0000 0.7500	Jul 3.2000 0.8000		0.7250		0.7750	Dec 3.4000 0.8500	(22a)
Effective ac	0.5997	0.4113 0.5846	0.4113 0.5846	0.3878 0.5752		0.3525 0.5621	0.3760 0.5707	0.3525 0.5621	0.3408 0.5581	0.3643 0.5664		0.3996 0.5798	
3. Heat losses	and heat 1	oss paramet	ter										
Window (Uw = 4 External Door T W8 T W9 T W10 Basement Floor Ground Floor External Wall Main Roof Exposed Ceilin Total net area Fabric heat los	g of externa			Gross m2 355.2000 62.2000 16.7000	Openings m2 58.3800 2.8500	51 7 0 0 0 73 4 296 59	tArea m2 .1100 .2700 .9500 .9500 .9500 .1000 .4000 .8200 .3500 .7000 .6000 .(26)(U-value W/m2K 4.0268 3.0000 4.2359 4.2359 1.2000 1.2000 1.6000 0.3000 0.3000 300) + (32)	A x W, 205.81; 21.81(4.02; 4.02; 4.02; 87.72(5.28(474.91; 17.80; 5.01(= 830.42;	/K 21 00 111 111 111 00 00 00 00 00 00	-value kJ/m2K	A x K kJ/K	
E3 Sil' E4 Jami E5 Grot E20 Exp E62 Bat E6 Intt E11 Eat E15 Fl. E16 Cot E17 Cot E18 Pat E25 St. P1 Part P2 Part	l Bridges ment pr lintels l o o nd floor (oosed floor osement floo prediate f ror (insula at roof wit rner (inver tty wall be aggered pa ty wall - G ty wall - R ty wall - R	(including (normal)	other stee n a dwellin fter level) rnal area g lings tween dwell r e floor witt attion at ce	g reater than ings hin a dwell iling level)	ea)		37 34 136 60 3 36 111 26 23 38 25 39 11		Psi-value 1.0000 0.1000 0.1000 0.3200 0.3200 0.2200 0.1400 0.1200 0.2400 0.0000 0.2400 0.2400 0.3200 0.3200 0.4800	Tot 37.74 3.42 13.66 19.45 1.01 7.92 15.65 3.15 5.53 6.98 0.00 9.55 2.83 4.67 0.00 3.60	00 80 00 60 76 00 90 90 20 20 20 20 20	
Point Thermal 1 Total fabric he Ventilation hea	eat loss	culated mon	nthly (38)m	= 0.33 x (25)m × (5)				(:	33) + (36)	(36a) = + (36a) =	0.0000 965.6335	(37)
(38)m Heat transfer	Jan 186.6622 coeff	Feb 181.9555	Mar 181.9555	Apr 179.0326	May	174.9706	177.6356		173.7026	Oct 176.2816 1141.9152	Nov 176.2816		
Average = Sum(Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	1144.3330 Dec	(44)
HLP HLP (average) Days in mont	3.2053	3.1922	3.1922	3.1841	3.1881 31	3.1728	3.1802	3.1728	3.1692 30	3.1764	3.1764	3.1881 3.1831 31	(40)
4. Water heati													
Assumed occupan	ncy											3.2093	(42)
Hot water usage	68.2754	67.2493	65.7542	62.8935	60.7823	58.4280	57.0899	58.5737	60.2002	62.7281	65.6502	68.0138	
Hot water usage	33.6782 e for other 47.4962	33.1781 uses 45.7691	32.4737 44.0420	31.1750 42.3148	30.2026 40.5877	29.1243	28.5419	29.2413	30.0028 42.3148	31.1566 44.0420	32.4821 45.7691	33.5644 47.4962	
Average daily h	not water u	se (litres	/day)									137.3510	
Daily hot wate:	149.4499	Feb 146.1965 208.1819	Mar 142.2699 218.6635	Apr 136.3834 186.7020	May 131.5727 177.1221	Jun 126.4129 155.4394	Jul 124.4923 150.5627	Aug 128.4027 158.9894	Sep 132.5179 163.4079	Oct 137.9267 187.1652		233.4145	
Energy content Distribution lo	35.5038	= 0.15 x (45)m 32.7995	28.0053	26.5683	23.3159	22.5844	23.8484	24.5112	Total = S 28.0748	30.7521	2281.3544 35.0122	(46)
Store volume b) If manufac	cturer decl											300.0000	
Hot water sto Volume facto: Temperature: Enter (49) or Total storage:	orage loss r from Tabl factor from (54) in (55	factor from e 2a n Table 2b			ay)							0.0330 0.7368 0.5400 3.9420	(52) (53)
	122.2022 ntains dedi	cated sola:	r storage			118.2602	122.2022	122.2022	118.2602	122.2022	118.2602		
	122.2022	110.3762	122.2022	118.2602	122.2022	118.2602	122.2022	122.2022	118.2602	122.2022	118.2602	122.2022	(57)

SAP 10 Online 2.12.4 Page 5 of 15



Primary loss Combi loss		21.0112	23.2624	22.5120		22.5120	23.2624	23.2624	22.5120	23.2624	22.5120		
Total heat re					n month 322.5867	296.2117	296.0273	304.4540	304.1801	332.6298	345.7861		
WWHRS PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w	/h	339.5693		327.4742	322.5867	296.2117	296.0273			332.6298			
Electric show										h/year) = S			
	0.0000	0.0000		0.0000 Tot	0.0000 al Energy u	0.0000 sed by inst	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 /year) = Su	0.0000 m(64a)m =	0.0000	
Heat gains fr				174.6962	175.2648	164.3014	166.4338	169.2357	166.9509	178.6041	180.7849	193.9820	(65)
5. Internal g	ains (see T	able 5 and	5a)										
Metabolic gai													
(66) m		Feb 192.5568		Apr 192.5568	May 192.5568	Jun 192.5568	Jul 192.5568	Aug 192.5568	Sep 192.5568	Oct 192.5568	Nov 192.5568	Dec 192.5568	(66)
Lighting gain					L9a), also 23.6955			28.0971	37.7118	47.8838	55.8875	59.5782	(67)
Appliances ga					or L13a), a 646.7106			555.8809	575.5842	617.5302	670.4795	720.2443	(68)
Cooking gains	(calculate	d in Append	dix L, equat	ion L15 or		see Table		57.4650	57.4650	57.4650	57.4650	57.4650	(69)
Pumps, fans Losses e.g. e	3.0000	3.0000	3.0000	3.0000		0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	
Water heating	gains (Tab	le 5)		-128.3712	-128.3712			-128.3712		-128.3712	-128.3712	-128.3712	(71)
Total interna	l gains		254.1362	242.6336	235.5710	228.1964	223.7013	227.4673	231.8762	240.0593	251.0901	260.7285	(72)
	1198.3013	1196.8659	1162.2638	1098.6432	1030.6276	966.7974	930.6674	933.0958	966.8228	1030.1239	1102.1076	1165.2017	(73)
6. Solar gain	S												
[Jan]									PP	7,000		Gains	
[oan]				m2	Solar flux Table 6a W/m2	Speci	fic data Table 6b	Specific or Tab	data le 6c	fact Table	or 6d	W	
North			2.3									11.3360	(74)
Northeast Southeast			1.9	800 200	12.9148		0.8500	0	.7000	0.77 0.77 0.77 0.77 0.77	00	10.5439 319.1151	(75)
Southwest West			0.8	300	40.2665		0.8500	0	.7000 .7000 .7000	0.77	00	13.7807 22.0652	(79)
Northwest Southeast			24.3	800	12.9148 44.6209		0.8500 0.8500 0.8500	0	.7000	0.77		129.8288 68.0993	(81)
			24.3	800 500	11.9531 12.9148 40.2665 40.2665 22.2970 12.9148 44.6209		0.8500 0.8500	0	.7000 .7000 .7000			129.8288	(81)
Southeast	574.7690	906.5130	24.3 2.8 1405.5382	2034.2948	2434.2870	2671.9150	2531.9379	2211.1085	1741.6157	1.00	699.2898	129.8288 68.0993 479.3031	(81) (82) (83)
Southeast Solar gains	574.7690	906.5130	24.3 2.8 1405.5382	2034.2948	2434.2870	2671.9150	2531.9379	2211.1085	1741.6157	1.00	699.2898	129.8288 68.0993 479.3031	(81) (82) (83)
Southeast 	574.7690 1773.0704	906.5130 2103.3789	24.3 2.8 1405.5382 2567.8020	2034.2948 3132.9380	2434.2870 3464.9146	2671.9150 3638.7124	2531.9379 3462.6053	2211.1085 3144.2043	1741.6157	1.00	699.2898	129.8288 68.0993 479.3031	(81) (82) (83)
Southeast Solar gains Total gains Total gains	574.7690 1773.0704 nal tempera	906.5130 2103.3789 ture (heat:	24.3 2.8 1405.5382 2567.8020	2034.2948	2434.2870 3464.9146	2671.9150 3638.7124	2531.9379 3462.6053	2211.1085 3144.2043	1741.6157	1.00	699.2898	129.8288 68.0993 479.3031 1644.5048	(81) (82) (83) (84)
Southeast Solar gains Total gains Total gains	574.7690 1773.0704 nal tempera uring heati	906.5130 2103.3789 ture (heati	24.3 2.8 1405.5382 2567.8020 ing season) in the livi	2034.2948 3132.9380 	2434.2870 3464.9146	2671.9150 3638.7124	2531.9379 3462.6053	2211.1085	1741.6157 2708.4385	1.00 1153.5098 2183.6336	699.2898 1801.3974	129.8288 68.0993 479.3031 1644.5048	(81) (82) (83) (84)
Solar gains Total gains 7. Mean inter Temperature d	574.7690 1773.0704 nal tempera uring heati	906.5130 2103.3789 ture (heati	24.3 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar	2034.2948 3132.9380 	2434.2870 3464.9146	2671.9150 3638.7124	2531.9379 3462.6053	2211.1085 3144.2043	1741.6157	1.00	699.2898	129.8288 68.0993 479.3031 1644.5048	(81) (82) (83) (84)
Solar gains Total gains Total gains Total gains Total gains Total gains Total gains	574.7690 1773.0704 	906.5130 2103.3789 ture (heati ng periods ains for li Feb 21.7545	24.3 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503	2034.2948 3132.9380 	2434.2870 3464.9146 om Table 9, Table 9a) May 21.7827	2671.9150 3638.7124 	2531.9379 3462.6053	2211.1085 3144.2043	1741.6157 2708.4385 Sep 21.9121	1.00 1153.5098 2183.6336 Oct 21.8626	00 699.2898 1801.3974 Nov 21.8626	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522	(81) (82) (83) (84)
Solar gains Total gains Total gains 7. Mean inter Temperature d Utilisation f tau alpha util living a	574.7690 1773.0704 mal tempera uring heati actor for g Jan 21.6657 2.4444 rea 0.9968 17.5333	906.5130 2103.3789 ture (heat: 	24.3 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846	2034.2948 3132.9380 	2434.2870 3464.9146 om Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321	Jul 21.8367 2.4558 0.6398 20.8601	2211.1085 3144.2043 	Sep 21.9121 2.4608 0.9238 20.1793	1.00 1153.5098 2183.6336 Oct 21.8626 2.4575 0.9824 19.2289	00 699.2898 1801.3974 Nov 21.8626 2.4575 0.9947 18.2566	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936	(81) (82) (83) (84) (85)
Solar gains Total gains Total gains Total gains The mean inter Temperature dutilisation full tau alpha util living a	574.7690 1773.0704 	906.5130 2103.3789 ture (heating periods ains for lifeb 21.7545 2.4503 0.9948 17.7385 18.6570	24.3 2.8 1405.5382 2567.8020 ing season) in the livi ving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570	2034.2948 3132.9380 	2434.2870 3464.9146 om Table 9, Table 9a) May 21.7827 2.4522 0.9328	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205	2531.9379 3462.6053 Jul 21.8367 2.4558 0.6398	2211.1085 3144.2043 	Sep 21.9121 2.4608 0.9238 20.1793 18.6678	0ct 21.8626 2.4575 0.9824 19.2289 18.6644	00 699.2898 1801.3974 Nov 21.8626 2.4575 0.9947 18.2566 18.6644	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589	(81) (82) (83) (84) (85) (86) (87) (88)
Solar gains Total gains 7. Mean inter Temperature d tau alpha util living a	574.7690 1773.0704 	906.5130 2103.3789 ture (heat: 	24.3 2.8 1405.5382 2567.8020 ing season) in the livi ving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570	2034.2948 3132.9380 	2434.2870 3464.9146 Dom Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589	2671.9150 3638.7124 	Jul 21.8367 2.4558 0.6398 20.8601 18.6626	2211.1085 3144.2043 	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677	1.00 1153.5098 2183.6336 Oct 21.8626 2.4575 0.9824 19.2289	00 699.2898 1801.3974 Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961	(81) (82) (83) (84) (85) (86) (87) (88) (89) (90)
Solar gains Total gains 7. Mean inter Temperature d Utilisation f tau alpha util living a MIT Th 2 util rest of	574.7690 1773.0704 	906.5130 2103.3789 ture (heat: 	24.3 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182	2034.2948 3132.9380 	2434.2870 3464.9146 om Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 0.0537	2211.1085 3144.2043 	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) =	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577	(81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91)
Solar gains Total gains Total gains 7. Mean inter Temperature d Utilisation f tau alpha util living a MIT Th 2 util rest of MIT 2 Living area f MIT	574.7690 1773.0704 	906.5130 2103.3789 ture (heati	24.3 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548	2034.2948 3132.9380 	2434.2870 3464.9146 Dm Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 0.0537 18.6626	2211.1085 3144.2043 	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677 fLA =	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) =	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 0.0000	(81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Southeast	574.7690 1773.0704 	906.5130 2103.3789 	24.3 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548	2034.2948 3132.9380 	2434.2870 3464.9146 Dom Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 18.7895	2211.1085 3144.2043 	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677 fLA = 18.3781	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487	Nov 21.8626 2.4575 0.9947 18.2564 0.9915 15.8878 a / (4) = 16.0246	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 0.0000	(81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Southeast	574.7690 1773.0704 	906.5130 2103.3789 ture (heati- ng periods ains for li Feb 21.7545 2.4503 0.9948 17.7385 18.6570 0.9923 15.2202 15.3657	24.3 2.8 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548	2034.2948 3132.9380 	2434.2870 3464.9146 Dm Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646 18.6646	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 0.0537 18.6626 18.7895	Aug 211.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.6654 18.7893	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677 fLA = 18.3781	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487	Nov 21.8626 2.4575 0.9947 18.2564 0.9915 15.8878 a / (4) = 16.0246	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 0.0000	(81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Southeast	574.7690 1773.0704 nal tempera nal tempera 21.6657 2.4444 rea 0.9968 17.5333 18.6509 house 0.9953 14.9554 raction 15.1043 djustment 15.1043	906.5130 2103.3789 ture (heat: ng periods ains for l: Feb 21.7545 2.4503 0.9948 17.7385 18.6570 0.9923 15.202 15.3657	24.3 2.8 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548	2034.2948 3132.9380 Ing area from fil, m (see Apr 21.8101) 2.4540 0.9730 19.0233 18.6608 0.9545 16.8557 16.9809	2434.2870 3464.9146 DM Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 0.0537 18.6626 18.7895	Aug 211.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.7893 18.7893	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677 fLA = 18.3781 18.3781	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) = 16.0246	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 0.0000 15.0570	(81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92)
Southeast	574.7690 1773.0704	906.5130 2103.3789 ture (heati- ng periods ains for li Feb 21.7545 2.4503 0.9948 17.7385 18.6570 0.9923 15.3657 15.3657	24.3 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548 16.0548	2034.2948 3132.9380	2434.2870 3464.9146 DM Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624 May 0.8321	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 18.7895 18.7895	Aug 21.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.7893 18.7893	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677 fLA = 18.3781 18.3781	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) = 16.0246	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 0.0000 15.0570 Dec 0.9919	(81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Southeast	574.7690 1773.0704	906.5130 2103.3789 ture (heati- ng periods ains for li Feb 21.7545 2.4503 0.9948 17.7385 18.6570 0.9923 15.3657 15.3657	24.3 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548 16.0548	2034.2948 3132.9380	2434.2870 3464.9146 DM Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624 May 0.8321	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 0.0537 18.6626 18.7895	2211.1085 3144.2043 Aug 21.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.6654 18.7893 18.7893	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677 fLA = 18.3781 18.3781	1.00 1153.5098 2183.6336 Oct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) = 16.0246	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 0.0000 15.0570	(81) (82) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92) (93)
Southeast	574.7690 1773.0704 anal tempera uring heati actor for g Jan 21.6657 2.4444 rea 0.9968 17.5333 18.6509 house 0.9953 14.9554 raction 15.1043 djustment 15.1043 djustment 15.1043 djustment 15.1043 diustment 15.1043	906.5130 2103.3789 ture (heat:	24.3 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548 16.0548	2034.2948 3132.9380	2434.2870 3464.9146 Dom Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624 17.9624 May 0.8321 2883.0850	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646 18.6646	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 18.7895 18.7895	Aug 211.1085 3144.2043 Aug 21.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.6654 18.7893 18.7893	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677 fLA = 18.3781 18.3781	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) = 16.0246 Nov 0.9834 1771.5242 8.4000	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 Dec 0.9919 1631.1200 5.5000	(81) (82) (83) (84) (85) (85) (86) (87) (88) (90) (91) (92) (93)
Southeast	574.7690 1773.0704	906.5130 2103.3789 ture (heat:	24.3 2.8 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548	2034.2948 3132.9380 Ing area from fil, m (see Apr 21.8101) 2.4540 0.9730 19.0233 18.6608 0.9545 16.8557 16.9809 16.9809 Apr 0.9287 2909.6151 10.4000 7532.9472 3328.7991	2434.2870 3464.9146 mm Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624 May 0.8321 2883.0850 13.5000 5114.3396	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646 18.6646	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 18.7895 18.7895 Jul 0.0953 330.0210 18.5000	Aug 211.1085 3144.2043 Aug 21.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.6654 18.7893 18.7893	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 0.8045 18.2677 fLA = 18.3781 18.3781 18.3781 20.7754 2100.1016 15.5000	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487 17.2487	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) = 16.0246 16.0246 Nov 0.9834 1771.5242 8.4000 8706.6564	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 0.0000 15.0570 Dec 0.9919 1631.1200 5.5000 10953.3086	(81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97)
Southeast	574.7690 1773.0704	906.5130 2103.3789 ture (heati- ng periods ains for li Feb 21.7545 2.4503 0.9948 17.7385 18.6570 0.9923 15.3657 15.3657	24.3 2.8 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548 16.0548 Mar 0.9691 2488.5301 7.9000 9358.4113 5111.1916 per year (kW	2034.2948 3132.9380 Ing area from fil, m (see Apr 21.8101) 2.4540 0.9730 19.0233 18.6608 0.9545 16.8557 16.9809 16.9809 Apr 0.9287 2909.6151 10.4000 7532.9472 3328.7991	2434.2870 3464.9146 mm Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624 May 0.8321 2883.0850 13.5000 5114.3396	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646 18.6646	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 18.7895 18.7895 Jul 0.0953 330.0210 18.5000 330.9592 0.0000	2211.1085 3144.2043 Aug 21.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.7893 18.7893 18.7893 Aug 0.1754 551.5437 18.3000 558.0989 0.0000	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 18.2677 fLA = 18.3781 18.3781 Sep 0.7754 2100.1016 15.5000 3279.0829 0.0000	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 17.1273 Living are 17.2487 17.2487	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) = 16.0246 16.0246 Nov 0.9834 1771.5242 8.4000 8706.6564	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 Dec 0.9919 1631.1200 5.5000 10953.3086 6935.7084 37548.0144	(81) (82) (83) (84) (85) (85) (86) (87) (88) (90) (91) (92) (93) (94) (95) (96) (97) (98a)
Southeast	574.7690 1773.0704	906.5130 2103.3789 ture (heat:	24.3 2.8 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548	2034.2948 3132.9380	2434.2870 3464.9146 mm Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624 17.9624 17.9624 17.9624 17.9624 17.9624 17.9624 17.9624	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646 18.6646 Jun 0.5647 2054.8875 16.5000 2468.9319 0.0000	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 0.0537 18.6626 18.7895 18.7895 Jul 0.0953 330.0210 18.5000 330.9592 0.0000	Aug 211.1085 3144.2043 Aug 21.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.6654 18.7893 18.7893 18.7893 18.7893 0.1754 551.5437 18.3000 558.0989 0.0000	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 18.2677 fLA = 18.3781 18.3781 Sep 0.7754 2100.1016 15.5000 3279.0829 0.0000 0.0000	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487 17.2487 0ct 0.9452 2063.8977 12.0000 5993.5280 2923.6449	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) = 16.0246 16.0246 Nov 0.9834 1771.5242 8.4000 8706.6564 4993.2952	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 0.0000 15.0570 Dec 0.9919 1631.1200 5.5000 10953.3086 6935.7084 37548.0144 0.0000 0.0000	(81) (82) (83) (84) (85) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98a)
Southeast	574.7690 1773.0704	906.5130 2103.3789 ture (heati- reperiods ains for 1: Feb 21.7545 2.4503 0.9948 17.7385 18.6570 0.9923 15.2202 15.3657 15.3657 Feb 0.9848 2071.4321 6.1000 10633.1713 5753.4888 t - total p 0.0000 on - total 5753.4888	24.3 2.8 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548	2034.2948 3132.9380	2434.2870 3464.9146 Dom Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624 17.9624 May 0.8321 2883.0850 13.5000 5114.3396 1660.0535	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646 18.6646 Jun 0.5647 2054.8875 16.5000 2468.9319 0.0000 0.0000	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 18.7895 18.7895 Jul 0.0953 330.0210 18.5000 330.9592 0.0000	2211.1085 3144.2043 Aug 21.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.7893 18.7893 18.7893 Aug 0.1754 551.5437 18.3000 558.0989 0.0000	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 18.2677 fLA = 18.3781 18.3781 Sep 0.7754 2100.1016 15.5000 3279.0829 0.0000 0.0000	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487 17.2487 0ct 0.9452 2063.8977 12.0000 5993.5280 2923.6449 0.0000 2923.6449	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) = 16.0246 16.0246 16.0246 493.2952	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 Dec 0.9919 1631.1200 5.5000 10953.3086 6935.7084 37548.0144 0.0000 0.0000 6935.7084 37548.0144	(81) (82) (83) (84) (85) (85) (86) (87) (88) (90) (91) (92) (93) (94) (95) (96) (97) (98a) (98b)
Southeast	574.7690 1773.0704	906.5130 2103.3789 ture (heati- reperiods ains for 1: Feb 21.7545 2.4503 0.9948 17.7385 18.6570 0.9923 15.2202 15.3657 15.3657 Feb 0.9848 2071.4321 6.1000 10633.1713 5753.4888 t - total p 0.0000 on - total 5753.4888	24.3 2.8 2.8 1405.5382 2567.8020 ing season) in the livi iving area, Mar 21.7545 2.4503 0.9891 18.2846 18.6570 0.9830 15.9182 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548 16.0548	2034.2948 3132.9380	2434.2870 3464.9146 Dom Table 9, Table 9a) May 21.7827 2.4522 0.9328 19.8336 18.6589 0.8674 17.8477 17.9624 17.9624 May 0.8321 2883.0850 13.5000 5114.3396 1660.0535	2671.9150 3638.7124 Th1 (C) Jun 21.8878 2.4592 0.8205 20.5321 18.6661 0.5650 18.5501 18.6646 18.6646 Jun 0.5647 2054.8875 16.5000 2468.9319 0.0000 0.0000	Jul 21.8367 2.4558 0.6398 20.8601 18.6626 0.0537 18.6626 18.7895 18.7895 Jul 0.0953 330.0210 18.5000 330.9592 0.0000	Aug 211.1085 3144.2043 Aug 21.8878 2.4592 0.7035 20.8109 18.6661 0.1320 18.6654 18.7893 18.7893 18.7893 18.7893 0.1754 551.5437 18.3000 558.0989 0.0000	Sep 21.9121 2.4608 0.9238 20.1793 18.6678 18.2677 fLA = 18.3781 18.3781 Sep 0.7754 2100.1016 15.5000 3279.0829 0.0000 0.0000	0ct 21.8626 2.4575 0.9824 19.2289 18.6644 0.9664 17.1273 Living are 17.2487 17.2487 0ct 0.9452 2063.8977 12.0000 5993.5280 2923.6449 0.0000 2923.6449	Nov 21.8626 2.4575 0.9947 18.2566 18.6644 0.9915 15.8878 a / (4) = 16.0246 16.0246 16.0246 493.2952	129.8288 68.0993 479.3031 1644.5048 21.0000 Dec 21.7827 2.4522 0.9973 17.4936 18.6589 0.9961 14.9076 0.0577 15.0570 0.0000 15.0570 Dec 0.9919 1631.1200 5.5000 10953.3086 6935.7084 47548.0144 0.0000 0.0000 6935.7084	(81) (82) (83) (84) (85) (85) (86) (87) (88) (90) (91) (92) (93) (94) (95) (96) (97) (98a) (98b)

SAP 10 Online 2.12.4 Page 6 of 15

9a. Energy requirements - Individual heating systems, including micro-CHP



Fraction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from main system(s) Efficiency of main space heating system 1 (in %) Efficiency of main space heating system 2 (in %) Efficiency of secondary/supplementary heating system, %			0.0000 (201) 1.0000 (202) 84.0000 (206) 0.0000 (207) 0.0000 (208)
Jan Feb Mar Apr May Jun	Jul Aug	Sep Oct	Nov Dec
Space heating requirement 6841.8330 5753.4888 5111.1916 3328.7991 1660.0535 0.0000	0.0000 0.0000	0.0000 2923.6449	4993.2952 6935.7084 (98)
Space heating efficiency (main heating system 1) 84.0000 84.0000 84.0000 84.0000 84.0000 0.0000	0.0000 0.0000	0.0000 84.0000	84.0000 84.0000 (210)
Space heating fuel (main heating system) 8145.0393 6849.3914 6084.7519 3962.8561 1976.2541 0.0000	0.0000 0.0000	0.0000 3480.5297	5944.3990 8256.7957 (211)
Space heating efficiency (main heating system 2) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (212)
Space heating fuel (main heating system 2) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (213)
Space heating fuel (secondary) 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (215)
Water heating			
Water heating requirement 382.1567 339.5693 364.1281 327.4742 322.5867 296.2117	296.0273 304.4540	304.1801 332.6298	345.7861 378.8791 (64)
Efficiency of water heater (217)m 83.4038 83.3721 83.2518 82.9955 82.1928 74.0000	74.0000 74.0000	74.0000 82.8562	74.0000 (216) 83.2712 83.4161 (217)
Fuel for water heating, kWh/month 458.2007 407.2936 437.3816 394.5688 392.4756 400.2860	400.0369 411.4243	411.0542 401.4541	415.2529 454.2038 (219)
Space cooling fuel requirement (221)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (221)
Pumps and Fa 7.3041 6.5973 7.3041 7.0685 7.3041 7.0685 Lighting 50.7383 40.7042 36.6496 26.8511 20.7405 16.9452	7.3041 7.3041 18.9202 24.5932	7.0685 7.3041 31.9441 41.9124	7.0685 7.3041 (231) 47.3400 52.1485 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantit (235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		0.0000 0.0000	0.0000 0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative (235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		0.0000 0.0000	0.0000 0.0000 (235a)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (233b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantit (235b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		0.0000 0.0000	0.0000 0.0000 (234b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative (235d)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		0.0000 0.0000	0.0000 0.0000 (235b)
Annual totals kWh/year Space heating fuel - main system 1	0.0000 0.0000	0.0000 0.0000	44700.0172 (211)
Space heating fuel - main system 2 Space heating fuel - secondary Efficiency of water heater Water heating fuel used Space cooling fuel			0.0000 (213) 0.0000 (215) 74.0000 4983.6325 (219) 0.0000 (221)
Electricity for pumps and fans: central heating pump main heating flue fan Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)			41.0000 (230c) 45.0000 (230e) 86.0000 (231) 409.4873 (232)
Energy saving/generation technologies (Appendices M ,N and Q) PV generation Wind generation Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N) Appendix Q - special features			0.0000 (233) 0.0000 (234) 0.0000 (235a) 0.0000 (235)
Energy saved or generated Energy used Total delivered energy for all uses			-0.0000 (236) 0.0000 (237) 50179.1370 (238)
10a. Fuel costs - using BEDF prices (533)			
	Fuel	Fuel price	Fuel cost
Space heating - main system 1	kWh/year 44700.0172	p/kWh	£/year
Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Total energy cost	4983.6325 0.0000 86.0000 409.4873	21.5100 21.5100	0.0000 (247a) 18.4986 (249)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	
Space heating - main system 1 Total CO2 associated with community systems	44700.0172		
Total CO2 associated with community systems Water heating (other fuel) Space and water heating	4983.6325	0.2100	
space and water neating Pumps, fans and electric keep-hot Energy for lighting Total CO2, kg/year	86.0000 409.4873	0.1387 0.1443	11.9293 (267)
13a. Primary energy - Individual heating systems including micro-CHP			
Space heating - main system 1 Total CO2 associated with community systems		Primary energy factor kg CO2/kWh 1.1300	Primary energy kWh/year 50511.0194 (275) 0.0000 (473)

SAP 10 Online 2.12.4 Page 7 of 15



Air changes per hour 50.0000 / (5) = 0.0530

0.0530 (8)

Yes Blower Door 10.0000 (17) 0.5530 (18)

4983.6325 1.1300 Water heating (other fuel) Space and water heating
Pumps, fans and electric keep-hot
Energy for lighting 56142.5242 (279) 130.1008 (281) 628.0853 (282) 86.0000 409.4873 1.5128 1.5338 Total Primary energy kWh/year 56900.7103 (286) SAP 10 EPC IMPROVEMENTS 00001_Copy Current energy efficiency rating: Current environmental impact rating: N Solar water heating SAP increase too small Solar photovoltaic panels Wind turbine Recommended Not applicable CO2 change -133 kg (1.3%) Recommended measures: SAP change Cost change Solar photovoltaic panels Measures omitted - SAP change or cost saving too small: $^{\mbox{\scriptsize M}}$ Solar water heating \$+ 0.5 -£. 51 -286 kg (2.7%) Energy Environmental Typical annual savings efficiency impact Recommended measures 0.37 kg/m² C 69 Solar photovoltaic panels Total Savings 0.37 kg/m² Potential energy efficiency rating: Potential environmental impact rating: Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023) Recommendation texts revision number 6.1 (11 Jun 2019) Typical heating and lighting costs of this home (per year, Thames Valley):

Current Potential Savi
Electricity £107 £107 £0 £2483 £2483 Mains gas Space heating Water heating £0 £0 £2262 £2262 £239 £239 Lighting Generated (PV) £88 £88 -£0 -£214 Total cost of uses
Delivered energy
Carbon dioxide emissions
CO2 emissions per m² £2375 137 kWh/m² 10 tonnes 29 kg/m² £2589 £214 140 kWh/m² 11 tonnes 29 kg/m² 158 kWh/m² 3 kWh/m² 0.1 tonnes 0 kg/m² 154 kWh/m² Primary energy 4 kWh/m² SAP 10 WORKSHEET FOR Conversion (As Designed) (Ve CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING 1. Overall dwelling characteristics Storey height (m) x 2.0000 (2a) Area Volume Volume (m3)
146.2000 (la) - (3a)
234.9000 (lb) - (3b)
225.0000 (lc) - (3c)
212.7000 (ld) - (3d)
124.4000 (le) - (3e) (m2) 73.1000 (1a) Basement floor 78.3000 (1b) 75.0000 (1c) 70.9000 (1d) 62.2000 (1e) Ground floor 3.0000 (2b) First floor Second floor 3.0000 (2c) 3.0000 (2d) Third floor 2.0000 (2e) Total floor area TFA = $(1a) + (1b) + (1c) + (1d) + (1e) \dots (1n)$ 359.5000 Dwelling volume (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =943.2000 (5) 2. Ventilation rate m3 per hour 0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 5 * 10 = 0 * 10 = 0 * 40 = 0.0000 (6a) Number of open chimneys Number of open flues Number of chimneys / flues attached to closed fire Number of flues attached to solid fuel boiler Number of flues attached to other heater 0.0000 (6b) 0.0000 (6c) 0.0000 (6d) 0.0000 (6e) Number of blocked chimmeys Number of intermittent extract fans Number of passive vents Number of flueless gas fires 0.0000 (6f) 50.0000 (7a) 0.0000 (7b) 0.0000 (7c)

SAP 10 Online 2.12.4 Page 8 of 15

Infiltration due to chimneys, flues and fans = (6a) + (6b) + (6c) + (6d) + (6e) + (6f) + (6g) + (7a) + (7b) + (7c) =

Pressure test Pressure Test Method

Infiltration rate



Number of sides Shelter factor	sheltered	d							(20) = 1	- [0.075 x	x (19)] =	0.8500	(19) (20)
Infiltration ra	te adjuste	ed to inclu	de shelter	factor					((21) = (18)	x (20) =	0.4701	(21)
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Effective ac	0.5993 0.6796	0.5876 0.6726	0.5758 0.6658	0.5171 0.6337	0.5053 0.6277	0.4466 0.5997	0.4466 0.5997	0.4348 0.5945	0.4701 0.6105	0.5053 0.6277	0.5288 0.6398	0.5523 0.6525	
3. Heat losses	and heat 1	loss parame	ter										
Element Window (Uw = 4 External Door T W8 T W9 T W10 Basement Floor Ground Floor External Wall Main Roof Exposed Ceiling Total net area Fabric heat los:	of externa		Aum(A, m2)	Gross m2 355.2000 62.2000 16.7000	Openings m2 58.3800 2.8500	2 51 7 0 0 0 73 4 0 296 0 5	######################################	U-value W/m2K 4.0268 3.0000 4.2359 4.2359 1.2000 1.2000 1.6000 0.3000 0.3000 (30) + (32)	A x 205.81 21.81 4.02 4.02 4.02 5.28 4.72 5.28 474.91 17.80 5.01	M/K .21 .00 .00 .41 .41 .41 .00 .00 .00 .00 .00 .00 .00 .0	(−value kJ/m2K	A x K kJ/K	
Thermal mass pa		TMP = Cm /	TFA) in kJ/	m2K								250.0000	(35)
B3 Sill E4 Jamb E5 Grou. E20 Exp E22 Bas. E6 Inte E11 Eav. E15 Fla E16 Cor. E17 Cor. E18 Par E25 Sta. P1 Part P2 Part P4 Part	ent r lintels nd floor osed floor ement floor es (insulat t roof with ner (norm ner (inver ty wall be ggered pa y wall - [y wall - [(normal) r (normal) r (normal) r (rior withi ation at ra th parapet al) rted - inte etween dwel rty wall be Ground floo Intermediat Roof (insul	lings tween dwell r e floor wit ation at ce	g reater than ings hin a dwell iling level	1)	rea)		37 34 136 60 3 36 111 26 23 38 25 39 11	.ength 1.7400 1.2800 1.6000 1.8000 1.1800 1.0000 1.0500 1.8500 1.8000 1.8000 1.8000 1.8000 1.8000 1.8000 1.8000 1.8000 1.8000	Psi-value 1.0000 0.1000 0.1000 0.3200 0.3200 0.1400 0.1200 0.1400 0.1800 0.0000 0.2400 0.2400 0.3200 0.0400 0.3200 0.0400 0.3200 0.0000 0.4800	Tot 37.74 3.42 13.66 19.45 1.01 7.92 15.65 3.15 5.53 6.98 0.00 9.55 2.83 4.67 0.00 3.60	00 80 00 60 76 00 90 92 40 00 20 20 20 20 20 00	
Thermal bridges Point Thermal b Total fabric he	ridges at loss		_						((33) + (36)	(36a) = + (36a) =	135.2122 0.0000 965.6335	
Heat transfer c	Jan 211.5282 oeff	Feb 209.3575	Mar 207.2299	Apr 197.2362	May 195.3664	Jun 186.6622	Jul 186.6622	Aug 185.0503	Sep 190.0149	Oct 195.3664	Nov 199.1489	Dec 203.1034	
Average = Sum(3		=		1102.0037	1100.3333			1100.0000				1162.8607	
HLP HLP (average) Days in mont	Jan 3.2744 31	Feb 3.2684 28	Mar 3.2625 31	Apr 3.2347 30	May 3.2295 31	Jun 3.2053 30	Jul 3.2053 31	Aug 3.2008 31	Sep 3.2146 30	Oct 3.2295 31	Nov 3.2400 30	Dec 3.2510 3.2347 31	
4. Water heating	g energy 1	requirement	s (kWh/year)									
Assumed occupand	су											3.2093	(42)
Hot water usage	68.2754 for baths	67.2493	65.7542	62.8935	60.7823	58.4280	57.0899	58.5737	60.2002	62.7281	65.6502	68.0138	(42a)
Hot water usage			32.4737	31.1750	30.2026	29.1243	28.5419	29.2413	30.0028	31.1566	32.4821	33.5644	
Average daily h			-	42.3148	40.5877	38.8606	38.8606	40.5877	42.3148	44.0420	45.7691	47.4962 137.3510	
	149.4499	Feb 146.1965	Mar 142.2699	Apr 136.3834		Jun 126.4129	Jul 124.4923	Aug 128.4027	Sep 132.5179	Oct 137.9267	Nov 143.9014	Dec 149.0744	
Energy content Energy content Distribution los	(annual) ss (46)m			186.7020		155.4394	150.5627	158.9894	163.4079		Sum (45) m =	233.4145 2281.3544	
Water storage 1	35.5038 oss:	31.2273	32.7995	28.0053	26.5683	23.3159	22.5844	23.8484	24.5112	28.0748	30.7521	35.0122 300.0000	
b) If manufact Hot water stor Volume factor Temperature for	rage loss from Tabl actor from	factor from le 2a n Table 2b			day)							0.0330 0.7368 0.5400	(51) (52) (53)
Enter (49) or (Total storage l	oss		122 2022	110 0000	100 0000	110 2002	122 2022	122 2022	110 0000	122 2022	110 2002	3.9420	
			177 2022	118.2602	122.2022	118.2602	122.2022	122.2022	118.2602	122.2022	118.2602	122.2022	(56)
If cylinder con	122.2022	icated sola 110.3762	r storage 122.2022	118.2602		118.2602	122.2022	122.2022	118.2602	122.2022	118.2602	122.2022	
If cylinder con Primary loss Combi loss	tains dedi 122.2022 23.2624 0.0000	icated sola 110.3762 21.0112 0.0000	r storage 122.2022 23.2624 0.0000	22.5120 0.0000	23.2624	118.2602 22.5120 0.0000	122.2022 23.2624 0.0000	122.2022 23.2624 0.0000	118.2602 22.5120 0.0000	122.2022 23.2624 0.0000	118.2602 22.5120 0.0000	122.2022 23.2624 0.0000	(59)
If cylinder con Primary loss Combi loss Total heat requ	tains dedi 122.2022 23.2624 0.0000	icated sola 110.3762 21.0112 0.0000 water heati	r storage 122.2022 23.2624 0.0000	22.5120 0.0000	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59) (61) (62) (63a) (63b) (63c)

SAP 10 Online 2.12.4 Page 9 of 15



Diameter about	/->							Total p	er year (kW	h/year) = S	um(64)m =	3994.0831	(64)
Electric show	0.0000	0.0000	0.0000			0.0000 used by inst	0.0000 antaneous e		0.0000 wer(s) (kWh	0.0000 /year) = Su			
Heat gains fi						164.3014							(65)
5. Internal of	gains (see T	Table 5 and	5a)										
Metabolic ga:	ins (Table 5		Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gair	ns (calculat	ed in Appen	dix L, equa	192.5568 ation L9 or	192.5568 L9a), also	192.5568 see Table 5		192.5568	192.5568				
Appliances ga	ains (calcul	lated in App	endix L, eq	quation L13	or L13a), a		le 5	28.0971	37.7118 575.5842	47.8838 617.5302	55.8875 670.4795	59.5782	
Cooking gains	s (calculate		lix L, equat	ion L15 or	L15a), also			57.4650	57.4650	57.4650	57.4650		
Pumps, fans Losses e.g.	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000		
Water heating	g gains (Tab	ole 5)				-128.3712							
Total interna	al gains	259.4202 1196.8659		242.6336 1098.6432		228.1964 966.7974	223.7013 930.6674	227.4673 933.0958	231.8762 966.8228	240.0593	251.0901 1102.1076		
6. Solar gair	ıs												
[Jan]				m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b			Acce fact Table	or 6d	Gains W	
North Northeast			2.3	3000	10.6334		0.8500	0	.7000 .7000 .7000 .7000 .7000 .7000	0.77 0.77	00	10.0844 9.2117	
Southeast Southwest			19.2 0.8	200 300	11.2829 36.7938 36.7938 19.6403		0.8500 0.8500 0.8500 0.8500	0	.7000 .7000	0.77 0.77	00	291.5940 12.5922	(77) (79)
West Northwest			24.3	(800	11 2824	; ;	0.8500	0 0 0	.7000	0.77	00	19.4361 113.4243	(81)
Southeast			2.8						.7000	1.00	00	61.0091	(02)
Solar gains Total gains													
7. Mean inter													
Temperature of	during heati	ng periods	in the livi	ng area fro	om Table 9,							21.0000	(85)
Utilisation :	factor for of Jan 21.2080	Feb	ving area, Mar 21.2858	nil,m (see Apr 21.4687	May	Jun 21.6657	Jul 21.6657	Aug 21.6960	Sep 21.6028	Oct 21.5033	Nov 21.4334	Dec 21.3609	
alpha util living a	2.4139	2.4165	2.4191	2.4312		2.4444	2.4444	2.4464	2.4402	2.4336	2.4289	2.4241	
	0.9975	0.9954	0.9911	0.9803		0.9092	0.8408	0.8762	0.9557	0.9882	0.9961		
MIT Th 2 util rest of	18.6191	17.3868 18.6218	17.8901 18.6245	18.6146 18.6372		20.0854 18.6509	20.5042 18.6509		19.8081 18.6465		17.8760 18.6348		
MIT 2	0.9964 14.4405		0.9867 15.4007	0.9686 16.3283	0.9225 17.2917	0.8053 18.1304	0.5832 18.5307	0.6599 18.4772	0.9012 17.8341	0.9792 16.6214	0.9940 15.3885		
Living area :	14.5965	14.9076	15.5444	16.4603	17.4125	18.2433	18.6447	18.5892	fLA = 17.9481	Living are 16.7494		14.5609	(92)
Temperature a adjusted MIT		14.9076	15.5444	16.4603	17.4125	18.2433	18.6447	18.5892	17.9481	16.7494	15.5322	0.0000 14.5609	
8. Space heat	ing require	ement											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation Useful gains	0.9923 1702.4982	0.9867 2105.7293	0.9749 2522.4658	0.9474 2931.4785	0.8895 3085.7369	0.7733 2686.9793	0.5820 1927.8269	0.6491 1929.4602	0.8679 2246.3907	0.9633 2027.8604	0.9878 1710.9748	0.9936 1590.8718	(95)
Ext temp. Heat loss rat	te W				11.7000	14.6000			14.1000		7.1000		
Space heating	g kWh	6486.8967				0.0000	0.0000	0.0000				7825.5682	
Space heating Solar heating	g requiremer g kWh	nt - total p	er year (kW	Nh/year)								44579.7088	
Solar heating Space heating	g contributi	0.0000 ion - total			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating	7751.1005 g requiremen	6486.8967 nt after sol				0.0000 (kWh/year)	0.0000	0.0000	0.0000			7825.5682 44579.7088 124.0048	
9a. Energy re												0.0000	(201)
Fraction of s Fraction of s Efficiency of	space heat f	from main sy	stem(s)		.m (rabie II	.,						0.0000 1.0000 84.0000	(202)
Efficiency of	f main space	heating sy	stem 2 (in	%)								0.0000	(207)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	7751.1005	6486.8967			2638.5486	0.0000	0.0000	0.0000	0.0000	3803.0161	5839.6972	7825.5682	(98)

SAP 10 Online 2.12.4 Page 10 of 15



84.0000 84.0000 84.0000 84.0000 0.0000 0. Space heating fuel (main heating system)	.0000 0.0000	0.0000	84.0000	84.0000	84.0000	(210)
9227.5006 7722.4960 7161.3860 5022.9968 3141.1293 0.0000 0.	.0000 0.0000	0.0000	4527.4001	6952.0205	9316.1526	(211)
	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(212)
	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary) 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating						
Water heating requirement 382.1567 339.5693 364.1281 327.4742 322.5867 296.2117 296.	.0273 304.4540	304.1801	332.6298	345.7861	378.8791	(64)
Efficiency of water heater	.0000 74.0000	74.0000	83.0968	83.3702	74.0000 83.4790	(216)
Fuel for water heating, kWh/month	.0369 411.4243	411.0542	400.2918	414.7599	453.8613	
Space cooling fuel requirement						
Pumps and Fa 7.3041 6.5973 7.3041 7.0685 7.3041 7.0685 7.	.0000 0.0000 .3041 7.3041	0.0000 7.0685	0.0000 7.3041	0.0000 7.0685	0.0000 7.3041	(231)
Electricity generated by PVs (Appendix M) (negative quantity)	.9202 24.5932	31.9441	41.9124	47.3400	52.1485	
(233a)m -37.8598 -56.9899 -87.5316 -105.2832 -119.4192 -113.5030 -111. Electricity generated by wind turbines (Appendix M) (negative quantity)		-87.2397	-67.8548	-42.8118	-32.3041	(233a)
(234a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0. Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0. Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if	.0000 0.0000 net generation)	0.0000	0.0000	0.0000	0.0000	(235a)
(235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0. Electricity generated by PVs (Appendix M) (negative quantity)	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
	.0000 0.0000 net generation)	0.0000	0.0000	0.0000	0.0000	(235b)
	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Space heating fuel - main system 1					53071.0819	
Space heating fuel - main system 2 Space heating fuel - secondary					0.0000	(215)
Efficiency of water heater Water heating fuel used					74.0000 4976.6775	(219)
Space cooling fuel					0.0000	(221)
Electricity for pumps and fans: central heating pump					41.0000	(230c)
main heating flue fan Total electricity for the above, kWh/year					45.0000 86.0000	
Electricity for lighting (calculated in Appendix L)					409.4873	(232)
Energy saving/generation technologies (Appendices M ,N and Q) PV generation					-965.1988	(233)
Wind generation Hydro-electric generation (Appendix N)					0.0000	(234)
Electricity generated - Micro CHP (Appendix N)					0.0000	(235)
Appendix Q - special features Energy saved or generated					0.0000	(236)
Appendix Q - special features					0.0000	(236) (237)
Appendix Q - special features					0.0000 -0.0000 0.0000	(236) (237)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses					0.0000 -0.0000 0.0000	(236) (237)
Appendix $\mathbb Q$ - special features Energy saved or generated Energy used Total delivered energy for all uses					0.0000 -0.0000 0.0000 57578.0480	(236) (237) (238)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices	Fuel kWh/year	Fì	uel price p/kWh		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year	(236) (237) (238)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices	Fuel	F			0.0000 -0.0000 0.0000 57578.0480	(236) (237) (238)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel)	Fuel kWh/year 53071.0819 4976.6775		p/kWh 3.6400 3.6400		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511	(236) (237) (238) (240) (473) (247)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000		p/kWh 3.6400 3.6400 16.4900 16.4900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814	(236) (237) (238) (240) (473) (247) (247a) (249)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s)	Fuel kWh/year 53071.0819 4976.6775 0.0000		p/kWh 3.6400 3.6400 16.4900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000	(236) (237) (238) (240) (473) (247) (247a) (247a) (249) (250)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000	(240) (247) (247) (247) (247) (247a) (249) (250) (251)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000		p/kWh 3.6400 3.6400 16.4900 16.4900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000	(240) (473) (247) (247) (247) (247) (249) (250) (251)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000	(240) (473) (240) (473) (247) (247a) (247a) (249) (250) (251)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.1613	(240) (473) (240) (473) (247) (247a) (247a) (249) (250) (251)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.1613	(240) (473) (240) (473) (247) (247a) (247a) (249) (250) (251)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.1613	(240) (473) (240) (473) (247) (247a) (247a) (249) (250) (251)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost deflator (Table 12):	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 16.4900 5.5900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.1613 2127.4830	(240) (473) (247) (247) (247) (247) (250) (251) (252) (255)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instananeous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 16.4900 5.5900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.163 2127.4830	(240) (473) (247) (247) (247) (247) (250) (251) (252) (255)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost deflator (Table 12): Energy cost deflator (ECE)	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 16.4900 5.5900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.163 2127.4830	(240) (247) (247) (247) (247) (247) (250) (251) (252) (255)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12)	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 16.4900 5.5900		0.0000 -0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 2127.4830 0.3600 1.8934 69.3074	(240) (247) (247) (247) (247) (247) (250) (251) (252) (255)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000		p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 16.4900 5.5900		0.0000 -0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 2127.4830 0.3600 1.8934 69.3074	(240) (247) (247) (247) (247) (247) (250) (251) (252) (255)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000	255) x (256)	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 5.5900		0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 18.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.1613 2127.4830 0.3600 1.8934 69.3074 69 C	(240) (473) (247) (247) (247a) (247a) (255) (255) (255) (257) (258)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity weported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000	255) x (256) Emissi	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 16.4900 5.5900	45.0] =	0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.1633 2127.4830 0.3600 1.8934 69.3074 69.3074 C Emissions gg CO2/year	(240) (473) (247) (247) (247a) (247a) (250) (251) (252) (255) (256) (257) (258)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity weported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost deflator (Table 12): Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000	255) x (256) Emissi	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 5.5900	45.0] =	0.0000 -0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 2127.4830 0.3600 1.8934 69.3074 69 C	(240) (247) (247) (247) (247a) (250) (251) (252) (255) (255)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band Space heating (Section 12) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel)	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000	255) x (256) Emissi	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 5.5900	45.0] =	0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 18.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.1613 2127.4830 0.3600 1.8934 69.3074 69 C	(240) (473) (247) (247) (247a) (247a) (250) (251) (252) (255) (256) (257) (258)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices 10a. Sap rating - Individual heating systems 10b. Fuel costs - using Table 12 prices 10a. Sap rating - Individual heating systems 10a. Sap rating (Section 12) 10a. Carbon dioxide emissions - Individual heating systems including micro-CHP 10a. Carbon dioxide emissions - Individual heating systems including micro-CHP 10a. Carbon dioxide emissions - Individual heating systems including micro-CHP 10a. Carbon dioxide emissions - Individual heating systems including micro-CHP 10a. Carbon dioxide emissions - Individual heating systems including micro-CHP 10a. Carbon dioxide emissions - Individual heating systems including micro-CHP 10a. Carbon dioxide emissions - Individual heating systems including micro-CHP 10a. Carbon dioxide emissions - Individual heating systems including micro-CHP	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000 [(255) x (256) Emissi	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 5.5900 16.4900 5.5900	45.0] =	0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 0.0000 -159.163 2127.4830 0.3600 1.8934 69.3074 69.0006 C Emissions tg CO2/year 11144.9272 0.0000 1045.1023 2120.0295 2190.0295	(240) (247) (247) (247) (247) (247a) (250) (251) (252) (255) (255) (257) (258)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000 [(255) x (256) Emissi	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 5.5900 16.4900 5.5900	45.0] =	0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 2127.4830 0.3600 1.8934 69.3074 69.3074 69.3074 1144.9272 0.0000 1045.1023 12190.0295	(240) (247) (247) (247) (247) (247a) (250) (251) (252) (255) (255) (257) (258)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices 10a. Fuel costs - using Table 12 prices 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity used in dwelling Total energy cost Total energy cost 11a. SAP rating - Individual heating systems Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (ther fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies Evy Unit electricity used in dwelling	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000 Energy kWh/year 53071.0819 4976.6775 86.0000 409.4873 -965.1988	255) x (256) Emissi	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 5.5900 16.4900 0.2100 0.2100 0.2100 0.1387 0.1443	45.0] =	0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 181.1511 0.0000 14.1814 67.5245 92.0000 -159.1613 2127.4830 0.3600 1.8934 69.3074 69.3074 69.3074 11144.9272 0.0000 1045.1023 12190.0295 11.9293 59.1017	(240) (247) (247) (247) (247) (250) (251) (252) (255) (258) (261) (373) (264) (265) (267) (268)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses 10a. Fuel costs - using Table 12 prices 10a. Fuel costs - using Table 12 prices 10a. Fuel costs - using Table 12 prices Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 11a. SAP rating - Individual heating systems Energy cost factor (ECF) SAP value SAP rating (Section 12) SAP band Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies	Fuel kWh/year 53071.0819 4976.6775 0.0000 86.0000 409.4873 -965.1988 0.0000 [(255) x (256) Emissi	p/kWh 3.6400 3.6400 16.4900 16.4900 16.4900 5.5900 16.4900 5.5900	45.0] =	0.0000 -0.0000 0.0000 57578.0480 Fuel cost £/year 1931.7874 0.0000 18.1511 0.0000 -159.1613 0.0000 -159.1613 2127.4830 0.3600 1.8934 69.3074 69 C Emissions gg CO2/year 11144.9272 0.0000 0145.1023 12190.0295 11.9293 59.1017	(240) (247) (247) (247) (247a) (247a) (250) (251) (252) (255) (255) (257) (258)

SAP 10 Online 2.12.4 Page 11 of 15



(36a) =

0.0000

CO2 emissions per m2 33.7500 (273) EI value EI rating 59.6822 60 (274) EI band SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 1. Overall dwelling characteristics Storey height Volume (m3) 146.2000 (1a) - (3a) 234.9000 (1b) - (3b) 225.0000 (1c) - (3c) (m2) (m) (m) 2.0000 (2a) 3.0000 (2b) 73.1000 (1a) 78.3000 (1b) 75.0000 (1c) Basement floor Ground floor First floor 3.0000 (2c) 212.7000 (1d) -124.4000 (1e) -Second floor 70.9000 (1d) 3.0000 (2d) Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)...(ln) $(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) =$ 943.2000 (5) Dwelling volume 2. Ventilation rate m3 per hour 0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 5 * 10 = 0 * 10 = Number of open chimneys Number of open flues Number of chimneys / flues attached to closed fire Number of flues attached to solid fuel boiler Number of flues attached to other heater Number of blocked chimneys 0.0000 (6b) 0.0000 (6c) 0.0000 (6d) (6f) 0.0000 Number of intermittent extract fans Number of passive vents Number of flueless gas fires 50.0000 (7a) 0.0000 (7b) 0.0000 (7c) * 40 = Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = Pressure Test Method 0.0530 (8) Yes Blower Door 10.0000 (17) 50.0000 / (5) = Measured/design AP50 Infiltration rate Number of sides sheltered 0.5530 (18) 2 (19) - [0.075 x (19)] (21) = (18) x (20) 0.8500 (20) 0.4701 (21) Shelter factor (20) = 1 -Infiltration rate adjusted to include shelter factor Jan 3.8000 0.9500 Apr 3.3000 0.8250 May 3.4000 0.8500 Jun 3.0000 0.7500 Aug 3.0000 0.7500 Sep 2.9000 0.7250 Dec 3.4000 (22) 0.8500 (22a) Feb Wind speed Wind factor 3.5000 0.8750 3.5000 0.8750 3.2000 Adj infilt rate 0 4466 0 4113 0.4113 3. Heat losses and heat loss parameter Gross Openings NetArea m2 51.1100 kJ/K m2 W/m2K W/K kJ/m2K 4.0268 3.0000 4.2359 205.8121 21.8100 4.0241 Window (Uw = 4.80) (27) External Door
T W8
T W9 7.2700 0.9500 0.9500 4.2359 4.0241 (27a) 0.9500 73.1000 T W10 4.2359 4.0241 Basement Floor Ground Floor External Wall 1.2000 87.7200 5.2800 4.4000 (28a) 355.2000 474.9120 58.3800 296.8200 1.6000 (29a) Main Roof Exposed Ceiling 59.3500 16.7000 2.8500 Total net area of external elements Aum(A, m2) Fabric heat loss, W/K = Sum (A x U) 511.6000 830.4213 (26)...(30) + (32) =Thermal mass parameter (TMP = Cm / TFA) in kJ/m2KList of Thermal Bridges KRI Element E2 Other lintels (including other steel lintels) E3 Sill E4 Jamb Length 37.7400 34.2800 Psi-value 1.0000 0.1000 0.1000 37.7400 3.4280 13.6600 136.6000 60.8000 3.1800 36.0000 0.3200 0.3200 0.2200 19.4560 1.0176 7.9200 E5 Ground floor (normal) E20 Exposed floor (normal) E22 Basement floor E6 Intermediate floor within a dwelling 111.8500 0.1400 15.6590 Ell Eaves (insulation at rafter level)
El5 Flat roof with parapet
El6 Corner (normal)
El7 Corner (inverted - internal area greater than external area) 26.3300 23.0500 38.8000 3.1596 5.5320 6.9840 0.1200 0.1800 25.8000 0.0000 0.0000 E17 Corner (inverted - internal area greater than ext E18 Party wall between dwellings E25 Staggered party wall between dwellings P1 Party wall - Ground floor P2 Party wall - Intermediate floor within a dwelling P4 Party wall - Roof (insulation at ceiling level) Thermal bridges (Sum(L x Psi) calculated using Appendix K) Point Thermal bridges 0.2400 39.8000 9.5520 14.6000 65.9000 0.3200 4.6720 0.4800 3.6000

SAP 10 Online 2.12.4 Page 12 of 15



Total fabric heat loss Ventilation heat loss calculated mo	m+hlv (38)m = 0 33	v (25)m v (5)				(33) + (36)	+ (36a) =	965.6335	(37)
Jan Feb (38) m 186.6622 181.9555	Mar Apr 181.9555 179.03	May	Jun 174.9706	Jul 177.6356	Aug 174.9706	Sep 173.7026	Oct 176.2816	Nov 176.2816	Dec 180.4725	(38)
Heat transfer coeff 1152.2957 1147.5890										
Average = Sum(39)m / 12 =									1144.3330	
Jan Feb HLP 3.2053 3.1922	Mar Apr 3.1922 3.18	May 3.1881	Jun 3.1728	Jul 3.1802	Aug 3.1728	Sep 3.1692	Oct 3.1764	Nov 3.1764	Dec 3.1881	(40)
HLP (average) Days in mont 31 28	31	30 31	30	31	31	30	31	30	3.1831 31	
4. Water heating energy requirement Assumed occupancy									3.2093	(42)
Hot water usage for mixer showers 68.2754 67.2493	65.7542 62.89	35 60.7823	58.4280	57.0899	58.5737	60.2002	62.7281	65.6502	68.0138	
Hot water usage for baths 33.6782 33.1781	32.4737 31.1		29.1243	28.5419	29.2413	30.0028	31.1566	32.4821	33.5644	
Hot water usage for other uses 47.4962 45.7691	44.0420 42.33		38.8606	38.8606	40.5877	42.3148	44.0420	45.7691	47.4962	
Average daily hot water use (litres									137.3510	
Jan Feb Daily hot water use	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
149.4499 146.1965 Energy conte 236.6920 208.1819 Energy content (annual)	142.2699 136.38 218.6635 186.70		126.4129 155.4394	124.4923 150.5627	128.4027 158.9894	132.5179 163.4079	137.9267 187.1652 Total = S	143.9014 205.0139 um(45)m =	149.0744 233.4145 2281.3544	
Distribution loss (46)m = 0.15 x (35.5038 31.2273	45) m 32.7995 28.00	26.5683	23.3159	22.5844	23.8484	24.5112	28.0748	30.7521	35.0122	(46)
Water storage loss: Store volume									300.0000	(47)
b) If manufacturer declared loss Hot water storage loss factor fro Volume factor from Table 2a									0.0330 0.7368	
Temperature factor from Table 2b Enter (49) or (54) in (55)									0.7366 0.5400 3.9420	(53)
Total storage loss 122.2022 110.3762	122.2022 118.20	122.2022	118.2602	122.2022	122.2022	118.2602	122.2022	118.2602	122.2022	
If cylinder contains dedicated sola 122.2022 110.3762	r storage		118.2602	122.2022	122.2022	118.2602	122.2022	118.2602	122.2022	
Primary loss 23.2624 21.0112 Combi loss 0.0000 0.0000	23.2624 22.53 0.0000 0.00	0.0000	22.5120 0.0000	23.2624	23.2624 0.0000	22.5120 0.0000	23.2624	22.5120 0.0000	23.2624 0.0000	
Total heat required for water heati 382.1567 339.5693	364.1281 327.4	42 322.5867	296.2117	296.0273	304.4540	304.1801	332.6298	345.7861	378.8791	
WWHRS 0.0000 0.0000 PV diverter -0.0000 -0.0000	0.0000 0.00	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000 0.0000 FGHRS 0.0000 0.0000 Output from w/h	0.0000 0.00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
382.1567 339.5693	364.1281 327.4	42 322.5867	296.2117	296.0273		304.1801 er year (kW			378.8791 3994.0831	
Electric shower(s) 0.0000 0.0000	0.0000 0.00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains from water heating, kWh/ 195.0718 174.3304	month 189.0773 174.69	Total Energy u 162 175.2648	164.3014		169.2357		178.6041	180.7849	0.0000	
5. Internal gains (see Table 5 and										
Metabolic gains (Table 5), Watts Jan Feb	Mar Apr		Jun		Aug	Sep	Oct	Nov	Dec	
(66)m 192.5568 192.5568 Lighting gains (calculated in Appen	192.5568 192.55	68 192.5568	192.5568	192.5568						(66)
57.9672 51.4859 Appliances gains (calculated in App	41.8712 31.69 endix L, equation 1	92 23.6955 13 or L13a), a	20.0047 also see Tab	21.6158 ble 5		37.7118	47.8838	55.8875	59.5782	(67)
753.4903 761.3092 Cooking gains (calculated in Append	lix L, equation L15	or L15a), also	see Table	5		575.5842				(68)
57.4650 57.4650 Pumps, fans 3.0000 3.0000	3.0000 3.00	550 57.4650 00 3.0000	57.4650 0.0000	57.4650 0.0000	57.4650 0.0000		57.4650 3.0000			
Losses e.g. evaporation (negative v -128.3712 -128.3712	alues) (Table 5) -128.3712 -128.3	12 -128.3712	-128.3712	-128.3712	-128.3712	-128.3712	-128.3712	-128.3712	-128.3712	(71)
Water heating gains (Table 5) 262.1933 259.4202 Total internal gains	254.1362 242.63	36 235.5710	228.1964	223.7013	227.4673	231.8762	240.0593	251.0901	260.7285	(72)
1198.3013 1196.8659	1162.2638 1098.64	32 1030.6276	966.7974	930.6674	933.0958	966.8228	1030.1239	1102.1076	1165.2017	(73)
6. Solar gains										
[Jan]	Area m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	ss or 6d	Gains W	
North									11.3360	(74)
Northeast Southeast Southwest	1.9800 19.2200	12.9148	5	0.8500	0	.7000	0.77	00	11.3360 10.5439 319.1151 13.7807	(75) (77)
West	2.3000 1.9800 19.2200 0.8300 2.4000 24.3800 2.8500	40.2665)	0.8500 0.8500	0	.7000	0.77	00	13.7807	(80)
Northwest Southeast	2.8500	12.9148 44.6209) 	0.8500	0 0 	.7000	1.00	00	68.0993	(82)
Solar gains 574.7690 906.5130 Total gains 1773.0704 2103.3789	1405.5382 2034.29	48 2434.2870	2671.9150	2531.9379	2211.1085	1741.6157	1153.5098	699.2898	479.3031	(83)

7. Mean internal temperature (heating season)

SAP 10 Online 2.12.4 Page 13 of 15



Temperature d												21.0000	(85)
tau	Jan 21.6657	Feb 21.7545	Mar 21.7545	Apr 21.8101	May 21.7827	Jun 21.8878	Jul 21.8367	Aug 21.8878	Sep 21.9121	Oct 21.8626	Nov 21.8626	Dec 21.7827	
alpha util living a	2.4444	2.4503	2.4503	2.4540	2.4522	2.4592	2.4558	2.4592	2.4608	2.4575	2.4575		
ucii iiving u	0.9968	0.9948	0.9891	0.9730	0.9328	0.8205	0.6398	0.7035	0.9238	0.9824	0.9947	0.9973	(86)
MIT Th 2 util rest of	17.5333 18.6509	17.7385 18.6570	18.2846 18.6570	19.0233 18.6608	19.8336 18.6589	20.5321 18.6661	20.8601 18.6626	20.8109 18.6661	20.1793 18.6678	19.2289 18.6644	18.2566 18.6644		
MIT 2	0.9953 14.9554	0.9923 15.2202	0.9830 15.9182	0.9545 16.8557	0.8674 17.8477	0.5650 18.5501	0.0537 18.6626	0.1320 18.6654	0.8045 18.2677	0.9664 17.1273	0.9915 15.8878		
Living area f		15.3657	16.0548	16.9809	17.9624	18.6646	18.7895	18.7893		Living are		0.0577	(91)
Temperature a adjusted MIT		15.3657	16.0548	16.9809	17.9624	18.6646	18.7895	18.7893	18.3781	17.2487	16.0246	0.0000	
8. Space heat													
Utilisation Useful gains Ext temp.	Jan 0.9902 1755.6949 5.6000	Feb 0.9848 2071.4321 6.1000	Mar 0.9691 2488.5301 7.9000	Apr 0.9287 2909.6151 10.4000	May 0.8321 2883.0850 13.5000	Jun 0.5647 2054.8875 16.5000	Jul 0.0953 330.0210 18.5000	Aug 0.1754 551.5437 18.3000	Sep 0.7754 2100.1016 15.5000	Oct 0.9452 2063.8977 12.0000	Nov 0.9834 1771.5242 8.4000	1631.1200	(95)
Heat loss rat		10633.1713	9358.4113	7532.9472	5114.3396	2468.9319	330.9592	558.0989	3279.0829	5993.5280	8706.6564	10953.3086	(97)
Space heating Space heating	6841.8330	5753.4888 nt - total p			1660.0535	0.0000	0.0000	0.0000	0.0000	2923.6449	4993.2952	6935.7084 37548.0144	
Solar heating Solar heating	0.0000 contribut		0.0000 per year ()	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating Space heating Space heating	6841.8330 requirement	5753.4888 nt after sol				0.0000 (kWh/year)	0.0000	0.0000	0.0000	2923.6449 (98c	4993.2952	6935.7084 37548.0144 104.4451	
9a. Energy re	quirements	- Individua	al heating s	ystems, inc	luding mic								
Fraction of s Fraction of s				ntary syste	m (Table 11	1)						0.0000	
Efficiency of Efficiency of Efficiency of	main space main space	e heating sy e heating sy	ystem 1 (in ystem 2 (in	%)								84.0000 0.0000 0.0000	(206) (207)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating Space heating	6841.8330	5753.4888			1660.0535	0.0000	0.0000	0.0000	0.0000	2923.6449	4993.2952	6935.7084	(98)
Space heating	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating	8145.0393	6849.3914	6084.7519		1976.2541	0.0000	0.0000	0.0000	0.0000	3480.5297	5944.3990	8256.7957	(211)
Space heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
-1	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		nt											
Efficiency of	382.1567	339.5693	364.1281	327.4742	322.5867	296.2117	296.0273	304.4540	304.1801	332.6298	345.7861	378.8791 74.0000	
(217)m Fuel for wate	83.4038 er heating,		83.2518	82.9955	82.1928	74.0000	74.0000	74.0000	74.0000	82.8562	83.2712	83.4161	(217)
Space cooling		407.2936 irement	437.3816	394.5688	392.4756	400.2860	400.0369	411.4243	411.0542	401.4541	415.2529	454.2038	(219)
(221)m Pumps and Fa	0.0000 7.3041	6.5973	0.0000 7.3041	0.0000 7.0685	0.0000 7.3041	0.0000 7.0685	0.0000 7.3041	0.0000 7.3041	0.0000 7.0685	0.0000 7.3041	0.0000 7.0685		
Lighting Electricity g		y PVs (Apper					18.9202	24.5932	31.9441	41.9124	47.3400	52.1485	(232)
(233a)m Electricity g	enerated b		ines (Append	lix M) (nega	tive quanti				-91.5605	-71.7422	-46.8835		
(234a)m Electricity g		y hydro-elec						0.0000	0.0000	0.0000	0.0000		(234a)
(235a)m Electricity u		electricity							0.0000	0.0000	0.0000		(235a)
(235c)m Electricity g		y PVs (Apper					0.0000	0.0000	0.0000	0.0000	0.0000		(235c)
(233b)m Electricity g		y wind turbi					0.0000	0.0000	0.0000	0.0000	0.0000		(233b)
(234b)m Electricity g		y hydro-elec						0.0000	0.0000	0.0000	0.0000		(234b)
(235b)m Electricity u (235d)m	0.0000 used or net 0.0000		0.0000 generated 0.0000		0.0000 P (Appendia 0.0000		0.0000 ve if net g 0.0000	0.0000 eneration) 0.0000	0.0000	0.0000	0.0000		(235b) (235d)
Annual totals Space heating	kWh/year		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	44700.0172	
Space heating Space heating	fuel - ma	in system 2										0.0000	(213)
Efficiency of Water heating Space cooling	water hear fuel used	ter										74.0000 4983.6325 0.0000	(219)
Electricity f		nd fans:											•
central he main heati	ating pump ng flue fa	n										41.0000 45.0000	(230e)
Total electri Electricity f	city for t	he above, kV		lix L)								86.0000 409.4873	(231)
Energy saving	/generatio				d Q)								
PV generation Wind generati Hydro-electri	.on	on (Appendix	« N)									-995.7123 0.0000 0.0000	

SAP 10 Online 2.12.4 Page 14 of 15



Electricity generated - Micro CHP (Appendix N) Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses			0.0000 (235) -0.0000 (236) 0.0000 (237) 49183.4247 (238)	5)
10a. Fuel costs - using BEDF prices (533)				
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges	Fuel kWh/year 44700.0172 4983.6325 0.0000 86.0000 409.4873	Fuel price p/kWh 4.8000 4.8000 21.5100 21.5100 21.5100	Fuel cost £/year 2145.6008 (240) 0.0000 (473) 239.2144 (247) 18.4986 (249) 88.0807 (250) 98.0000 (251)	3) 7) 7a) 9)
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost	-995.7123 0.0000	21.5100 5.5900	-214.1777 0.0000 -214.1777 (252 2375.2168 (255)	
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP				
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting	Energy kWh/year 44700.0172 4983.6325 86.0000 409.4873	Emission factor kg CO2/kWh 0.2100 0.2100 0.1387 0.1443	Emissions kg CO2/year 9387.0036 (261 0.0000 (373 1046.5628 (264 10433.5664 (265 11.9293 (267 59.1017 (268	3) 1) 5)
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year	-995.7123 0.0000	0.1332 0.0000	-132.6282 0.0000 -132.6282 (269 10371.9692 (272	
13a. Primary energy - Individual heating systems including micro-CHP				
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting	Energy Pr	imary energy factor kg CO2/kWh 1.1300 1.1300 1.5128 1.5338	Primary energy kWh/year 50511.0194 (275 0.0000 (473 5631.5048 (278 56142.5242 (279 130.1008 (281 628.0853 (282	3) 3) 3)
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total Primary energy kWh/year	-995.7123 0.0000	1.4922 0.0000	-1485.7923 0.0000 -1485.7923 (283) 55414.9180 (286)	

SAP 10 Online 2.12.4 Page 15 of 15

APPENDIX B – BREEAM PRE-ASSESSMENT



Project name: 9 The Green Building type: Residential **Date:** 04/01/2024

15

Version

Target score: 61.35 Target rating:

VERY GOOD

102: Home User Guide 3 0 0 3 Credits awarded for production of home User Guide OR 102: Responsible construction practices 2 0 0 2 Achieve a CCS score of at least 35, with at least 7 points in each section. 4 2 Achieve a CCS score of at least 35, with at least 7 points in each section. 5 2 Achieve a CCS score of at least 35, with at least 7 points in each section. 6 2 0 1 2 Achieve a CCS score of at least 35, with at least 7 points in each section. 7 3 Achieve a CCS score of at least 35, with at least 7 points in each section. 8 2 0 0 1 2 Achieve a CCS score of at least 35, with at least 7 points in each section. 9 3 Compliance letter. 9 3 Compliance letter. 9 4 Compliance letter. 1 0 0 1 1 Compliance letter. 1 0 Achieve a CCS score of at least 35, with at least 7 points in each section. 1 0 Compliance letter. 1 0 Compli	Credit issue	Credits available	Credits targeted	Potential credits	Credit requirements	Evidence Required	Responsibility	Status	Notes
Security	Management		1 0						
10. Responsible construction practices 2	Man 01: Home User Guide	3	0	3		17		Outstanding	
Pack Construction afte impacts Pack					be submitted on the BRE website for this credit.	·	1 ' 1	Outstanding	
The Construction site impacts The Construction of the site of the second	Man 02: Responsible construction practices	2	0	2	Achieve a CCS score of at least 35, with at least 7 points in each section.	Compliance letter.	1	Outstanding	
1.02 Construction after impacts 1						Final CCS report	1	Outstanding	
Monitor, report and set surgets for emergy are arising from all excitations and sociations (CO emissions.) Monitor, report and set stargets for water consumption and gring from all excitations and sociations (CO emissions.) Monitor, report and set stargets for water consumption and gring from all excitations and stargets for water consumption and gring from all excitations and set all and fail themse suppliers and corresponding PFFC/FSC contribution. Monitor, report and set targets for water consumption and gring from all excitations and procurement plant.	Man 03: Construction site impacts	1	0	1	Carry out at least 2 of the following:	Completed Checklist A4	` ,	Outstanding	
associated COZ emissions. 3] Monitor, report and set largets for water consumption arising from site activities. 1) Main contractor operates an environmental materials policy (sustainable procurement plan). 1) Main contractor is 101 Mol control, report and set largets for water consumption and reports for certified. 2				_	, ·	·			
III Main contractor operates an environmental materials policy (sustainable procurement plant), vi Main contractor operates an environmental materials policy (sustainable procurement plant), vi Main contractor is 103 1400.0 certified. vi At least 80% of sile timber is either reclaimed, reused or responsible soured (75C certified).									
v) At least 80% of site timber is either reclaimed, reused or responsible soured (FSC certified). 2					iii) Main contractor operates an environmental materials policy (sustainable	certification			
Physical Security. Project management of ecological features 1 1 1 0 Ecology survey carried out and all existing features of ecology value are protected during construction. Project management 2 2 0 2 2 First credit: Roles and responsibilities are assigned to all members of the project team across key design and refurbishment stages. Second credit: Handower meeting arranged and at least two of the following actions carried out: 1					v) At least 80% of site timber is either reclaimed, reused or responsible soured (FSC		Contractor	Outstanding	
Stages 2-4). Contractor Stages 2-4). Contract	Man 04: Security	2	0	2			Contractor	Outstanding	Not currently targeted
Appointment Contractor Co						1	Contractor	Outstanding	Not currently targeted
1 1 0 Ecology survey carried out and all existing features of ecology value are protected during construction. 2 0 2 First creft foles and responsibilities are assigned to all members of the project team across key design and refurbishment stages. Second credit: Handworr meeting arranged and at least two of the following actions carried out: (i) A site inspection within three months of occupantion. (ii) Longer term after care (e.g. a helpline, nominated individual or other appropriate system) to support building users for at least the first 12 months of occupation. (iii) Longer term after care (e.g. a helpline, nominated individual or other appropriate system) to support building users for at least the first 12 months of occupation.						dwelling is SbD certified and that the principles and guidance of Section 2 (Physical Security) have been	Contractor	Outstanding	Not currently targeted
during construction. 106: Project management 2						·			
team across key design and refurbishment stages. Second credit: Handover meeting arranged and at least two of the following actions carried out: i) A site inspection within three months of occupation. ii) Conduct post-occupancy interviews with building occupants or a survey via phone or posted information within three months of occupation. iii) Longer term after care (e.g. a helpline, nominated individual or other appropriate system) to support building users for at least the first 12 months of occupation. Example meeting minutes from handover meeting to introduce the aftercare team and home user guide; present key information about how the building operates; and answer questions. Where appropriate this should also include demonstrations of newly installed equipment and an insight into their advantages. Information should be presented in a clear manner and with an appropriate level of technical terminology. Example meeting minutes from handover meeting to introduce the aftercare team and home user guide; present key information about how the building operates; and answer questions. Where appropriate this should also include demonstrations of newly installed equipment and an insight into their advantages. Information should be presented in a clear manner and with an appropriate level of technical terminology. Example meeting minutes from construction stage progress meeting Project brief Ridge Outstanding Outstanding	Man 05: Protection and enhancement of ecological features	1	1	0	during construction.	Ecology Report	Ecologist		
carried out: i) A site inspection within three months of occupation. ii) Conduct post-occupancy interviews with building occupants or a survey via phone or posted information within three months of occupation. iii) Longer term after care (e.g. a helpline, nominated individual or other appropriate system) to support building users for at least the first 12 months of occupation. Example meeting minutes from construction stage progress meeting Project brief the aftercare team and home user guide; present key information about how the building operates; and answer questions. Where appropriate this should also include demonstrations of newly installed equipment and an an insight into their advantages. Information should be presented in a clear manner and with an appropriate level of technical terminology. Example meeting minutes from construction stage progress meeting Project brief Ridge Outstanding Outstanding Outstanding	Man 06: Project management	2	0	2		1	Ridge	Outstanding	Not currently targeted
progress meeting Project brief Ridge Outstanding Outstanding					carried out: i) A site inspection within three months of occupation. ii) Conduct post-occupancy interviews with building occupants or a survey via phone or posted information within three months of occupation. iii) Longer term after care (e.g. a helpline, nominated individual or other appropriate	the aftercare team and home user guide; present key information about how the building operates; and answer questions. Where appropriate this should also include demonstrations of newly installed equipment and an insight into their advantages. Information should be presented in a clear manner and with an appropriate	Ridge	Outstanding	
						progress meeting	_		
						,			
Total credits: 11 1 10	= . 1 10	44	1	10		Example of contractor's regular progress report	Ridge	Outstanding	

Project name: 9 The Green Building type: Residential

Date: 04/01/2024 15

Version

Target score: 61.35

Target rating: VERY GOOD



Credit issue	Credits available	Credits targeted	Potential credits	Credit requirements	Evidence Required	Responsibility	Status	Notes
Health and Wellbeing		1		<u> </u>	<u> </u>	'		<u>'</u>
Hea 01: Daylighting	2	0	2	First credit: Complete Checklist A7 to confirm the refurbishment results in a neutral impact on ADFs in kitchens, living rooms, dining rooms and studies. Second credit: Each room meets the minimum daylighting requirements.	Completed Checklist A7; and ADF and uniformity calculations for kitchen, living room, dining rooms and studies.	Daylight Consultant	Appointment Required	Not currently targeted. Minimum daylighting levels: - Kitchens: ADF of at least 2% - Living rooms, dining rooms and studies: ADF of at least 1.5% - At least 80% of the working plan receives direct light from the sky.
Hea 02: Sound insulation	4	2	0	For noise transmittance between dwellings (separating walls and floors) for a historic building: 1 credit: No worse than the values determined pre-refurbishment 2 credits: 3dB improvement (airbourne amd impact sound insulation) 3 credits: 5dB improvement (airbourne amd impact sound insulation) 4 credits: 8dB improvement (airbourne amd impact sound insulation)	Acoustic report confirming airborne sound insulation values at least 5dB higher than Part E; and impact sound insulation values at least 5dB lower than Part E.	Acoustic Consultant	Appointment Required	
Hea 03: Volatile organic compounds	1	1	0	All decorative paints and varnishes meet the minimum VOC content levels and all products specified within at least five of the following product categories do not exceed the stated levels VOC emissions levels: wood panels, timber structures,	Finishes schedule clearly showing the make/model and manufacturer for all finishes used on walls, floors and ceilings.	Architect	Outstanding	
				wood flooring, resilient, textile and laminated floor coverings, suspended ceiling tiles, flooring adhesives, wall coverings, adhesives for hanging flexible wall coverings.	Corresponding certification confirming VOC emissions achieved and standard against which each product has been tested.	Architect & Contractor	Outstanding	
Hea 04: Inclusive design	2	2	0	Complete sections 1, 2 and 3 of Checklist A8.	Checklist A8 completed by access expert	Architect or Access Consultant	Outstanding	
Hea 05: Ventilation	2	2	0	One credit: minimum levels of background, extract and purge ventilation provided in accordance with Building Regulations Part F. Two credits: project complies in full with Section 5 of Building Regulations Part F.	Confirmation that the ventilation system has been designed to comply with Section 5 of Building Regulations Part F.	M&E consultant	Appointment Required	Project must achieve at least 1 credit in order to obtain a BREEAM rating.
					As-built information confirming Part F has been achieved in full.	Contractor	Outstanding	
Hea 06: Safety	1	1	0	Dwelling provided with compliant fire detection and alarm systems. Where mains gas is used within dwelling, compliant carbon monoxide detection and alarm systems must be installed.	Written statement confirming fire detection and alarm systems; and layouts showing location of detectors and alarms.	M&E consultant	Outstanding	Project must achieve at least 1 credit in order to obtain a BREEAM rating.
					As-built drawings confirming location of smoke detectors and alarms	Architect or Contractor	Outstanding	
Total credits:	12	8	2					
Ene 01: Improvement in energy efficiency rating	6	2.5	3.5	Credits awarded based on the improvement in the dwelling's EPC rating (see 'additional information tab' for details).	Pre-refurbishment (existing) and post-refurbishment (asbuilt) SAP worksheets for the dwelling	XCO2	Appointment Required	Please note two SAP calculations are required: one for the existing, pre-refurbishment development and one for the post-refurbishment development. NOTE: XCO2 will provide a preliminary assessment pre-planning, but the final as-built analysis would fall under a separate appointment.
Ene 02: Energy efficiency rating post-refurbishment	4	2	1.5	Credits awarded based on energy efficiency rating post-refurbishment (see 'additional information tab' for details).	Post-refurbishment (as-built) SAP worksheet for the dwelling.	XCO2	Appointment Required	Project must achieve at least 2 credits for "VERY GOOD". NOTE: XCO2 will provide a preliminary assessment pre-planning, but the final as-built analysis would fall under a separate appointment.
Ene 03: Primary energy demand	7	6	0	Credits awarded based on primary energy demand post refurbishment (see 'additional information tab' for details).	Post-refurbishment (as-built) SAP worksheet for the dwelling.	XCO2	Appointment Required	NOTE: XCO2 will provide a preliminary assessment pre-planning, but the final as-built analysis would fall under a separate appointment.
Ene 04: Renewable technologies	2	0	2	One credit: at least 10% of the dwelling's primary energy demand per annum is supplied by low or zero carbon technologies. Two credits: at least 15% of the dwelling's primary energy demand per annum is supplied by low or zero carbon technologies.	Post-refurbishment (proposed) SAP worksheet for the dwelling confirming LZC technologies (such as PVs) provide at least 15% of the dwelling's primary energy demand.	XCO2	Appointment Required	To achieve credits for this issue the development must achieve a primary energy demand for the dwelling of no greater than 220
Ene 05: Energy labelled white goods	2	2	0	First credit: fridges, freezers and fridge/freezers are A+ rated Second credit: washing machines are A++ rated, dishwashers A+ rated and waster- dryers / tumble dryers A rated.	Manufacturer's literature for all installed white goods (fridge-freezers, washing machines, tumble dryers and dishwashers).	Contractor	Outstanding	

Project name: 9 The Green
Building type: Residential
Date: 04/01/2024

Version 15

Target score: 61.35

Target rating: VERY GOOD



Credit issue	Credits available	Credits targeted	Potential credits	Credit requirements	Evidence Required	Responsibility	Status	Notes
					List of all installed white goods (including make/model and manufacturer)	Architect or Contractor	Outstanding	
Ene 06: Drying space	1	1	0	At least 6m of fixed drying line provided for 3+ bedroom properties.	Manufacturer's specification for proprietary system installed	Architect or Contractor	Outstanding	
Ene 07: Lighting	2	2	0	Internal lighting (one credit): Internal lighting has an average wattage of no more than 9 Watts/m ² .	As-built internal lighting layouts confirming location and type of installed light fittings	Architect or Contractor	Outstanding	
					Manufacturer's literature for installed light fittings confirming wattage.	Contractor	Outstanding	
				External lighting (one credit): External lighting and lighting in communal areas has an efficiency of greater than 45 lumens per circuit Watt.	As-built lighting schedule confirming location and type of light fittings in communal areas (entrances, stairs, etc.).	n/a	Complete	External lighting must include automatic control to prevent operation during daylight hours.
					Manufacturer's literature for each installed luminaire type confirming an energy efficiency of greater than 45 lumens per circuit watt.	n/a	Complete	
					As-built external lighting schedule confirming location and type of all external luminaires.	Contractor	Outstanding	
					Confirmation that external lighting will be controlled by a time clock or daylight sensor to avoid operation during daylight hours.	Contractor	Outstanding	
					List of all installed security lighting (if present) confirming burglar security lights have a maximum wattage of 150W, PIR control and daylight cut-off sensors. Confirmation that any other security lighting has energy efficiency of greater than 45 lumens per circuit watt and is fitted with daylight cut-off sensors or timers.	Contractor	Outstanding	
					Written confirmation that the lighting design follows the requirements of CIBSE LG9 and does not compromise the safety of any persons using the building.	Contractor	Outstanding	
Ene 08: Energy display devices	2	2	0	Compliant, fixed, display screen is installed allowing for monitoring of electricity and gas consumption. System must be capable of displaying the following information: 1. Local time 2. Current (real time) energy consumption (kilowatts and kilowatt hours) 3. Current (real time) estimated emissions (g/kg CO2) 4. Current (real time) tariff 5. Current (real time) cost (per hour) 6. Visual presentation of data (i.e. non-numeric) to allow consumers to easily identify high and low level of usage	Compliant M&E Specification AND Manufacturer's Literature confirming compliance with requirements.	M&E consultant or Contractor	Appointment Required	
Ene 09: Cycle storage	2	2	0	One credits: 1 cycle storage space provided Two credits: 2 cycle storage spaces provided	Drawing confirming location of cycle store; confirmation of number of spaces provided and security arrangements.	Architect	Complete	Shown on drawings, therefore complete as far as the Design Stage Assessment goes
Ene 10: Home office	1	1	0	Study cannot be located in kitchen or living room. Home office must have: two double power sockets; telephone point; window; adequate ventilation; and sufficient space to allow a desk, chair and filing cabinet or bookshelf.	Drawing showing location of home office; electrical layout confirming allocated room has sufficient services; GA drawings confirming allocated room has sufficient space.	Architect + M&E consultant	Outstanding	
Total credits:	29	20.5	7			•		

Project name: 9 The Green **Building type:** Residential

04/01/2024

/01/2024

Version 15

Target score: 61.35

Target rating: VERY GOOD



Credit issue	Credits available	Credits targeted		Credit requirements	Evidence Required	Responsibility	Status	Notes
Water								
Wat 01: Internal water use	3	2.5	0	Credits are awarded based on calculated water consumption.	Completed as-built water use schedule confirming type	Architect or	0	Minimum standard for Very Good = 1 credit.
				1 credit: less than 140 litres/person/day	of water fittings installed	Contractor	Outstanding	
				2 credits = less than 118 litres/person/day	Manufacturer's literature for each water using			
				2.5 credits = less than 107 litres/person/day	component confirming flow rate.	Contractor	Outstanding	
Wat 02: External water use	1	1	0	Compliant rainwater collection system specified for external or internal irrigation.	Manufacturer's literature for proprietary system installed	Architect or		
Wat 02. External water use	1 1	1	0	Compilant failtwater conection system specified for external or internal impation.	1	l	Outstanding	
					(e.g. water butt).	Contractor		
Wat 03: Water meter	1	1	0	Water meter linked to internal display screen to provide a visible display of mains	Compliance letter confirming specification of water			
				potable water consumption to occupants.	meter with visible display; M&E specification;	M&E consultant	Appointment	
					manufacturer's literature.	IVIQE CONSUITANT	Required	
Total credits	5	4.5	0					
Materials	1 -	4.5						
	1 25	T 0	1.0	TI DESCRIPTION OF THE PROPERTY	In	I		lar and a second
Mat 01: Environmental impact of materials	25	0	12	The BREEAM Domestic Refurbishment Mat 01 calculator is used to determine the	Completed as-built materials schedule including Green			Not currently targeted.
				number of credits awarded. Credits are awarded according to the impact of new	Guide ratings for build-ups and quantity information.	Contractor	Outstanding	To determine the actual number of credits achieved information
				materials according to their Green Guide rating and their impact on improving the		Contractor	Outstanding	must be provided for all newly specified materials (build-ups and
				thermal performance of the dwelling.				areas).
Mat 02: Responsible sourcing of materials				All timber and timber-based products used on the project meets the UK	Confirmation of all timber suppliers and corresponding			This is a minimum requirement for all BREEAM ratings.
	n/a	n/a	n/a	Government's definition of 'legally harvested and traded timber'.	FSC/PEFC certificates	Contractor	Outstanding	
								Man harman de Carta ad a atta a facilitat de la carta
	n/a	n/a	n/a	Where the principal contractor sources materials for the project in accordance with	Not targeted - assuming contractor is a 'Micro-enterprise	n/a	Outstanding	Not targeted - instead option for small contractors is targeted - sec
	, -	.,,	.,,	a documented sustainable procurement plan OR	(see below)	.,, -		line item below
	3	3	0	Where the principal contractor is a Micro-enterprise (<10 employees): Where the	Completed Checklist A9			
				principal contractor addresses parts 1, 2 AND 3 of Checklist A-9: Sustainable		Contractor	Outstanding	
				procurement statement three credits can be awarded				
	12	0	4	The available RSM credits can be awarded where the applicable building materials	As-built materials schedule confirming supplier			Four credits have been estimated as 'potenital' at this stage, for
	12				1	Cambusatan	0	
				are responsibly sourced in accordance with the BREEAM methodology.	information and responsible sourcing certifications.	Contractor	Outstanding	achieving at least 18% of the available RSM points.
Mat 03: Insulation	8	8	n/a	4 credits: insulation index for new insulation used in the building is ≥ 2 .	As-built materials schedule confirming insulation			
				4 credits: where ≥ 80% of the new thermal insulation used in the building elements	suppliers and products.			
				is responsibly sourced.		Contractor	Outstanding	
Total credits	48	11	16					
	10		10					
Waste				Inc. 15. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	L	ı		
Wst 01: Household waste	2	2	0	First credit: internal and external recycling facilities provided in accordance with	As-built drawings confirming location and size of internal	Architect	Outstanding	
				BREEAM requirements.	and external bins.			
				Internal storage dependent on collection scheme. If waste is sorted post-collection,	Details of waste management/collection			
				one internal bin can be provided; if waste streams are collected separately, three				
				internal bins must be provided. Recycling bins must be provided in addition to		Architect	Outstanding	
				general waste bins. Adequate external storage must also be provided.		Architect	Outstanding	
				general waste bills. Adequate external storage must also be provided.				
,				For dwellings with significant external private space, all of the following must be	Details of composting storage OR food waste collection			
				met	scheme in place (incl internal and external caddy storage			
				1 Where a composition continue of failth is any ideal for more / continue of 2				
				1 Where a composting service or facility is provided for green/garden waste; 2	space)	A	0	
	1	1		Where a composting service or facility is provided for kitchen waste; 3 Where an		Architect	Outstanding	
	1	1		interior container is provided for kitchen composting waste of at least seven litres.				
Wst 02: Refurbishment site waste management	3	1	2	Projects between £100,000 to £300,000:	Site Waste Management Plan			
	1	1		First credit: Compliant Site Waste Management Plan in place. Non-hazardous		Contractor	Outstanding	
	1	1		construction waste generated per £100,000 of project value no greater than 16.9				
				tonnes. At least 65% of non-hazardous construction waste (by weight) and 90% of	Final figures for construction waste generation and			Note: Further requirements come into play if the project value is
				non-hazardous demolition waste must be diverted from landfill.				greaterthan £300,000
				mon-nazaruous demonition waste must be diverted from landfill.	recycling rates.	Contractor	Outstanding	greater triair E300,000
T-1-1	-	2	2					
Total credits	5	3	2					

Project name: 9 The Green Building type: Residential 04/01/2024

Target score: 61.35 Target rating:

VERY GOOD

Version 15

Credit issue	Credits available	Credits targeted	Potential credits	Credit requirements	Evidence Required	Responsibility	Status	Notes
Pollution								
Pol 01: Nitrogen Oxide (NOx) emissions	3	3	0	Credits are dependent on the NOx emissions associated with space heating and hot water systems. No credits can be awarded if systems are powered by mains grid electricity (e.g. heat pumps).	Confirmation that the new boiler will generate no more than 40mg/kWh (Dry NOx)	M&E consultant and Contractor	Appointment Required	
Pol 02: Surface water run-off	3	1	1	One credit: Neutral impact on surface water Two credits: Reducing run-off from site (basic) Three credits: Reducing run-off from site (advanced)	Compliance letter; pre- and post-refurbishment drawings confirming no increase in impermeable area; drainage calculations.	Civil engineer and Contractor	Appointment Required	Neutral impact: Where there is no change in the size of the building footprint or hardstanding as a result of the refurbishment., OR where any new hardstanding areas are proposed, these are permeable, this must include all new pavements, driveways and where applicable public rights of way, car parks and non-adoptable roads).
					As-built drawings confirming no increase in impermeable area as a result of the development.	Contractor	Outstanding	
Pol 03: Flooding	2	0	2	FRA has been carried out and either the site is confirmed as 'low flood risk' or mitigation measures are implemented.	Flood risk assessment.	Civil Engineer / Flood Risk Consultant	Appointment Required	Not currently targeted
					Written confirmation that all recommendations within the flood risk assessment have been implemented.	Contractor	Outstanding	
Total credits:	8	4	3					
Innovation								
Man 05: Ecological enhancement	1	0	1	Implement all recommendations for enhancing site ecology (as listed in the Ecology Report).	Ecology Report	Ecologist	Appointment Required	This is already being carried out for the Non-Domestic RFO assessment.
Man 06: Early design input	n/a	n/a	n/a	Appointment of BREEAM AP to oversee key stages. OR	Compliance letter; early meeting minutes; BREEAM AP reports.	BREEAM AP	Outstanding	Not targeted - instead option for small projects is targeted - see line item below
	1	1	0	For small-scale projects (<5 dwellings): Appointment of BREEAM Assessor from early stages (prior to the production of a refurbishment specification).	Compliance letter; early meeting minutes; BREEAM Assessor notes.	BREEAM Assessor	Appointment Required	Note: XCO2's appointment covers this at the pre-planning stage, but continued appointment is required throughout the construction stages to award the credit
Man 06: Thermographic survey and air tightness testing	1	0	1	Where thermographic surveying and airtightness testing have been carried out at both pre-refurbishment and post-refurbishment stages.	Compliance letter.	Energy Consultant or Contractor	Appointment Required	If targeted, please note there is a requirement to complete two thermographic surveys - one before and one after the refurbishment works.
Hea 04: Inclusive design	1	0	1	Complete sections 1, 2 and 3 of Checklist A8.	Checklist A8 (sections 1-3) completed by access expert	Architect or Contractor	Outstanding	
Ene 08: Energy display devices	1	1	0	In addition to displaying information regarding electricity and gas use each device must be capable of recording historic consumption data for a minimum of two years.	Compliant M&E Specification AND Manufacturer's Literature confirming compliance with requirements.	M&E consultant	Appointment Required	
Total credits:	12	2	3	A maximum of 10 Innovation credits can be achieved per assessment.				