Welbeck Strategic Land II LLP

LAND AT COOMBE FARM, SAYERS COMMON

Energy and Sustainability Statement

Independent, multidisciplinary engineering and environmental consultants

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Energy and Sustainability Statement

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Client: Welbeck Strategic Land II LLP

Engineer: Create Consulting Engineers (Create) Limited
15 Princes Street
Norwich
Norfolk
NR3 1AF

Tel: 01603 877010
Email: enquiries@createce.co.uk
Website: www.createce.co.uk

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Revision/Date	Writer	Reviewer	Approver	Nature of Revision
Draft Issue October 2025	Mirza Baig, MSc., BEng. Mech, NDEA, OCDEA & Pooja Nair, MSc, BTech. Civil, BREEAM Assessor, LEED AP	Sunanda Swain, MSc., BREEAM Assessor, BREEAM AP, LEED AP	Sunanda Swain, MSc., BREEAM Assessor, BREEAM AP, LEED AP	
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EXECUTIVE SUMMARY

This Energy and Sustainability Statement has been prepared to support the outline planning application for the proposed residential development at Land at Coombe Farm, Sayers Common, BN6 9HY.

The proposed development lies within the jurisdiction of Mid Sussex District Council (MSDC). The energy and sustainability statement has been developed in accordance with the Mid Sussex District Local Plan 2014-2031 (Adopted 2018) and the National Planning Policy Framework (2024). The Energy and Sustainability Statement for the proposed development demonstrates that the design will holistically incorporate sustainable principles into the full range of sustainability aspects, including Energy and Water Efficiency, Flood Risk, Surface water runoff, Land and Ecology, Waste management, and Sustainable Transport/Accessibility, as set out in the Local Plan.

The Client is committed to minimising the use of fossil fuels wherever possible. As a result, this proposal emphasises the use of electricity, which is increasingly becoming cleaner and greener due to the widespread decarbonization of the grid.

To assess predicted carbon emissions, the SAP 10 fuel carbon factors have been used in line with Building Regulations Part L (2021).

At this stage of the design, a qualitative approach to evaluating proposed energy efficiency measures is deemed most appropriate to support an outline planning application for the development. However, the principles of the Energy Hierarchy,' Be Lean,' 'Be Clean,' and 'Be Green' have been adhered to within this report to meet local planning policy requirements.

'Be Lean – Use less energy':

The energy strategy for the proposed outline planning application focuses on reducing on-site energy demand through fabric energy efficiency measures. The approach prioritises superior passive design, the specification of energy-saving features, and the integration of low-carbon technologies within the building services design, achieving significant reductions in anticipated energy consumption and CO_2 emissions compared to a standard development.

The following measures could be incorporated within the Outline Application:

- Optimised building orientation to maximise solar gains and daylighting.
- Shading to mitigate overheating.
- Passive/ natural ventilation and enhanced use of natural daylight.
- Use of materials with high thermal mass in walls, floors, and roof.
- Thermally efficient glazing and high-performance insulation.
- High levels of airtightness.
- Low U-values throughout the building envelope.
- Limitation of thermal bridging through Accredited Construction Details.
- Highly efficient heating systems with advanced controls.
- Use of Low and zero-carbon technologies such as mechanical ventilation with heat recovery, where required, to maintain indoor air quality.
- 100% energy-efficient lighting throughout.

These measures aim to reduce CO_2 emissions from the proposed residential development by approximately 15–20% below the baseline set by the current Building Regulations, primarily through passive design, a highly

efficient building fabric, and efficient heating systems. The design will continue to evolve with a focus on optimising building fabric and services efficiency.

'Be Clean – Supply energy efficiently':

If a heat network exists nearby, the development should connect to it. Local authorities and heat network operators have been consulted, but after reviewing the Heat Network Planning Database, it was found that the proposed development is too far from any existing or proposed heat network. Consequently, the scheme will proceed with an all-electric system, with provisions to connect to a heat network in the future if one becomes viable.

'Be Green – Supply energy from renewable sources.':

Policy DP39 of the Mid Sussex Local Plan requires all new development to minimise energy consumption and incorporate low- or zero-carbon (LZC) energy technologies.

A feasibility study was undertaken to assess the suitability of incorporating low and zero-carbon (LZC) technologies on-site. The study identified the following technologies as the most viable for this development:

- High-efficiency heat pumps
- On-site photovoltaic (PV) systems
- Solar thermal panels

A highly optimised energy strategy has been developed, incorporating passive design principles, high-performance building fabric, efficient building services, advanced controls, and appropriate LZC technologies. Through the integration of both passive and active measures, the proposed development aims to achieve a 75–80% reduction in CO_2 emissions compared to the baseline set by current Building Regulations, significantly exceeding the requirements of the Mid Sussex Local Plan.

Summary of Sustainability Strategies

- Sustainable Travel and Transport: The proposed development is supported by strong transport links via the B2118, A23, bus services, and nearby rail connections, alongside enhanced pedestrian and cycle routes. The Development also provide parking and cycle provision as per WSCC standards. A Travel Plan and off-site improvements, including upgraded footways, bus stop enhancements, and safe access for service vehicles, aim to encourage sustainable travel while ensuring traffic impacts are robustly assessed.

- Water: All dwellings will feature flow control devices and water-efficient fixtures to limit internal water use to less than 110 litres per person per day.

- Climate change: The development will be designed to withstand future climate conditions, minimising risks such as flooding, heat island effects and overheating.

- Biodiversity and landscape: Although some biodiversity loss is expected, the scheme will implement compensatory measures, including the Planting of new trees and native species and the Installation of bird and bat boxes to enhance ecological value.

- Air quality: The proposed development's air quality impact is expected to be negligible. The impacts on sensitive receptors during the construction phase will be high and sort-term, which can be mitigated by implementing appropriate mitigation measures.

- Noise: The noise assessment shows the site is acoustically viable, with background noise limits of 45 dB by day and 36 dB at night, requiring careful ventilation strategies, acoustic barriers, fencing, and façade design to meet national standards. With these measures, including noise control for building services, the development can provide a high-quality acoustic environment, and noise is not considered a barrier to planning approval.

- Land pollution: Land Contamination study identified potential contamination sources such as historic agriculture, nearby industry, landfill, radon, and UXO, but all risks to residents, workers, water, and the wider environment were assessed as low or negligible. The assessment concludes there is no significant contamination, and exposure risks to future residents are negligible.

- Light Pollution: The site's lighting strategy prioritises safety while protecting sensitive ecological habitat features such as ancient woodland, hedgerows, and bat corridors, using measures like warm-spectrum LEDs, directional fittings, motion sensors, reduced spill, and strict avoidance of illumination near habitats. With these mitigation measures, the construction phase impacts due to light spill on nocturnal species and their habitats will be minor and short-term, and the operational effects are negligible, ensuring compliance and ecological protection.

- FRA and SUDS: A Flood Risk Assessment confirms the site lies in Flood Zone 1 with low risk from all flooding sources, and infiltration is not feasible due to clay bedrock. A sustainable drainage strategy using an attenuation basin and controlled discharge ensures compliance with national and local policies.

- Landscape and Ecology: The ecological assessment found the site to have low to moderate ecological value, with species-poor grassland but important features such as ancient woodland edges, hedgerows, mature trees, and low levels of bats, reptiles, and breeding birds. With mitigation during construction, native planting, habitat enhancements, and biodiversity net gain measures, the development is expected to improve local ecological value without significant impacts on protected species or designated sites.

- Material management: Where practicable, new building materials will be sourced locally to reduce transport-related emissions and support the local economy. New materials will be selected based on their environmental impact, and responsible suppliers will be used where possible.

- Waste management: Adequate facilities will be provided for domestic operational and construction-related wastes, including segregated bins for refuse and recycling.

The Applicant has embraced a sustainable design approach by incorporating efficient Low and Zero-Carbon (LZC) technologies. This ensures compliance with the policies outlined in the adopted local plan and the National Planning Policy Framework (2024).

1.0 INTRODUCTION

1.1 Create Consulting Engineers Ltd has been appointed by Welbeck Strategic Land II LLP to prepare an Energy Statement in support of an outline planning application for the proposed development at Land at Coombe Farm, Sayers Common, BN6 9HY.

1.2 It has been understood that this is an outline planning application (with all matters reserved except for access) comprising a residential development of up to 210 dwellings (Use Class C3); with associated access, landscaping, amenity space, drainage and associated works.

1.3 This report details the sustainability measures incorporated in the development at Land at Coombe Farm, Sayers Common, in line with relevant Local, Regional, and National planning policies.

Site Location and Description

1.4 The proposed development lies within the jurisdiction of Mid Sussex District Council (MSDC). The Site is bounded by the A23 to the east and the B218 to the west. The red-line boundary extends around existing residential dwellings, which are to be retained, with the Sayers Common village to the north-west of the site.

1.5 The Site, located in West Sussex approximately 200m south of Sayers Common (within the civil parish of Hurstpierpoint and Sayers Common), comprises 13ha of fields and Coombe Wood to the southeast of the village, which has a rich historic core and, since the partial bypassing of the A23 in the 1990s, has grown as a popular residential settlement; the Site lies around 4.7km west of Burgess Hill, 14km north of Brighton, and 23km south of Gatwick Airport.

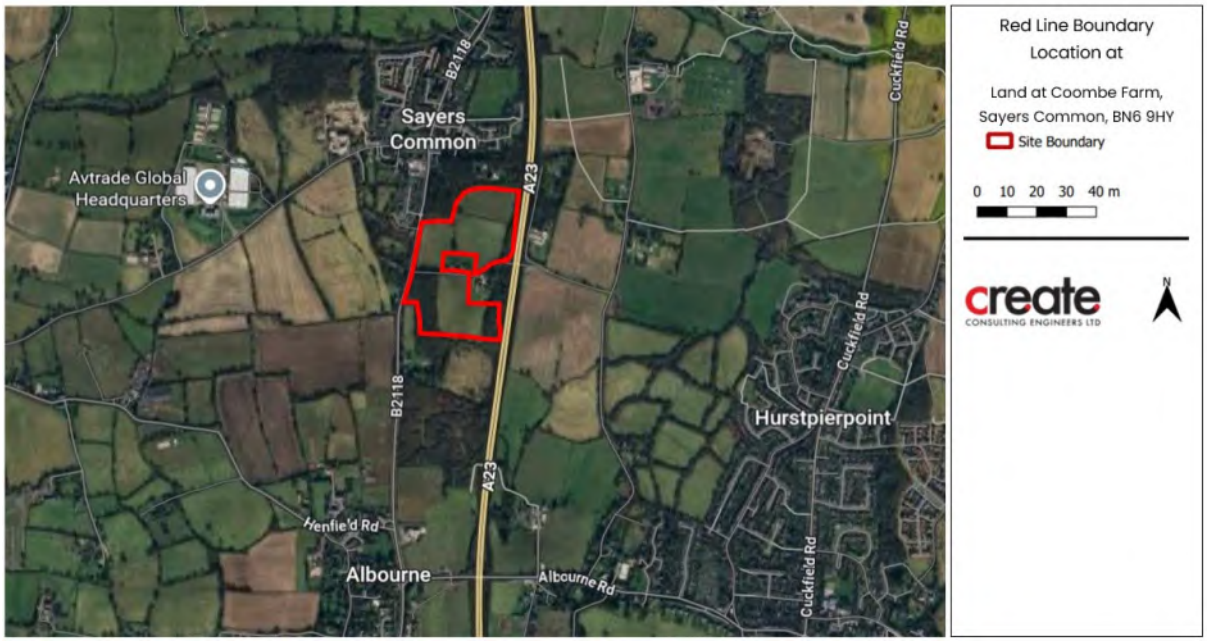


Figure 1.1: Site red line boundary (Source: Google Maps)

1.6 The proposed development will comprise the construction of approximately 210 numbers of residential dwellings with private gardens, soft landscaping, hardstanding for access and infrastructure. The proposed housing mix complies with the requirements set out in draft Policy DPH7 of the Emerging Mid Sussex District Local Plan (2021–2039). Details of the housing mix percentages specified in Policy DPH7 are provided in Table 1.1. The layout and distribution of dwellings across the site are illustrated in Figure 1.2: Proposed Site Masterplan.

Figure 1.2: Proposed Site Masterplan (Source: Pegasus Group)

Tenure Type	1 Bed / 2 Person	2 Bed / 4 Person	3 Bed / 5 Person	4+ Bed / 6 Person
Market Housing	5–10%	20–25%	40–45%	25–30%
Affordable Ownership	10–15%	50–55%	25–30%	5–10%
Affordable Rented	30–35%	40–45%	15–20%	5–10%

Table 1.1: Housing Mix Requirements (Draft Policy DPH7, Emerging Mid Sussex District Local Plan 2021–2039)

Objectives

1.7 The objectives of this report are to:

- Demonstrate how the proposed development has been assessed against the policy requirements of the Mid Sussex District Local Plan (2018).
- Identify the passive and active design measures that are to be adopted to ensure that the design complies with Part L1A 2021 of the Building Regulations.
- Identify the most suitable energy-efficient design approach for the scheme, the feasibility of Low and Zero Carbon technologies, and operational Best Practices.
- Identify the drivers relating to an energy-efficient design over and above minimum compliance with current Building Regulations and energy targets.
- Identify areas for consideration at the initial stages of the project to facilitate the incorporation of the principles of sustainable design and construction, pertaining to energy efficiency and carbon emission reduction, water efficiency, materials efficiency, sustainable waste management and pollution reduction strategy into the design of the development.

Report Structure

1.8 This introductory section is followed by a comprehensive review of national, regional, and local policies on energy, sustainability and best practice standards. Sections 3-5 contain the results of the energy assessment, addressing measures taken to mitigate the effects of climate change and enhance the energy efficiency of the scheme, as well as reducing CO_2 emissions. The remaining Sections 6-12 detail the sustainability strategy for the scheme related to Flood Risk, Surface Water Run-Off, Ecology, Pollution, Sustainable Construction Processes, Materials & Recycling, Sustainable Transport and Accessibility.

2.0 CURRENT AND FUTURE PLANNING POLICIES/GOOD PRACTICE REVIEW AND PROJECT REQUIREMENTS

Climate Change Act 2008 (2050 Target Amendment)

2.1 On 26th November 2008, the UK Government published the Climate Change Act 2008, the world's first long-term legally binding framework to mitigate against climate change. The Act initially set legally binding targets for greenhouse gas emissions reduction of 80% by 2080 (from 1990 levels). This was amended in 2019 to a revised target of a 100% reduction in carbon emissions by 2050, over the 1990 baseline emissions levels, known as the net-zero target. In addition, there are interim carbon budget levels, which provide stepping stones to achieve the overall target.

National Planning Policy Framework December 2024

Planning for climate change

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

2.3 The need to mitigate and adapt to climate change should also be considered in preparing and assessing planning applications, taking into account the full range of potential climate change impacts.

2.4 New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through incorporating green infrastructure and sustainable drainage systems; and
b) help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings in plans should reflect the Government's policy for national technical standards.

2.5 To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts);
b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

2.6 In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

2.7 Local planning authorities should also give significant weight to the need to support energy efficiency and low carbon heating improvements to existing buildings, both domestic and non-domestic (including through installation of heat pumps and solar panels where these do not already benefit from permitted development rights). Where the proposals would affect conservation areas, listed buildings or other relevant designated heritage assets, local planning authorities should also apply the policies set out in chapter 16 of this Framework.

2.8 When determining planning applications for all forms of renewable and low carbon energy developments and their associated infrastructure, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and give significant weight to the benefits associated with renewable and low carbon energy generation and the proposal's contribution to a net zero future;
b) recognise that small-scale and community-led projects provide a valuable contribution to cutting greenhouse gas emissions;
c) in the case of applications for the repowering and life-extension of existing renewable sites, give significant weight to the benefits of utilising an established site.

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

Future Home Standard

2.10 The Future Homes Standard (FHS) is a key part of the UK's strategy to achieve net zero carbon emissions by 2050. It aims to significantly improve the energy efficiency of new homes while reducing their carbon footprint. The FHS focuses on decarbonising heating and hot water systems, minimising heat loss, and replacing existing technologies with low-carbon alternatives.

2.11 From 2025 onwards, all new homes in England will be required to meet the FHS, which mandates a 75–80% reduction in carbon emissions compared to homes built to the 2013 Building Regulations. This step change will ensure that new housing developments are fit for a low-carbon future, aligning with national climate commitments.

2.12 Homes built to the FHS are required to be 'zero-carbon ready' and designed so that they won't require retrofitting to benefit from the decarbonisation of the electricity grid and transition of electric heating.

2.13 By prioritising high levels of fabric efficiency and integrating low-carbon technologies, the FHS represents a significant move towards sustainable construction practices and the delivery of homes that are both energy-efficient and environmentally responsible.

Local Planning Policy

Mid Sussex District Local Plan 2014-2031 (Adopted in 2018)

- Policy DP1: Sustainable Economic Development

Strategic Objectives:
7) To promote a place which is attractive to a full range of businesses, and where local enterprise thrives; and
8) To provide opportunities for people to live and work within their communities, reducing the need for commuting.

Evidence Base: Burgess Hill Employment Sites Study; Coast to Capital Strategic Economic Plan; Gatwick Diamond Strategy; Mid Sussex Economic Development Strategy, Northern West Sussex Economic Growth Assessment; Housing and Economic Development Needs Assessment.

The total number of additional jobs required within the district over the plan period is estimated to be an average of 543 jobs per year. This will be achieved by:

- *Encouraging high quality development of land and premises to meet the needs of 21st century businesses;*
- *Supporting existing businesses, and allowing them room to expand;*
- *Encouraging inward investment, especially the location, promotion and expansion of clusters or networks of knowledge, creative or high technology industries; and*
- *Seeking the provision of appropriate infrastructure to support business growth – in particular high speed broadband connections.*

Provision for new employment land and premises will be made by:

- *Allocating 25 hectares of land as a high-quality business park at Burgess Hill to the east of Cuckfield Road;*
- *Allocating further sites within the Site Allocations DPD;*
- *Incorporating employment provision within large scale housing development as part of a mixed use development where it is appropriate; and*
- *Allowing new small-scale economic development, in the countryside, including tourism (in accordance with Development in the Countryside policies).*

The development of a Science and Technology Park has been proposed to support research and development and provide high quality employment for the wider area. The Coast to Capital Strategic Economic Plan identifies a broad location to the west of Burgess Hill. This broad location is indicated on the Policies Map. The Council would consider any such proposals taking into account:

- *how the proposal demonstrates that it would contribute to meeting the overall objectives of this policy;*
- *how the proposal demonstrates that the development would comprise uses falling within the definition of a 'Science Park' as set out by the UK Science Park Association, alongside appropriate ancillary uses required to serve the development and its employees;*

- *how the proposal would secure the objectives of policy DP21: Transport, particularly in terms of delivering sustainable transport; and*
- *the identification of and response to environmental, ecological and landscape constraints on and around the site and how the proposal demonstrates that it would achieve a high quality of design, layout, ecological protection and enhancement, and landscaping to address the objectives of Policies DP26: Character and Design, DP37: Trees, Woodlands and Hedgerows, and DP38: Biodiversity.*

Effective use of employment land and premises will be made by:

- *Protecting allocated and existing employment land and premises (including tourism) unless it can be demonstrated that there is no reasonable prospect of its use or continued use for employment or it can be demonstrated that the loss of employment provision is outweighed by the benefits or relative need for the proposed alternative use;*
- *Permitting appropriate intensification, conversion, redevelopment and/ or extension for employment uses providing it is in accordance with other policies in the Plan;*
- *Giving priority to the re-use or adaptation of rural buildings for business or tourism use and to the diversification of activities on existing farm units (in accordance with Development in the Countryside policies).*

Neighbourhood Plans should:

- *Identify the needs of local businesses and their local residents for employment opportunities and any areas requiring economic regeneration, infrastructure provision or environmental enhancement as required by paragraph 21 of the National Planning Policy Framework; and*
- *Allocate sufficient land within their towns and villages to meet these needs.*

If monitoring indicates that there is an insufficient supply of allocated employment sites to meet the District's jobs needs, then the Council will consider allocating sites through a Site Allocations Development Plan Document, produced by the District Council.

- Policy DP21: Transport

Strategic Objectives: 6) To ensure that development is accompanied by the necessary infrastructure in the right place at the right time that supports development and sustainable communities. This includes the provision of efficient and sustainable transport networks; and 15) To create places that encourage a healthy and enjoyable lifestyle by the provision of first class cultural and sporting facilities, informal leisure space and the opportunity to walk, cycle or ride to common destinations.

Evidence Base: Mid Sussex Transport Study; West Sussex Transport Plan 2011-2026.

Development will be required to support the objectives of the West Sussex Transport Plan 2011-2026, which are:

- *A high quality transport network that promotes a competitive and prosperous economy;*
- *A resilient transport network that complements the built and natural environment whilst reducing carbon emissions over time;*
- *Access to services, employment and housing; and*
- *A transport network that feels, and is, safer and healthier to use.*

To meet these objectives, decisions on development proposals will take account of whether:

- *The scheme is sustainably located to minimise the need for travel noting there might be circumstances where development needs to be located in the countryside, such as rural economic uses (see policy DP14: Sustainable Rural Development and the Rural Economy);*
- *Appropriate opportunities to facilitate and promote the increased use of alternative means of transport to the private car, such as the provision of, and access to, safe and convenient routes for walking, cycling and public transport, including suitable facilities for secure and safe cycle parking, have been fully explored and taken up;*
- *The scheme is designed to adoptable standards, or other standards as agreed by the Local Planning Authority, including road widths and size of garages;*
- *The scheme provides adequate car parking for the proposed development taking into account the accessibility of the development, the type, mix and use of the development and the availability and opportunities for public transport; and with the relevant Neighbourhood Plan where applicable;*
- *Development which generates significant amounts of movement is supported by a Transport Assessment/Statement and a Travel Plan that is effective and demonstrably deliverable including setting out how schemes will be funded;*
- *The scheme provides appropriate mitigation to support new development on the local and strategic road network, including the transport network outside of the district, secured where necessary through appropriate legal agreements;*
- *The scheme avoids severe additional traffic congestion, individually or cumulatively, taking account of any proposed mitigation;*
- *The scheme protects the safety of road users and pedestrians; and*
- *The scheme does not harm the special qualities of the South Downs National Park or the High Weald Area of Outstanding Natural Beauty through its transport impacts.*

Where practical and viable, developments should be located and designed to incorporate facilities for charging plug-in and other ultra-low emission vehicles.
Neighbourhood Plans can set local standards for car parking provision provided that it is based upon evidence that provides clear and compelling justification for doing so.

- Policy DP26: Character and Design

Strategic Objectives: 2) To promote well located and designed development that reflects the District's distinctive towns and villages, retains their separate identity and character and prevents coalescence; 4) To protect valued characteristics of the built environment for their historical and visual qualities; 12) To support sustainable communities which are safe, healthy and inclusive; and 14) To create environments that are accessible to all members of the community.

Evidence Base: CABE Good Practice Guidance.
All development and surrounding spaces, including alterations and extensions to existing buildings and replacement dwellings, will be well designed and reflect the distinctive character of the towns and villages while being sensitive to the countryside. All applicants will be required to demonstrate that development:

- *is of high quality design and layout and includes appropriate landscaping and greenspace;*

- *contributes positively to, and clearly defines, public and private realms and should normally be designed with active building frontages facing streets and public open spaces to animate and provide natural surveillance;*

- *creates a sense of place while addressing the character and scale of the surrounding buildings and landscape;*

- *protects open spaces, trees and gardens that contribute to the character of the area;*

- *protects valued townscapes and the separate identity and character of towns and villages;*

- *does not cause significant harm to the amenities of existing nearby residents and future occupants of new dwellings, including taking account of the impact on privacy, outlook, daylight and sunlight, and noise, air and light pollution (see Policy DP29);*

- *creates a pedestrian-friendly layout that is safe, well connected, legible and accessible;*

- *incorporates well integrated parking that does not dominate the street environment, particularly where high density housing is proposed;*

- *positively addresses sustainability considerations in the layout and the building design;*

- *take the opportunity to encourage community interaction by creating layouts with a strong neighbourhood focus/centre; larger (300+ unit) schemes will also normally be expected to incorporate a mixed use element;*

- *optimises the potential of the site to accommodate development.*

- Policy DP28: Accessibility

Strategic Objectives: 12) To support sustainable communities which are safe, healthy and inclusive; 13) To provide the amount and type of housing that meets the needs of all sectors of the community; and 14) To create environments that are accessible to all members of the community.

Evidence Base: CABE Good Practice Guidance; Mid Sussex Whole Plan and CIL Viability Assessment (2016); DCLG Technical Housing Standards – nationally described space standard, March 2015; Housing and Economic Development Needs Assessment.

All development will be required to meet and maintain high standards of accessibility so that all users can use them safely and easily.

This will apply to all development, including changes of use, refurbishments and extensions, open spaces, the public realm and transport infrastructure, and will be demonstrated by the applicant.

With regard to listed buildings, meeting standards of accessibility should ensure that the impact on the integrity of the building is minimised.

Accessible and Adaptable Dwellings

Developments of 5 or more dwellings will be expected to make provision for 20% of dwellings to meet Category 2 – accessible and adaptable dwellings under Building Regulations – Approved Document M Requirement M4(2), with the following exceptions:

Where new dwellings are created by a change of use;

Where the scheme is for flatted residential buildings of fewer than 10 dwellings;

Where specific factors such as site topography make such standards unachievable by practicable and/or viable means;

Where a scheme is being proposed which is specifically intended for the needs of particular individuals or groups, where a greater proportion may be appropriate.

Wheelchair-user dwellings

Category 3 – Wheelchair-user dwellings under Building Regulations – Approved Document M Requirement M4(3) will be required for a reasonable proportion of affordable homes, generally 4%, dependent on the suitability of the site and the need at the time.

The Requirement will also apply to private extra care, assisted living or other such schemes designed for frailer older people or others with disabilities and those in need of care or support services.

- Policy DP29: Noise, Air and Light Pollution

Strategic Objectives: 3) To protect valued landscapes for their visual, historical and biodiversity qualities; and 12) To support sustainable communities which are safe, healthy and inclusive.

Evidence Base: Data held by Environmental Health, Air Quality Action Plan – Stonepound Crossroads, Hassocks.

The environment, including nationally designated environmental sites, nationally protected landscapes, areas of nature conservation or geological interest, wildlife habitats, and the quality of people's life will be protected from unacceptable levels of noise, light and air pollution by only permitting development where:

Noise pollution:

- *It is designed, located and controlled to minimise the impact of noise on health and quality of life, neighbouring properties and the surrounding area;*
- *If it is likely to generate significant levels of noise it incorporates appropriate noise attenuation measures;*

Noise sensitive development, such as residential, will not be permitted in close proximity to existing or proposed development generating high levels of noise unless adequate sound insulation measures, as supported by a noise assessment are incorporated within the development.

- *In appropriate circumstances, the applicant will be required to provide:*
- *an assessment of the impact of noise generated by a proposed development; or*
- *an assessment of the effect of noise by an existing noise source upon a proposed development;*

Light pollution:

- *The impact on local amenity, intrinsically dark landscapes and nature conservation areas of artificial lighting proposals (including floodlighting) is minimised, in terms of intensity and number of fittings;*
- *The applicant can demonstrate good design including fittings to restrict emissions from proposed lighting schemes;*

Air Pollution:

- *It does not cause unacceptable levels of air pollution;*
- *Development on land adjacent to an existing use which generates air pollution or odour would not cause any adverse effects on the proposed development or can be mitigated to reduce exposure to poor air quality to recognised and acceptable levels;*
- *Development proposals (where appropriate) are consistent with Air Quality Management Plans.*

The degree of the impact of noise and light pollution from new development or change of use is likely to be greater in rural locations, especially where it is in or close to specially designated areas and sites.

- Policy DP38: Biodiversity

Strategic Objectives: 3) To protect valued landscapes for their visual, historical and biodiversity qualities; and 5) To create and maintain easily accessible green infrastructure, green corridors and spaces around and within the towns and villages to act as wildlife corridors, sustainable transport links and leisure and recreational routes.

Evidence Base: Biodiversity 2020; Biodiversity Action Plan; Biodiversity Opportunity Areas; Green Infrastructure mapping; Habitats and Species Records; Mid Sussex Ancient Woodland Survey; Mid

Sussex Infrastructure Delivery Plan; The Natural Choice: Securing the Value of Nature; West Sussex SNCI Register.

Biodiversity will be protected and enhanced by ensuring development:

- *Contributes and takes opportunities to improve, enhance, manage and restore biodiversity and green infrastructure, so that there is a net gain in biodiversity, including through creating new designated sites and locally relevant habitats, and incorporating biodiversity features within developments; and*

- *Protects existing biodiversity, so that there is no net loss of biodiversity. Appropriate measures should be taken to avoid and reduce disturbance to sensitive habitats and species. Unavoidable damage to biodiversity must be offset through ecological enhancements and mitigation measures (or compensation measures in exceptional circumstances); and*
- *Minimises habitat and species fragmentation and maximises opportunities to enhance and restore ecological corridors to connect natural habitats and increase coherence and resilience; and*
- *Promotes the restoration, management and expansion of priority habitats in the District; and*
- *Avoids damage to, protects and enhances the special characteristics of internationally designated Special Protection Areas, Special Areas of Conservation; nationally designated Sites of Special Scientific Interest, Areas of Outstanding Natural Beauty; and locally designated Sites of Nature Conservation Importance, Local Nature Reserves and Ancient Woodland or to other areas identified as being of nature conservation or geological interest, including wildlife corridors, aged or veteran trees, Biodiversity Opportunity Areas, and Nature Improvement Areas.*

Designated sites will be given protection and appropriate weight according to their importance and the contribution they make to wider ecological networks.

Valued soils will be protected and enhanced, including the best and most versatile agricultural land, and development should not contribute to unacceptable levels of soil pollution.

Geodiversity will be protected by ensuring development prevents harm to geological conservation interests, and where possible, enhances such interests. Geological conservation interests include Regionally Important Geological and Geomorphological Sites.

- Policy DP39: Sustainable Design and Construction

Strategic Objectives: 1) To promote development that makes the best use of resources and increases the sustainability of communities within Mid Sussex, and its ability to adapt to climate change.

Evidence Base: Gatwick Sub Region Water Cycle Study; West Sussex Sustainable Energy Study, Mid Sussex Sustainable Energy Study.

All development proposals must seek to improve the sustainability of development and should where appropriate and feasible according to the type and size of development and location, incorporate the following measures:

- *Minimise energy use through the design and layout of the scheme including through the use of natural lighting and ventilation;*
- *Explore opportunities for efficient energy supply through the use of communal heating networks where viable and feasible;*
- *Use renewable sources of energy;*
- *Maximise efficient use of resources, including minimising waste and maximising recycling/ re-use of materials through both construction and occupation;*

- *Limit water use to 110 litres/person/day in accordance with Policy DP42: Water Infrastructure and the Water Environment;*

- *Demonstrate how the risks associated with future climate change have been planned for as part of the layout of the scheme and design of its buildings to ensure its longer term resilience.*

- Policy DP40: Renewable Energy Schemes

Strategic Objectives: 1) To promote development that makes the best use of resources and increases the sustainability of communities within Mid Sussex, and its ability to adapt to climate change.

Evidence Base: Gatwick Sub Region Water Cycle Study; Capacity of Mid Sussex District to Accommodate Development Study; Mid Sussex Landscape Capacity Study; Mid Sussex Sustainable Energy Study; West Sussex Sustainable Energy Study.

Proposals for new renewable and low-carbon energy projects (other than wind energy development – see below), including community-led schemes, will be permitted provided that any adverse local impacts can be made acceptable, with particular regard to:

- *Landscape and visual impacts, including cumulative impacts, such as on the setting of the South Downs National Park and High Weald Area of Outstanding Natural Beauty, and the appearance of existing buildings;*
- *Ecology and biodiversity, including protected species, and designated and non-designated wildlife sites;*
- *Residential amenity including visual intrusion, air, dust, noise, odour, traffic generation, recreation and access.*

Assessment of impacts will need to be based on the best available evidence, including landscape capacity studies.

Proposals for wind energy development involving one or more wind turbines will only be granted if:

- *the development site is in an area identified as suitable for wind energy development in a Neighbourhood Plan; and*
- *following consultation, it can be demonstrated that the planning impacts identified by affected local communities have been fully addressed and therefore the proposal has their backing.*

- Policy DP41: Flood Risk and Drainage

Strategic Objectives: 1) To promote development that makes the best use of resources and increases the sustainability of communities within Mid Sussex, and its ability to adapt to climate change; and 12) To support sustainable communities which are safe, healthy and inclusive.
Evidence Base: Gatwick Sub Region Water Cycle Study; Strategic Flood Risk Assessment; Water. People. Places SuDS guidance.

Proposals for development will need to follow a sequential risk-based approach, ensure development is safe across its lifetime and not increase the risk of flooding elsewhere. The District

Council's Strategic Flood Risk Assessment (SFRA) should be used to identify areas at present and future flood risk from a range of sources including fluvial (rivers and streams), surface water (pluvial), groundwater, infrastructure and reservoirs.

Particular attention will be paid to those areas of the District that have experienced flooding in the past and proposals for development should seek to reduce the risk of flooding by achieving a reduction from existing run-off rates.

Sustainable Drainage Systems (SuDS) should be implemented in all new developments of 10 dwellings or more, or equivalent non-residential or mixed development

unless demonstrated to be inappropriate, to avoid any increase in flood risk and protect surface and ground water quality. Arrangements for the long term maintenance and management of SuDS should also be identified.

For the redevelopment of brownfield sites, any surface water draining to the foul sewer must be disconnected and managed through SuDS following the remediation of any previously contaminated land.

SuDS should be sensitively designed and located to promote improved biodiversity, an enhanced landscape and good quality spaces that improve public amenities in the area, where possible.

The preferred hierarchy of managing surface water drainage from any development is:

- *Infiltration Measures*
- *Attenuation and discharge to watercourses; and if these cannot be met,*
- *Discharge to surface water only sewers.*

Land that is considered to be required for current and future flood management will be safeguarded from development and proposals will have regard to relevant flood risk plans and strategies.

- Policy DP42: Water Infrastructure and the Water Environment

Strategic Objectives: *1) To promote development that makes the best use of resources and increases the sustainability of communities within Mid Sussex, and its ability to adapt to climate change; 6) To ensure that development is accompanied by the necessary infrastructure in the right place at the right time that supports development and sustainable communities. This includes the provision of efficient and sustainable transport networks.*

Evidence Base: *Building Regulations (Approved Document G); Gatwick Sub Region Water Cycle Study; DCLG Housing Standards Review: Technical Consultation, September 2014; South East Water - Water Resources Management Plan 2014, Strategic Flood Risk Assessment.*

New development proposals must be in accordance with the objectives of the Water Framework Directive, and accord with the findings of the Gatwick Sub Region Water Cycle Study with respect to water quality, water supply and wastewater treatment and consequently the optional requirement under Building Regulations – Part G applies to all new residential development in the district.

Development must meet the following water consumption standards:

- *Residential units should meet a water consumption standard of 110 litres per person per day (including external water use);*
- *Non-residential buildings should meet the equivalent of a 'Good' standard, as a minimum, with regard to the BREEAM water consumption targets for the development type.*

Development proposals which increase the demand for off-site service infrastructure will be permitted where the applicant can demonstrate;

- *that sufficient capacity already exists off-site for foul and surface water provision. Where capacity off-site is not available, plans must set out how appropriate infrastructure improvements approved by the statutory undertaker will be completed ahead of the development's occupation; and*
- *that there is adequate water supply to serve the development.*

Planning conditions will be used to secure necessary infrastructure provision.

Development should connect to a public sewage treatment works. If this is not feasible, proposals should be supported by sufficient information to understand the potential implications for the water environment.

The development or expansion of water supply or sewerage/sewage treatment facilities will normally be permitted, either where needed to serve existing or proposed new development, or in the interests of long-term water supply and waste water management, provided that the need for such facilities outweighs any adverse land use or environmental impacts and that any such adverse impact is minimised.

Building Regulations Approved Document Part L

2.14 Part L of the current Building Regulations (2021) focuses on reducing carbon emissions in new and existing buildings. As the proposal involves an outline planning application that includes the construction of new residential dwellings, the development falls under the scope of Part L1A: 2021, which applies to new dwellings.

2.15 The overall structure of compliance with the 2021 Building Regulations for new buildings includes five criteria to comply with:

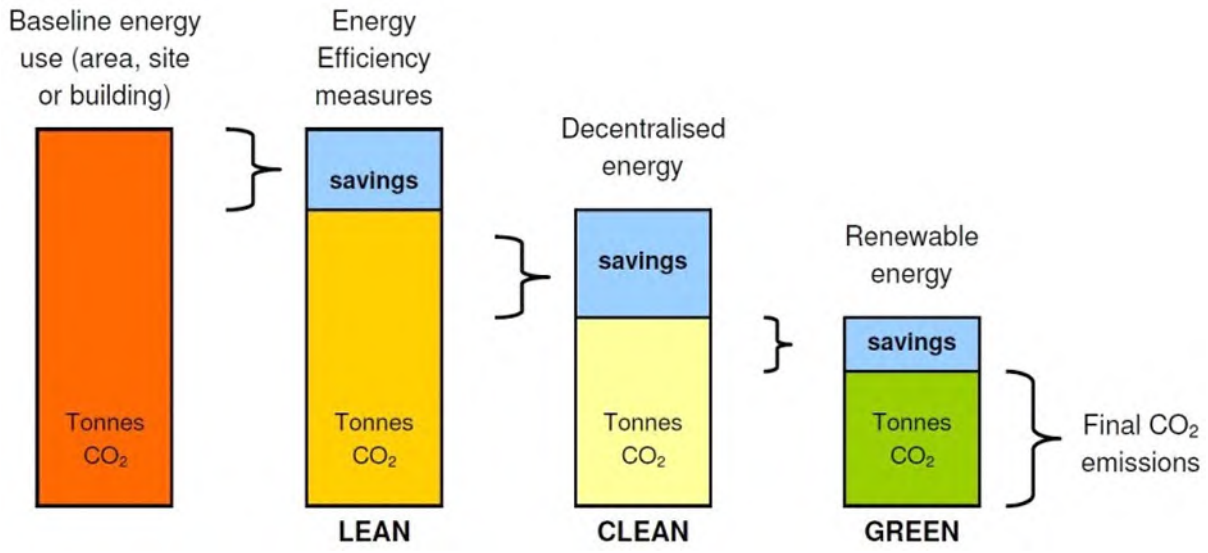
- **Criterion 1** – The Dwelling/Building Emission Rate (DER/BER) should be better than the Target Emission Rate (TER) and Dwelling/Building Primary Energy Rate should not exceed the Target Primary Energy Rate.
- **Criterion 2** – Limit on design flexibility;
- **Criterion 3** – Limiting effects of heat gain in summer;
- **Criterion 4** – Commissioning and airtightness;
- **Criterion 5** – Efficient operation of buildings.

2.16 The detailed energy strategy for the scheme will be developed to ensure the scheme meets the relevant requirements of the Building Regulations.

3.0 ENERGY EFFICIENCY STRATEGY – 'BE LEAN'

Introduction

3.1 The proposed energy strategy has, as its first priority, minimised energy consumption through the performance of the building envelope and services. The following section details the energy efficiency features of the development.



3.2 This analysis includes:

- Building Regulations Approved Document L1 and L2 (2021) initial compliance assessment, identifying the potential for the design to comply with and exceed Building Regulations requirements and meet and exceed the Local Plan requirements.
- An energy demand assessment of the proposed scheme contained within this document provides carbon dioxide emissions estimates from the analysis of passive energy efficiency enhancements and Low and Zero Carbon potential. This will use SAP 10 carbon dioxide fuel factors.

3.3 In further detail, the energy efficiency strategy of the scheme has been achieved by incorporating the following design and technology features:

Energy Efficiency Features

3.4 The proposed development at Land at Coombe Farm, Sayers Common, will adopt an ambitious *fabric-first* approach to reduce primary energy demand significantly. This will be further reduced by the use of on-site low-carbon technologies to meet anticipated construction standards, which are likely to target zero-carbon performance. The following section outlines the preliminary energy strategy for the proposed development as part of this outline application.

Physical Form and Orientation of the Building

3.5 Passive solar design involves adapting the internal layout and glazing to best respond to the local climate and annual sun path, to reduce energy demands and improve occupant comfort through

the use of heat and light from the sun. Good orientation will make the dwellings take advantage of the sun and prevailing wind at the site and can significantly improve comfort and reduce heating and cooling needs.

3.6 Passive solar heating techniques will be implemented using thermal mass, heat flow, and effective insulation to store, distribute, and retain heat during winter periods. Both cooling and heating techniques will be considered. Passive cooling options, such as shading, improved insulation, natural ventilation, and landscape features, will also be explored.

3.7 Overheating will be avoided wherever possible by taking advantage of the surrounding natural environment. The positioning of existing and proposed trees will be considered to take advantage of their natural shading abilities during the summer, but also to maintain a good level of natural daylight in the living areas of the dwellings. This will reduce reliance on artificial lighting and thus limit energy consumption.

Building Envelope Specification and Thermal Performance

3.8 A 'fabric first' approach has been used to minimise the heating and cooling requirements of the building and associated systems.

3.9 The heat losses of the spaces will be reduced by optimising the thermal performance of the building fabric and limiting the air permeability through a very high standard of construction. This strategy will lead to a steady but extremely low space heating load for all of the spaces of the scheme.

3.10 Building fabric thermal transmittance is measured by the U-value of each building element in Watts/m²/K. The U-Value is essentially a measure of the rate at which energy is lost through a building element; the greater the U-Value, the higher the rate of energy loss.

3.11 The outline application includes a proposed residential development comprising 51 dwellings. The development will be required to comply with the building fabric performance standards set out in Approved Document Part L1A: 2021

3.12 A comparison between a typical specification that meets the 2021 Building Regulations and a more ambitious specification designed to anticipate future building standards is presented in Table 3.1 below. The proposed development shall seek to incorporate values that exceed the building fabric element standards of Part L1A and L2A:2021 (Criteria 2 – Limits on design flexibility)

Building Element/ Characteristic	Part L1A Limiting U-values	Potential Proposed Values
External Wall - U value (W/m²K)	0.26	0.16
Ground/Exposed upper floor	0.18	0.10
Roof - U value (W/m²K)	0.16	0.10
Windows - U value (W/m²K)	1.60	1.10
Doors - U value (W/m²K)	1.60	1.00
Design Air Permeability (m³/hr/m² @50Pa)	8	3.00
Thermal Bridges	Accredited Construction Details	Standard Accredited Construction Details

Table 3.1: Building Fabric Standard Specified for the residential development (Outline Application)

3.13 The building fabric U-values and air tightness for the development are expected to meet or exceed the Part L1/L2:2021 standards for building fabric elements, as indicated in Table 3.1 above, and will enable the dwellings' Fabric Energy Efficiency (DFEE) rate to be equal to or lower than the Part L1/L2:2021 Target Fabric Energy Efficiency (TFEE) rate.

3.14 Thermal bridges will be reduced through the application of Accredited or Bespoke Construction Details, or similar, to most of the junctions. It has been proposed that the following junctions will be constructed to the high ACD standard, or will be independently modelled, contributing towards the energy and CO_2 emissions reduction from the development:

- Lintels, sills and jambs;
- Ground floor/external wall;
- Intermediate floors/external wall;
- Eaves/external wall;
- Gable/external wall;
- Party walls between dwellings;
- Roofs between dwellings;
- Balconies – thermally broken structure penetrating wall insulation – bespoke psi-value calculation, e.g., Schoeck standard (psi-value approx. 0.32W/mK).

Air Tightness and Ventilation Strategy/Scope for Natural Ventilation

3.15 Ventilation is the intentional introduction of outdoor air into the building to maintain good air quality. It can be either natural using windows or a mechanical ventilation system or mixed-mode ventilation. The design will incorporate good natural ventilation and air-tightness measures to improve the thermal performance of dwellings and reduce the risk of condensation. Mechanical ventilation with heat recovery could be considered along with natural ventilation. This strategy will help to mitigate overheating risk if present. However, this will be further analysed at the design stage.

3.16 Air permeability is a measure of infiltration. It indicates how often the entire air quantity in a building is exchanged with outside air within 1 hour without any ventilation in place. Any air exchange with outside air is carrying heat energy away from the building, resulting in a higher heating load. Lower air permeability levels are desirable for conserving heat energy and in the case of mechanical ventilation systems for reducing fan power consumption. Infiltration is different from ventilation. Infiltration is essentially unwanted air exchanges through imperfections in the building fabric while ventilation is the air exchanges intended by the designer. To comply with building regulations, the typical target values for air permeability are as follows: 3 $m^3/m^2 \cdot h$ @ 50 Pa for dwellings.

3.17 To provide adequate ventilation in dwellings with such low levels of air permeability, a system that continuously supplies fresh air is required. Currently, the most efficient way to achieve this is through Mechanical Ventilation with Heat Recovery (MVHR). This system not only provides continuous ventilation but also enhances energy efficiency by recovering heat from the exhaust air and using it to warm the incoming air during the winter months. The system can be switched off during warmer months through the use of a summer bypass. The MVHR Summer Bypass mode will provide free cooling to all habitable spaces by supplying fresh air from outside when the outside temperature is less than or equal to 21°C and room temperatures exceed 26°C. A typical MVHR system has a heat exchange efficiency of 92% and a specific fan power (SFP) of 0.55-1.07 W/l/s.

Overheating

3.18 Overheating in UK dwellings has become a major concern due to several factors such as anthropogenic climate change, high summer temperature, an increase in the number of hot days during summer and poor building design. A high level of ventilation helps reduce energy demand but has the potential to increase ambient air temperature in the building. Similarly, low ventilation rate, increased glazing areas can contribute to overheating. The design of dwellings will incorporate various strategies to reduce overheating risks while minimising increases in energy demand and CO_2 emissions.

3.19 Overheating will be mitigated through the inclusion of openable windows to enable effective purge ventilation. All windows facing south-east, south, and west could be fitted with low g-value glazing to limit solar thermal gains.

3.20 Shading control systems, in the form of individually controlled interior opaque blinds, are recommended to provide effective solar control, as they offer both solar shading and glare reduction. This enhances occupant comfort and reduces the risk of overheating within the building. Any required blinds should be incorporated into the base build and designed so as not to interfere with the operability of the windows.

3.21 Additionally, mechanical ventilation units with a boost mode and a summer by-pass facility, as described in the paragraph above, could be installed in each dwelling, providing ventilation and free cooling during spring and summer nights without compromising the security of the dwellings.

3.22 External heat gain will be reduced through orientation, shading, fenestration, insulation etc. Internal heat gains will be reduced through energy-efficient design, proper insulation of piping networks, energy-efficient appliances and lighting.

3.23 Planting trees around the dwellings can regulate microclimate and reduce ambient air temperature. Hence, they help in reducing overheating risks.

3.24 The occupiers will be provided with guidance on how to reduce energy use within dwellings, which will help reduce internal gains and thus minimise the risk of overheating.

3.25 The above-mentioned passive and active design measures should be sufficient to ensure thermal comfort within the residential dwellings of the proposed development. However, if required, a detailed overheating analysis should be undertaken in accordance with CIBSE TM59 and Approved Document Part O to verify compliance and performance.

Envelope Tightness

3.26 The envelope tightness can be ascertained by using a combination of the following techniques such as thermal imaging, blower door testing, and visual inspections. The defects in the building envelope should be rectified. Note that the types of issues typically found are improperly insulated access panels, air leaks at room corners and around window and door frames, missing or compacted wall insulation, air infiltration at lighting fixtures, and a host of other energy-wasting defects.

3.27 Envelope tightness should be ascertained by using a combination of the following techniques:

- Blower door testing
- Thermal Imaging

3.28 The building envelope should achieve the desired results.

Lighting and Appliances

3.29 High-efficiency, low-energy lighting and controls have been specified throughout. All new spaces will utilise 100% low-energy lighting.

3.30 Lighting will be designed in accordance with CIBSE (Chartered Institute of Building Service Engineers) Guide A: Environmental Design and relevant CIBSE Lighting Guides.

3.31 Unnecessary light spill will be reduced by avoiding the use of external decorative lighting; providing fittings only where they are required for security and maintenance purposes. It is recommended that external luminaires be selected to minimize sky glow and light spill, and positioned to ensure that only the required level of illumination is provided.

3.32 Energy efficiency of white goods and appliances shall be considered while procuring those for the scheme if those are to be installed by the developer. The current EU energy rating scheme for appliances in the UK is a scale from A to G, which replaced the previous A+++ to D scale on March 1, 2021. An A-grade appliance will use the least kW per hour, and a G-grade appliance will use the most. Information on the EU Energy Efficiency Labelling Scheme will be provided below.

- An A rating is more energy efficient than the previous A+++
- A+++ is now equivalent to a B or C rating.
- A++ is now equivalent to a D or E rating.
- A+ is now equivalent to an F or G rating.

Internal Heat Gains

3.33 Internal heat gains are generated by the utilisation of electrical devices, or by thermal emission of artificial lighting, pipe work and by the activity of occupants as metabolic heat. This can be reduced by providing adequate insulation of pipes, duct system and water heater, installing energy-efficient lighting, household appliances and equipment and having adequate ventilation strategies. Doubling the energy efficiency of lighting, for example, will reduce heat gain from lighting by 50%. Improving the motor and fan efficiency of HVAC equipment is an important way to reduce heat gain.

Electric Vehicles

3.34 After the launch of the Government's Road to Zero strategy, in which it states its intention to end the sale of new petrol and diesel vehicles by 2040, a requirement to install charging points in all new build homes will be incorporated into the next release of the building regulations (Approved Document Part S: Infrastructure for Charging Electric Vehicles)

3.35 It is therefore recommended that provisions be made for all homes in the proposed development to include an EV charging point, and for businesses to be provided with EV charging points commensurate with the predicted building occupancy.

The Choice and Design of Building Systems and Plant

3.36 The building systems and plant have been chosen to optimise the efficiency of the systems by matching installed capacity to anticipated building demand. Items of equipment, which make up the building's mechanical building services installation, will be specified to achieve high annual energy efficiency in operation and will be serviced regularly to maintain their performance.

3.37 The proposed method for supplying heating and hot water to the dwellings could be via air source heat pumps (ASHPs). This approach minimises the use of fossil fuels in line with current building regulations and SAP guidance. Space heating will be delivered through underfloor heating distribution pipes or low-temperature radiators. The efficiency of the proposed system is expected to be in the range of 380–420% (SCOP: 3.8–4.2). The heating system will be controlled by a programmer for each heating zone, supplemented by thermostats and thermostatic radiator valves (TRVs).

3.38 Distribution pipes and all hot water storage tanks will be well insulated to minimise heat losses from the system.

3.39 Heat pumps would provide not only an energy-efficient ('Lean') strategy for the development but also a 'Green' solution, i.e., LZC technology. Heat pumps are further described in Section 5 of this report.

3.40 The installation of energy efficiency systems such as Wastewater Heat Recovery (WWHR) could also be considered, as these will assist in improving the energy efficiency of each individual dwelling. WWHR systems work by recovering heat from wastewater, typically from showers, and diverting it back into the water heating system. This results in lower energy demand and, therefore, lower carbon emissions and running costs.

Commissioning and Handover

3.41 To make sure that the dwellings and their systems are performing as designed, testing and commissioning shall be carried out before they are handed over to the occupiers. All control services covered under building regulations need to be commissioned (Parts F, L and J). Pre-testing of building fabric helps to make sure the targeted fabric performance levels are met in practice when the main air barrier is still easily accessible. This will help to make long-term repairs relatively easily, if required.

3.42 Design review shall be undertaken and a commissioning plan shall be developed for the commissioning, performance testing, handover, and post-handover stages. Appropriate project team members that be appointed to conduct and manage commissioning activities.

3.43 All building systems such as hot water, heating, ventilation, comfort cooling and LZC technologies that are present, will be commissioned in line with the manufacturer's guidance and appropriate commissioning best practice guidance by individuals who were not involved in the installation.

3.44 For complex building services and system such as communal systems with a centralised plant, a specialist commissioning manager shall be appointed to conduct and manage commissioning activities.

3.45 The schedule of the commissioning and testing shall detail a suitable timescale for the commissioning and re-commissioning of all complex and non-complex building services and control systems and the testing and inspection of building fabrics.

3.46 The schedule shall identify the appropriate standards for all commissioning activities to be conducted, where applicable, by:

- Current Building Regulations.
- BSRIA guidelines.
- CIBSE guidelines.
- Other appropriate standards.

Energy Demand Calculation Methodology

3.47 For the outline application, detailed energy modelling has not been undertaken, as the design is still at an early stage. However, an indicative estimate of potential carbon emissions reduction has been calculated using example energy modelling based on the accommodation schedule and the proposed dwelling types.

3.48 The approved energy demand calculation methodologies for domestic dwellings are described below. These will be used at the full planning application and detailed design stage to inform the design of the development and to ensure the requirements of the Building Regulations and Planning Policy are met.

3.49 The carbon emissions reduction has been calculated based on SAP 10 carbon factors for gas and electricity.

Standard Assessment Procedure (SAP)

3.50 The Standard Assessment Procedure (SAP) forms the basis for demonstrating compliance with Part L1A/Volume 1 of the Building Regulations 2021 and, as such, will be used to estimate the energy efficiency features required for Part L compliance, as well as to predict the annual building regulated energy demand, consumption and CO_2 emissions of the residential units.

3.51 The SAP assessment is carried out for indicative dwellings, the SAP in line with the AD Part L 2021. The latest version of SAP will be used to calculate the carbon emissions and primary energy demand of the residential part of the development at a later stage, when the design progresses.

3.52 The SAP methodology determines a Dwelling Emission Rate or 'DER' and Dwelling Primary Energy Demand. This value is compared to the energy requirements and emissions of a notional dwelling of the same shape and dimensions, which determines a compliant building (the Target Emissions Rate or 'TER' and Target Primary Energy Demand).

3.53 The DER calculation determines the regulated energy use and emissions, which are described as the energy used for space and water heating as well as lighting, pumps and fans. Unregulated energy is the energy used for cooking and appliances, and is not included in Approved Document Part L.

Example Modelling

3.54 Example modelling has been conducted for dwellings using the proposed values for building fabric U-values for dwellings, as outlined in Table 3.1. This modelling provides a reference point for evaluating the effectiveness of proposed energy efficiency measures and low-carbon technologies against standard development benchmarks.

Results of the Energy Simulation

3.55 The total CO_2 emissions have been estimated using energy modelling results for selected sample dwellings, in the form of semi-detached, detached, and terraced houses. The regulated CO_2 emissions for the proposed dwellings within the scheme are estimated to be approximately 244.7 tonnes per year, as summarised in the table below. Detailed calculations are provided in the TER worksheets in Appendix B and the Carbon Calculation Spreadsheet in Appendix A.

	Carbon Dioxide Emissions for residential dwellings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	244.7	-
After energy demand reduction (be lean)	171.2	-
Improvement over Part L1A: 2021	73.5	tCO_2 per annum
	30%	

Table 3.2: Estimated CO_2 emissions from the Baseline development and Be Lean case for Residential development

3.56 At the Be Lean stage, the optimised building fabric and efficient services are expected to improve the Part L Target Emission Rate (TER) by approximately 15–20% for the residential dwellings within the proposed development, compared to the baseline set by the current building regulations.

3.57 To comply with the local plan, which requires minimising energy consumption and promoting the use of renewable energy, the proposed development will incorporate low-carbon and renewable energy technologies. A study of feasible systems for the development at Land at Coombe Farm, Sayers Common, is summarised in Section 4 of this report.

4.0 'BE CLEAN' – SUPPLY ENERGY EFFICIENTLY

4.1 Connection to a decentralised energy network and the use of combined heat and power are recognised methods of generating energy more efficiently. The Mid Sussex Local Plan encourages all new developments to reduce CO_2 emissions by using renewable energy and local energy systems where suitable. Development proposals should explore opportunities to link to an existing or planned decentralised energy network. Where an existing decentralised energy network is not present, major developments should undertake a detailed investigation into the feasibility of establishing a District Heating Network with the proposed development as an anchor heat load or contribute towards such feasibility work.

Decentralised Energy Networks

4.2 According to data from the Heat Network Planning Database (HNPD), the are no nearby potential heat networks closer to the development site.

4.3 In situations where there are no existing connections for a decentralised heat network, and there are no immediate plans to incorporate decentralised energy sources into the development area, it's essential to explore various options and factors. These include the establishment of key infrastructure components like:

- Energy Centre
- Plant equipment and associated pipework within this centre
- Primary heating network
- Substations
- Provision for a temporary boiler space
- Secondary heating network
- Metering systems
- Heat interface units (HIUs).

5.0 LOW AND ZERO CARBON TECHNOLOGIES – 'BE GREEN'

Overview

5.1 The final step in the energy hierarchy requires that the clean generation of energy by renewable energy technologies be examined.

5.2 The following section is a discussion of the various low and zero-carbon technologies that are currently available, with an appraisal of each one as to the potential suitability for installation within the development. As the scheme develops, and new technologies emerge, or existing technologies become more or less viable, all will continue to be assessed on an ongoing basis.

Low and Zero Carbon Technology	Suitability for the proposed development
Heat Pumps	**YES**
Photovoltaic Panels	**YES**
Solar thermal panels	**YES**
Biomass boilers	**NO**
Gas CHP	**NO**
Wind turbines	**NO**

Table 5.1: Review of suitability of LZC technology for the site

Heat Pumps

5.3 ASHPs are currently considered the most suitable option for providing heating to the development. The choice of air source heat pumps was dictated by the Client's desire to utilise low carbon energy sources and to eliminate the use of more carbon intensive fuels (gas, LPG, oil).

5.4 Heat pumps are a thermodynamic device based on the vapour compression cycle. The four elements of the refrigeration circuit are: the evaporator, compressor, heat exchanger and condenser. The heat, which is extracted from the medium goes through a number of processes and is distributed throughout individual dwellings through a standard wet central heating system. Heat pumps utilise electricity to drive their pumps and compressor units. They are essentially a form of efficient electric heating. The efficiency of a heat pump is rated by its coefficient of performance (CoP).

5.5 The CoP is a measure of the electricity input to the system and the heat energy extracted. Several factors affect the CoP of a heat pump; the consistency of the heat source and the required output temperature. A consistent heat source (such as the ground) will deliver greater efficiencies than a heat source that varies seasonally. Also, heat pump efficiency is greatest when the required output temperature rise is lowest; hence heat pumps are commonly paired with under floor heating systems that require lower flow temperatures than conventional radiator emitters.

5.6 The viability of a heat pump system depends on the heat load and usage profile of the building to be served. Heat pumps can generally offer efficient space heating but have to be carefully designed to provide domestic hot water throughout the year. Given the high standard of building fabric, the hot water heating load will be dominant for the residential units while space heating loads will be relatively low.

5.7 Air Source Heat Pumps (ASHPs) are generally reliable with maintenance frequency comparable to a standard boiler. Heat pumps have to be carefully sized with heat losses considered at an early design stage.

5.8 The energy resource is solar energy stored in the air, which is plentiful. Most UK sites are suitable. The pumps have a life expectancy of around 20 years.

5.9 ASHPs do require a suitable external location for placing the condenser unit. The space required is small and typically easily concealed but care needs to be taken to prevent accidental damage.

Figure 5.1: ASHP – External Unit

5.10 Heat pumps have been identified as a very suitable heating method for the site. Preliminary calculations demonstrate that the residential development can comfortably exceed the local plan requirements, achieving a 35-50% reduction in carbon emissions compared to the baseline set by the current building regulations at BeGreen Stage.

5.11 Further assessment of the system will be undertaken for the development; however, it is anticipated that all dwellings could be effectively heated using heat pumps.

Photovoltaic (PV)

5.12 Photovoltaic (PV) cells directly convert sunlight into electrical current using semiconductors. The output of a cell is directly proportional to the intensity of the light received by the active surface of the cell. The location and positioning of PV cells is therefore critical to achieving acceptable performance. Exposure to sunlight causes electricity to flow through the cells. Mono-crystalline PV cells provide higher levels of electricity generating performance over other panel types. PV panels can be incorporated into a range of building designs and positions, provided they are located in a shade-free environment and facing as close to south as possible.

5.13 The usable roof area for PV panels for the residential dwellings is anticipated to be sufficient.

5.14 PV panels are particularly sensitive to overshading, so careful consideration should be given to the possible obstructions before selecting this technology. The most suitable panels' orientation is due

south, south-east or south-west, however horizontally mounted panels provide a good amount of 'free' energy, only 12% less than energy produced by south facing collectors.

5.15 To limit the visual impact of the system on the development solar slates or mini panels could be fitted on roofs imitating the roofs' finish and therefore increasing the attractiveness of the system. A number of in-roof mounting systems are also available on the market to fit into the roof structure and blend with the surrounding architectural features. Please refer to the Figures below for examples of suitable PV systems.

Figure 5.2: Mini PV panels

Figure 5.3: In-roof mounting systems

Figure 5.4: Solar slates

5.16 Photovoltaic systems have minimal maintenance requirements. It is generally restricted to periodic visual inspection and cleaning of the panels, especially those mounted horizontally. Installation may be more problematic on roofs with many dormer windows and roof lights. Large arrays may need electrical infrastructure upgrade.

5.17 An inverter will be required to convert the DC output from the panels into AC for domestic consumption.

5.18 The proposed dwellings will have sufficient roof space to support the installation of photovoltaic panels. When combined with air source heat pumps, these systems can substantially reduce emissions. The option to install PV panels will be evaluated further based on financial viability and technical feasibility, and on the basis of their potential to contribute to additional emission reductions.

Results of Energy Simulation:

5.19 Table 5.2 presents the estimated emission reductions for the residential development at Land at Coombe Farm, Sayers Common. The integration of heat pumps and PV systems offers an effective approach to achieving a 40–60% reduction in emissions at the BeGreen stage.

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	244.7		
Be lean	171.2	73.5	30%
Be clean	171.2	0.0	0%
Be green	53.8	117.5	48%
Total Savings	-	190.9	78%

Table 5.2: Residential -On-Site Emission Reduction (BeGreen)

5.20 Example energy modelling has been conducted for a representative sample of dwellings within the proposed development. The modelling includes efficient building fabric, energy-efficient services such as MVHR, and LZC technologies like heat pumps and photovoltaic panels. The results show a potential ~78% reduction in CO_2 emissions compared to the Part L1A 2021 regulations, as summarised in Table 5.2. Detailed SAP worksheets for the BeGreen stage are provided in Appendix C.

5.21 The proposed development is projected to achieve a 75–80% reduction in on-site carbon emissions compared with the Building Regulations 2021 baseline, exceeding the minimum requirements of Mid Sussex's Local Plan for new dwellings to incorporate sustainability principles and demonstrate energy efficiency.

5.22 The proposed residential dwellings will be designed to aim for compliance with the Future Homes Standard and achieve the equivalent of Code for Sustainable Homes Level 4 by delivering significant carbon reductions over earlier building regulation benchmarks.

Standard	Target Reduction
Future Homes Standard	75–80% over Part L1A 2013
Proposed Development Aspirational Target	75-80% over Part L1A 2021

Table 5.3: Comparison of Proposed Development Performance Against Standards

Solar Thermal Hot Water

5.23 Solar water systems use the energy radiated by the sun and convert it into useful heat in the form of hot water.

5.24 SHW systems use heat collectors/panels mounted on the roof in which a fluid is heated by the sun. This fluid is circulated through a hot water cylinder within the building which heats the stored water. Collectors should be mounted on southwest to southeast facing roofs or flat roofs orientated at this angle, at an elevation of between 10° and 60°. Sufficient space inside the building needs to be allocated for the heat exchange cylinder which stores the domestic hot water heated during the day and supplied for later use.

5.25 Heat will be transferred and stored in a central thermal store. The solar panel system would ideally supply approximately 45-55% of the development's domestic hot water requirement; the remainder of energy required for domestic hot water would be supplied by the gas boilers within the individual residential unit.

5.26 Solar hot water installations are ideally suited to residential units, given their relatively constant and significant hot water demand. Providing sufficient hot water storage is installed, this technology is well-suited technically to the residential part of the development.

5.27 Usually, a system consisting of only 1 to 2 solar thermal panels is needed to reduce the dwelling's energy demand by 10-15%, and therefore, it is safe to assume that sufficient unshaded roof area for this application would be available on every residential unit on the site.

5.28 A SHW system requires solar panels, some additional piping and a modified hot water storage tank, but generally does not require many system changes to a standard building. In addition, SHW is a very mature technology with multiple suppliers of proven systems.

5.29 The suitability of the system is compromised by its visual impact. Evacuated tube collectors are visually intrusive and therefore used less often on bigger estates. In-roof flat plate panels are visually more suitable for traditional dwellings; however, the feasibility of incorporating solar thermal hot water systems can be further investigated.

Figure 5.5: Evacuated Tube Solar Thermal Panels

Bio-fuels

5.30 Bio-fuels have the potential to contribute to the reduction of CO_2 emissions of various developments by using this fuel within a boiler or CHP plant. Biofuels are considered to have low or zero CO_2 intensities as theoretically the CO_2 released when these fuels are combusted is no greater than the CO_2 that has been absorbed from the atmosphere when the plants grew.

5.31 However, there are a number of issues which must be considered with this type of fuel in urban locations:

- Potential air quality impacts with combusting bio-fuels in urban areas, in particular elevated NOx emissions and particulates and must be addressed.
- Transporting this type of fuel increases lorry movements into and out of town, affecting congestion and transport emissions. The relatively rapid degradation of biodiesel would require appropriately sized on-site storage tanks with regular fuel deliveries.
- Importantly, the actual bio-diesel CO_2 intensity cannot be guaranteed due to variations in fuel stock supplier, demand, the energy input processing the fuel and CO_2 emissions due to growing, harvesting and processing the base fuel.
- Biofuel availability is currently uncertain due to unknown future supply and demand. Whilst an increase in demand for larger developments may stimulate the supply chain, availability could change with variation in demand. Transport is likely to have the most significant impact on the biofuel industry over emerging building demand.
- Socio-economic issues from growing and harvesting feedstock, with potential impacts on food production, particularly for biodiesel that is imported. Solid biofuels have a lesser impact in this area.
- On-site fuel storage requirements demanding additional space, along with regular access to the on-site fuel storage area.
- Increased plant maintenance is generally required, adding to costs and plant down-time.

Wind Turbines

5.32 Electricity is produced from wind energy by linking a generator to a turbine which is generally a horizontal axis three-blade design. Electricity is then converted to AC for use in the dwellings. Turbines are generally mounted on slender towers sufficiently high to maximise the wind energy which may be captured and to isolate the turbine from disturbance to wind patterns caused by adjacent dwellings.

5.33 Electricity generated at any one time by a wind turbine is highly dependent on the speed and direction of the wind. The wind speed is dependent on a number of factors, such as location within the UK, height of the turbine above ground level and nearby obstructions. There are also issues with planning such as visual impact, noise and conservation issues which have to be considered.

5.34 However, the development site at Land at Coombe Farm, Sayers Common, is located in an area where stand-alone turbines would make an obvious impact on the local landscape and be likely to raise considerable local opposition and encounter problems in planning. The turbines may also be unpopular with the residents of the new development. Further concerns exist relating to the issue of visual "flicker" and possible noise problems. These concerns are all heightened by the fact that any turbine would need to be of significant size to make a meaningful contribution to the site's energy demand. Therefore, although this option is technically feasible (wind regime permitting), it is not recommended unless no other more suitable technologies are available.

6.0 TRANSPORT

6.1 Sustainable transport links are central to sustainable development. They provide a positive contribution to the environment and to the societal and economic sustainability of the places they serve. The provision of alternative sustainable transport options and associated facilities reduces dependency on fossil fuel-based transport options and provides the following benefits.

- Encourages active travel and helps improve occupants' health and wellbeing;
- Reduce traffic congestion and encourage clean travel, which improves the local air quality; and
- Provides cost savings compared with maintaining and running traditionally fuelled cars.

6.2 Paul Basham Associates Ltd were commissioned to carry out the transport assessment and travel plan in support of the outline planning application for the proposed development.

6.3 The site currently comprises agricultural land with a public bridleway running through it. It is situated in close proximity to nearby settlements, including Albourne, Hurstpierpoint, and Burgess Hill, which offer a range of facilities.

6.4 The site is well connected by the B2118 and A23, with accessible pedestrian and cycle networks, including public rights of way, and National Cycle Routes nearby.

6.5 Public transport links are strong, with local bus services adjacent to the site and rail connections available at Hassocks and Burgess Hill, supporting sustainable travel options.

6.6 The proposed development will deliver 210 residential dwellings with vehicular access from the B2118 via a new priority junction, designed to accommodate all vehicles while safeguarding land for a potential future signalised junction.

6.7 Pedestrian and cycle connectivity is central to the scheme, with retained and enhanced public rights of way, new footways, crossings, and internal links that promote sustainable travel and connect to nearby bus stops.

6.8 Off-site improvements include upgrading existing footways, formalising nearby bus stops with shelters, and improving a refuge island into a pedestrian crossing.

6.9 Parking and cycle provision will comply with WSCC standards, and servicing has been planned to ensure safe access for refuse and delivery vehicles.

6.10 The proposed development, currently on agricultural land, is expected to generate approximately 123 vehicle trips in the AM peak and 132 in the PM peak, based on MSDC Transport Study trip rates for private housing.

6.11 Trip distribution has been derived from 2011 Census "Travel to Work" data to assess likely impacts on the local highway network, with detailed routing shown in supporting diagrams. While initial assessments follow a traditional "predict and provide" approach, alternative "decide and provide" scenarios have also been tested, applying reductions in vehicular trips to reflect potential internalisation and mode shift from coordinated local development strategies. This ensures a robust and future-focused assessment of traffic impacts.

6.12 Refuse collection will be undertaken within the site, which comprises a simple priority junction, with a road width of 6m and 12m radii to ensure it is appropriately sized for refuse and delivery vehicles alike to access the site based on swept path analysis undertaken.

6.13 A Travel Plan has been prepared to accompany the development, setting out measures to promote walking, cycling and public transport in line with the Local plan.

6.14 The transport assessment undertaken for the proposed development indicates that the project will not cause a severe impact on the local road and transport infrastructure, and the scheme will promote sustainable travel practices.

7.0 CLIMATE CHANGE – MITIGATION AND ADAPTATION

7.1 Climate change brought about by man-made emissions of greenhouse gases has been identified as the greatest challenge facing human society at the beginning of the 21st century.

7.2 The effects of climate change are complex; they include:

- Increased average temperatures.
- Rising sea levels.
- Increased precipitation.
- More frequent extreme weather.

7.3 Action to address climate change falls into two categories: mitigation and adaptation. Mitigation measures are designed to reduce greenhouse gas emissions to slow down or stop climate change, whilst adaptation measures are designed to adjust society and dwellings to cope with climate change.

Climate Change Adaptation and Mitigation Strategy

7.4 The energy strategy for the scheme has considered measures to mitigate the effects of climate change through the specification of energy-efficient systems. The Energy Strategy is discussed further in Sections 3 to 5 of this report.

Water Efficiency

7.5 Water conservation has been incorporated into the proposed development through the implementation of water efficiency measures, in accordance with the updated Part G building regulation (2024 Amendment) and Policy DP39: Sustainable Design and Construction

7.6 The development will aim for internal water use below 110 litres per person per day, surpassing the enhanced requirements of Part G Building Regulations.

7.7 To achieve a reduced indoor water use, a combination of the following water-efficient fittings is proposed for the dwellings:

- Dual flush WC's – cisterns with both a half flush and full flush. The half flush delivers 3 litres for the removal of liquids, whilst the full flush delivers 6 litres for a long flush.

- Flow restrictors & aerators - restrictors fit within the existing plumbing structure of the shower head or connection pipe to taps to restrict water flow and reduce the outlet flow and pressure. Aerators restrict the flow of water but maintain pressure by adding air to the water, giving the perception of a powerful shower/taps without the water and energy consumption.

- Low volume baths – are typically the same size as a standard bath, but shaped to match the contours of the body, creating a more efficient area to be filled, conserving water.

- Appliances – where dishwashers and washing machines are specified, consideration will be given to low water-consuming appliances.

7.8 The following table presents a combination of water-efficient fittings which would allow the scheme to achieve an aspirational indoor water use lower than 105 litres/person/day and details the government's calculation methodology for assessing water consumption for the dwellings.

Installation Type	Unit of measure	Capacity/ flow rate (1)	Use Factor (2)	Fixed use (litres/ person/ day) (3)	Litres/ person/ day= [(1) x (2)] + (3) = (4)
WC (dual flush)	Full flush volume (litres)	6	1.46	0	8.76
	Part flush volume (litres)	3	2.96	0	8.88
Taps (excluding kitchen/ utility room taps)	Flow rate (litres/ minute)	6	1.58	1.58	11.06
Bath (where a shower also present)	Capacity to overflow (litres)	180	0.11	0	19.80
Shower (where bath also present)	Flow rate (litres/ minute)	6	4.37	0	26.22
Kitchen/utility room sink taps	Flow rate (litres/ minute)	6	0.44	10.36	13.00
Washing machine	Litres/kg dry load	8.17	2.1	0	17.16
Dishwasher	Litres/place setting	1.25	3.6	0	4.50
	-5	**Total calculated use (litres/person/day) = (SUM column 4)**			109.38
	-6	Contribution from greywater (litres/person/day)			
	-7	Contribution from rainwater (litres/person/day)			
	-8	Normalisation factor			0.91
	-9	Total water consumption = [(5) - (6) - (7)] x (8) (litres/person/day)			99.53
	-10	External water use			5
	-11	**Total water consumption = (9) + (10) (litres/person/day)**			**104.53**

Table 7.1: Water Efficiency Calculator Tool

7.9 Please note that the exact combination of fittings selected for each dwelling is not prescriptive and may vary from the selection included in Table 5.1. The purpose of the table is to demonstrate the level of performance that can be achieved with commercially available fittings that are technically and economically feasible.

7.10 A specification for water meters on the mains water supply will facilitate water consumption management and monitoring to reduce the impacts of water inefficiencies and leakage. The development may consider incorporating a mains water meter on the main supply to the new dwellings.

7.11 During the construction phase, best practices for water conservation will be implemented. This will involve the efficient use of water for site operations, including dust suppression and equipment cleaning, to minimise waste.

7.12 The contractor will be responsible for closely monitoring water consumption on site and shall establish clear reduction targets. Regular reviews of water usage will be conducted, and any opportunities to further reduce water consumption during construction will be implemented whenever feasible.

7.13 These strategies ensure that the project shall reduce consumption of potable water for sanitary use through water-efficient components and promote water conservation measures during construction and the post-occupancy period.

Urban Heat Island Effect

7.14 Urban Heat Islands are created due to the thermal gradient difference between developed and undeveloped areas. These are created due to the site's hardscape, including roads, sidewalks, courtyards, roofs, and parking lots. Reduction in the heat island effect can be achieved through both roof and non-roof measures. Increasing shades around the building can reduce the heat island effect created by hard surfaces. The following strategies could be incorporated.

- Planting trees-Planting trees and other vegetation lowers surface and air temperatures by providing shade and cooling through evapotranspiration. Trees and vegetation that directly provide shade to dwellings. This can decrease the need for air conditioning, making the home more comfortable and reducing the energy bill. Trees also protect occupant health by improving air quality, providing cooling shade for outdoor activities, and reducing exposure to harmful UV radiation.

- Solar panels – Providing solar panels on the roof will act as a shade, thus reducing the heat absorption through the roof and lowering the interior heat gain.

- Using high-albedo (light-coloured) paving and roofs is an effective strategy to mitigate the Urban Heat Island effect by reducing the amount of solar radiation absorbed by ground surfaces. Traditional dark asphalt and concrete can reach high surface temperatures during summer, storing and re-radiating heat into the surrounding environment. In contrast, lighter-coloured or reflective paving materials increase surface reflectivity, helping to keep streets, footpaths and public spaces cooler. This not only lowers local air and surface temperatures but also improves pedestrian comfort, reduces the risk of heat-related stress, and can contribute to reduced energy demand for cooling in nearby buildings.

Flood Risk Assessment (FRA) & Surface water drainage Strategy (SuDS)

7.15 A Flood Risk Assessment and Surface Water Drainage Strategy was undertaken by Paul Basham Associates Limited for the proposed development, as referenced in 145.5007 /FRADS/2.

7.16 The assessment shows that the site is located within Flood Zone 1. Various flooding sources were evaluated, including Tidal and fluvial flooding, surface water, artificial water bodies, groundwater, and sewer systems. The findings indicate that the site has a low residual flood risk from all the flooding sources.

7.17 The ground consists of Weald clay bedrock, and based on geotechnical tests, drainage through infiltration is not a viable option.

7.18 In adherence to the Sustainable Drainage Systems (SuDS) options, Attenuation and Discharge into a water course are considered practical SuDS for this project.

7.19 The development will feature an attenuation basin designed to manage surface water runoff. This basin will discharge water at a controlled rate, matching the existing greenfield Qmed for up to a 1 in 100-year event, accounting for climate change. The water will be directed into the existing ditch along the western boundary of the site.

7.20 The SuDS scheme will safely manage flood risk, improve water quality, and enhance biodiversity, ensuring a sustainable and climate-resilient drainage strategy for the site.

7.21 The developer could include rainwater harvesting at a basic level, such as providing water butts for individual dwellings.

7.22 Management and Maintenance of the drainage assets could be carried out by the developer for the site, and the shared spaces will be maintained by a private management company as part of the wider Site management regime

7.23 Overall, the risk of surface water flooding at the site is minimal. With the implementation of mitigation measures, the risks can be further reduced. The proposed development complies with NPPF, PPG, and local planning policy in relation to surface water management.

8.0 POLLUTION

Air Pollution

8.1 Create Consulting Engineers Limited were commissioned to carry out an air quality assessment in support of the outline planning application for the proposed development.

8.2 The air quality assessment (Ref: TR/VL/P25-3564/01) was conducted by establishing a baseline and by using air quality monitoring data to evaluate the air quality impact of the proposed development, particularly focusing on NO_2, PM_{10} and $PM_{2.5}$ concentrations across the site.

8.3 The Site is not located in Air Quality Management Area (AQAM). Previous air quality monitoring data indicated that the predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations across the site are below the UK Air quality objectives; therefore, future site users will not be exposed to high pollutant concentrations.

8.4 Air pollutant concentrations at the proposed development site are well within both short- and long-term objective thresholds and therefore are not expected to pose any constraint to the site's suitability for residential development.

8.5 The air dispersion modelling assessment carried out as part of the AQA shows that the predicted annual mean NO2 concentrations are well below AQO at all modelled sensitive receptor location. The change in concentration is very small and the impact on human sensitive receptors is considered as negligible, if the proposed development goes ahead. Overall, the significance of impacts of annual mean NO_2 concentrations as a result of the development was predicted to be negligible at all receptor locations, in accordance with EPUK-IAQM guidance.

8.6 Construction activities, including earthworks, building works, and associated vehicle movements, have been identified as the key environmental aspects of the development with the potential to negatively affect local air quality. The highest risk category identified is due to dust arising from earthworks, construction and track outs. The overall dust-related risk level for construction activities is considered as high. However, with the implementation of appropriate risk-based mitigation measures, the impacts due to fugitive dust emission related risks during the construction phase can be minimised.

8.7 It is recommended to develop and implement a Construction Environmental Management Plan (CEMP) during site preparation and the construction period. It is also recommended to carry out dust monitoring through implementation of a Dust Management Plan during construction phase.

8.8 In relation to the indoor air quality and occupant health, the building should establish good indoor air quality performance. Enhanced indoor air quality would help to improve occupant comfort and well-being and prevent or minimise exposure of building occupants, indoor surfaces and ventilation air distribution systems to environmental pollution and tobacco smoke. Provision of a mechanical ventilation system has been made, which complies with CIBSE standards. Provision of low-emitting materials and materials with low VOC content shall be used for:

- Adhesives and sealants
- Paints and coatings
- Polishes and finishes
- Flooring system

- Composite wood and Agri fibre products.

Noise

8.9 Create Consulting Engineers Ltd has conducted a Noise Impact Assessment for the outline planning application of the proposed developments as referenced in BD/CC/P24-3564/02 Rev A.

8.10 The measured background noise levels are 45 dB during the day and 36 dB at night. To avoid adverse impacts from plant noise, it is recommended that the Rating noise level does not exceed these background levels at the nearest residential property.

8.11 The proposed development has been assessed as acoustically viable, subject to the application of good design principles. Night-time noise levels are elevated and will inform the ventilation strategy. It is anticipated that systems such as Passive stack ("natural") and Continuous mechanical extract ventilation solutions will be required to ensure compliance with BS 8233 and WHO internal noise criteria, while still providing adequate ventilation without reliance on open windows.

8.12 External amenity areas have been reviewed and, with the introduction of acoustic barriers along the eastern boundary and standard close-boarded fencing, noise levels are expected to remain within the recommended 50–55 dB LAeq, T limits. To improve sound environments, the orientation of dwellings should be carefully considered. Additionally, nearfield screening techniques, such as using 1.8-meter close-boarded timber fences with a surface mass exceeding 10 kg/m², can achieve noise reductions of up to 9 dB in certain areas. Furthermore, shielding private external spaces from the A23 will further enhance the quality of these external sound environments.

8.13 The proposed façade constructions, incorporating standard double-glazing and acoustic trickle vents where necessary, are sufficient to provide internal noise environments in line with national guidance. Specialist façade treatments are not expected to be required across most of the site.

8.14 Plant noise associated with building services should be controlled to 45 dB LAR,Tr during the daytime and 36 dB LAR,Tr at night, to protect both existing and proposed receptors. Final noise criteria should be agreed with the Local Planning Authority, particularly for air source heat pumps, where the MCS 020(a) assessment approach may be acceptable.

8.15 Overall, the assessment demonstrates that, with the adoption of appropriate acoustic design principles and ventilation strategies, the proposed development is capable of delivering a high-quality acoustic environment for future residents. Noise is therefore not considered to present a constraint to the granting of planning permission, subject to appropriate conditions.

Land Pollution

8.16 Create Consulting Engineers Ltd has conducted a preliminary risk assessment for land contamination for the outline planning application as referenced in AW/VL/P25-3564/01.

8.17 The desk study and site walkover survey have been conducted for the existing site and revealed a low risk of contamination.

8.18 Potential contamination sources identified include historic agricultural use, nearby industrial units, scrap material stockpiles, adjacent landfill, radon gas, and unexploded ordnance.

8.19 The assessment found that:

- Risks to future residents from soil or made ground are low/negligible.
- Risks to water pipes, groundwater, and surface water are low.
- Risks to construction workers are very low, manageable with PPE.
- Risks from radon gas and UXO are low, requiring no mitigation.
- Off-site contamination sources pose a low risk to the development.

8.20 Based on the findings of the assessment, it has been concluded that there is no significant source of contamination or potential for contamination to be present, with the exposure risk presented to future site residents considered to be negligible.

Light Pollution

8.21 Create Consulting Engineers Ltd has conducted a preliminary risk assessment for Light pollution for the outline planning application as referenced in RN/VL/P25-3564/03.

8.22 The site is largely arable land of low ecological importance but contains sensitive features, including ancient woodland on the eastern boundary, hedgerows, mature trees, and grassy banks which support bats, nesting birds, great crested newts, and hedgehogs.

8.23 The site is classified as Environmental Zone E2, with the proposed lighting for the site being assessed in accordance with the limiting criteria for that zone. Figure 9.1 illustrates GN01:2021 Table 2 – Obtrusive light limitations for exterior installations.

8.24 Dark corridors along woodlands, hedgerows, and tree lines must be retained and kept free from significant illumination.

8.25 Lighting will be restricted to essential areas such as entrances, play areas, and footpaths, avoiding the wider site wherever possible.

8.26 Design measures include warm-spectrum LEDs, directional and low-spill fittings, minimised light spill with levels not exceeding 0.45 lux at sensitive boundaries, motion sensors to limit operation times, reduced column heights, and shielding to prevent overspill.

8.27 No lighting will be introduced within or immediately adjacent to woodlands or hedgerows, and landscaping or screening will be used where necessary to mitigate vehicle headlight glare.

8.28 Footpaths will be designed to the P5 lighting class, providing an average of 5 lux, a minimum of 1 lux, and uniformity of 0.40 to ensure safety while minimising brightness.

8.29 During construction, temporary lighting will be required for health and safety and security purposes, with impacts expected to be minor and short-term if best practice is followed. Lighting will be task-focused, time-limited, and designed to minimise glare and overspill.

8.30 In the operation stage, modern luminaires with zero tilt will limit upward light, ensuring negligible contribution to sky glow. Without mitigation, impacts may be minor adverse, but with proposed measures, effects are predicted to be negligible.

8.31 Mitigation measures include careful luminaire selection and placement, minimising glare, dimming or switching off lights when not required, and adhering to ILP, HSE, and CIE guidance.

8.32 Overall, the lighting strategy will provide a safe and functional environment for users while protecting ecological receptors and minimising environmental impacts. Construction effects will be temporary and minor, operational effects will be negligible with mitigation, and the balance between safety, compliance, and ecological protection will be maintained.

9.0 BIODIVERSITY AND LANDSCAPE

9.1 The Ecology Partnership Ltd has conducted preliminary ecological assessments for the proposed development.

9.2 A site survey was conducted to assess the existing ecological conditions. The Site comprises four grassland fields, parcels of ancient and semi-natural woodland, and boundary hedgerows and tree lines. The grassland is species-poor, heavily grazed, and classified as low-quality modified grassland.

9.3 The Site contains multiple mature trees, particularly pedunculate oak, and supports linear habitats along hedgerows and woodland edges. One pond is present on-site (currently dry), with six additional ponds identified within 250 m, though access is restricted to some by barriers such as roads and private property. The habitats provide limited value for great crested newts, while reptiles, bats, and breeding birds are present in low numbers. Historical records indicate the potential presence of hedgehogs, stag beetles, and badgers, although no active badger setts were recorded on-site.

9.4 Overall, the Site is considered to have low to moderate ecological value at a local level. Grassland and other species-poor habitats contribute minimally to biodiversity, while woodland, hedgerows, and tree lines provide important ecological connectivity, foraging, and nesting opportunities for bats, birds, and other species.

9.5 The proposed residential development is located near ancient woodland and within the 5 km Impact Risk Zone of Wolstonbury Hill SSSI. Residential development is not expected to adversely impact the SSSI. To protect ecological features, a Homeowners Pack is recommended to raise awareness of local sensitivities.

9.6 Best-practice measures will be implemented during construction to minimise impacts, potentially via a Construction Environmental Management Plan (CEMP). Mitigation includes: controlling run-off, suppressing dust, securing excavations to prevent harm to wildlife, retaining and protecting mature trees and hedgerows, and consulting an ecologist if protected species are discovered. Vegetation management should avoid the bird breeding season, and careful handling of fallen deadwood and scrub will protect amphibians, reptiles, and stag beetles.

9.7 Any loss of trees or hedgerows will be compensated with native planting, prioritising species of ecological value. Trees with potential for bat roosting will be retained or assessed further if removal is required, and lighting will follow best-practice guidance to reduce disturbance. Breeding bird habitats are largely retained, and compensation planting will mitigate the removal of minor hedgerows or scrub.

9.8 Biodiversity net gain will be achieved through habitat enhancements across the Site, targeting a minimum 10% net gain post-development. Measures include:

- Creation of species-rich grassland, ponds, and other aquatic habitats to support invertebrates and wildlife.
- Enhancement of hedgerows, scrub, and tree lines to maintain ecological connectivity and provide foraging and nesting opportunities.
- Installation of bird and bat boxes across the Site to enhance roosting and nesting opportunities.

- Additional native tree planting, including the creation of buffer zones around ancient woodland edges, to reinforce semi-natural habitats.

9.9 With the implementation of these enhancements, the development is predicted to deliver a measurable improvement in ecological value, safeguarding existing priority habitats, and supporting protected species such as bats, reptiles, and hedgehogs, while maintaining the functionality of woodland and hedgerow corridors.

9.10 The Site's ecological constraints are considered manageable. The development is not expected to significantly impact ancient woodland, statutory or non-statutory designated sites, or key protected species, provided the proposed mitigation, monitoring, and habitat enhancements are implemented.

10.0 MATERIALS MANAGEMENT

Materials

10.1 It is recommended to use materials with a low environmental impact, as well as seek to use locally sourced, recycled and reclaimed materials where possible.

10.2 The origin of materials chosen in the design and construction, where possible, will be selected carefully to minimise the local and wider negative impact on the natural environment. Locally extracted, manufactured, and sold materials should be procured.

10.3 It is recommended for the applicant to commit to procure timber from sustainable sources through approved schemes such as the Forest Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC).

10.4 When designing new developments, careful consideration is given to the impact of material selection.

10.5 The energy and natural resources consumed during extraction, procurement, processing, and manufacturing processes can be substantial. Therefore, preference will be given to the selection of sustainable materials that adhere to the principles outlined in the Green Guide. These materials should demonstrate low environmental impact over their life cycle and be sourced through sustainable procurement practices. Additionally, responsible supply chain management and waste disposal strategies will be prioritised to enhance sustainability efforts further.

10.6 The principal contractor, operating on behalf of the Applicant, will be required to ensure that commitments and specifications within the Sustainable Procurement Plan are upheld and accounted for. Good-practice principles for the responsible sourcing of sustainable materials will be applied across the scheme.

10.7 The applicant shall ensure that the proposed development gives preference to the selection of sustainable materials and the minimisation of materials. The following measures will be considered to demonstrate that the materials specified are sourced, managed, and used in a sustainable manner:

- The use of locally sourced materials will be prioritised, where feasible, to reduce transport-related emissions and to support local supply chains;
- Responsible sourcing of materials from suppliers that operate an Environmental
- The Management System will be prioritised. 100% of all timber included in the construction of floors, roofs, walls, and staircases will be legally sourced;
- The use of materials with high recycled content will be considered.
- The use of recyclable materials, such as aggregate, will be considered;
- The use of insulation materials with low Global Warming Potential (GWP) will be prioritised;
- The use of high VOC content paints, sealants and all ozone-depleting materials, including insulation, will be avoided where possible. Specific consideration will be given to embodied energy and durability, and the strength of materials selected for the scheme.

10.8 The proposed developments will be designed in accordance with circular economy principles, supporting the low-energy transformation initiative to reduce embodied carbon, maximise material reuse, and minimise waste generation.

Build Less

10.9 The principle of Build Less in the circular economy prioritises reusing, retaining, or adapting existing assets to reduce the demand for new construction. This can include the repurposing of existing dwellings, infrastructure, or materials on-site, thereby avoiding unnecessary new build and preserving embodied carbon.

10.10 Build Less is not directly applicable due to the absence of existing dwellings or infrastructure on the site. The focus therefore shifts towards other Circular economy principles to ensure that the new development minimises material demand, reduces waste, and maximises long-term value.

Build Light

10.11 To reduce material intensity and overall building weight, lightweight construction solutions could be adopted. These include using lightweight internal partitions and finishes, limiting screed application, and standardising window sizes to optimise material efficiency. This approach reduces resource consumption, simplifies future adaptability, and supports easier disassembly at the end of life.

Build Wise

10.12 The design philosophy focuses on longevity and adaptability. Lightweight internal walls and efficient column layouts will allow flexible reconfiguration of internal spaces, accommodating future needs without extensive demolition. Exposed building elements are designed to resist degradation from environmental factors such as solar radiation, wind, and temperature variations, ensuring durability. Furthermore, it is recommended to prepare and issue a disassembly guide to the future occupants to facilitate material recovery and recycling when the dwellings reach the end of their lifecycle.

Build Low Carbon

10.13 Material selection will emphasise low embodied carbon and high recycled content. Priority will be given to locally sourced materials to reduce transport emissions and support regional economies. By reducing reliance on high-carbon products and increasing recycled input, the development aims to significantly lower its carbon footprint.

Build for the Future

10.14 New dwellings are being designed with adaptability in mind, allowing them to serve alternative purposes in the future. This forward-thinking approach reduces the likelihood of demolition and waste generation, promoting a long-term circular strategy.

Build Collaboratively

10.15 The circular economy approach will be implemented through a collaborative process involving architects, engineers, and sustainability experts. This integration ensures that circular principles apply to new developments, emphasising waste reduction and resource efficiency.

11.0 WASTE MANAGEMENT

Sustainable Construction

11.1 Sustainable construction practices include good site management to encourage resource efficiency, increase materials recovery through the reuse and recycling of materials and waste diversion from landfill.

11.2 It is recommended to develop a construction management plan before commencement of the development. The construction management plan will appropriately demonstrate how the impacts of air/water pollution, noise and vibration will be mitigated during the construction of the development. Where feasible, timber used on site will be reclaimed, reused or responsibly sourced.

11.3 The following sustainable construction practices will be considered within the development:

- Reducing construction and excavation waste to landfill;
- Ensuring the products used in construction are responsibly sourced;
- Conducting biodiversity surveys and following up with necessary actions;
- Best practice site management principles through registering the site with the Considerate
- Constructor Scheme to commit to managing the site beyond best practice.

11.4 As part of achieving a sustainable construction approach, the main contractor will be encouraged to commit to reducing the impact of the construction processes on the environment through monitoring and mitigating construction site impacts throughout the construction period. Best practice pollution prevention policies will be encouraged with respect to air (dust) and water pollution arising from site activities. To minimise air (dust) pollution, skips will be covered, dust-generating site activities will be dampened down, and wet cutters will be used. Low-emission and efficient equipment will be used on-site.

Construction Waste

11.5 Waste reduction and recycling strategy shall be based upon the following waste hierarchy.

- Prevention
- Preparing for re-use
- Recycling
- Other recovery
- Disposal

11.6 As a primary objective, and in accordance with the waste hierarchy, the applicant will seek to prevent waste in the first instance. This will be achieved through a site waste management plan that begins with the planning and design process and filters down through the management of the construction process and across the lifetime of the development.

11.7 On-site waste will be minimised, and a high proportion of the waste that is produced will be diverted from landfill, through either:

- Re-use on site (in situ or for new applications) or re-use on other sites;
- Salvaged/reclaimed for re-use;
- Returned to the suppliers via 'take-back' schemes;
- Recovered and recycled using an approved waste management contractor.

11.8 Where it is not possible to reduce or re-use materials on site, opportunities to recycle the materials off-site will be explored, where feasible.

11.9 The applicant will collaborate with a principal contractor for the company in delivering the objective of maintaining the proportion of waste diverted to landfill to divert at least 70% or above.

Monitoring and Review

11.10 The applicant will monitor and review their waste management commitments by defining the following:

- Waste minimisation actions to be undertaken
- Procedures for minimising hazardous waste
- Procedures for sorting, reusing, and recycling construction waste into defined waste groups, whether on-site or through a licensed external contractor. The delivery of this target will be managed through the effective implementation on-site plan based on the waste hierarchy defined earlier.

Operational Waste

11.11 A vehicular access route has been designed as a simple priority junction, featuring a road width of 6 meters and 12-meter radii. This design ensures that it is adequately sized for both refuse and delivery vehicles to access the site, based on the swept path analysis conducted. Bin stores will be strategically located to facilitate kerbside collection throughout the development. All refuse storage areas will be designed to accommodate the necessary capacity for all waste streams and will be positioned within the specified collection distance for waste management operatives.

Management

11.12 The Applicant shall take steps to reduce the adverse impact of the construction process on the quality of the development area and its surroundings.

11.13 The Applicant can consider the following measures to ensure that the sustainable construction practices have been considered in the early stages of development, design and will continue through to construction.

- Stakeholder participation shall be encouraged during the design development process to ensure all interests, environmental and social considerations are reflected within the scheme design.
- To maximise every opportunity for a sustainable development from concept design through to developed design, enhancing the development schemes achieved standard, the applicant may consider appointing an assigned individual to work alongside the project team.
- Applicant shall monitor construction site impacts for both utility consumption, transportation by appointing an assigned individual.
- The impact of transport movement from the delivery of the majority of construction materials to, and waste from, the site should be monitored, and data collected.

11.14 The Applicant will ensure that the principal contractor, and other contractors and workers on site during the construction process, are all aware of and follow the sustainability requirements to minimise the possible negative effects of construction, such as air pollution, noise and vibration, traffic congestion, dust and contamination of land and water.

12.0 CONCLUSION AND RECOMMENDATIONS

12.1 The Energy hierarchy approach of "Be lean" – "Be clean" – "Be green" is fully adopted by implementing

- Passive design measures and 'Fabric First' approach (low U-values)
- High efficiency services, i.e., low energy lights, high efficiency ventilation
- LZC technologies: Efficient heat pump, photovoltaic panels, and Solar hot water

12.2 Excluded renewable sources are:

- Biomass
- Gas CHP
- Wind turbines

12.3 The residential component of the outline application is designed to achieve the following site-wide reductions in regulated CO_2 emissions, relative to a 2021 Part L compliant baseline:

- An overall reduction of 75–80% in regulated CO_2 emissions.
- A 50–60% reduction in regulated CO_2 emissions through the integration of LZC technologies (Be Green).
- A 15–20% reduction in regulated CO_2 emissions through fabric energy efficiency improvements implemented at the Be Lean stage.

12.4 Implementing Circular economy strategies, site waste management plan and resource efficiency benchmarks.

12.5 Adhering to best practice policies for air, water, noise, Light and ground pollution.

12.6 Achieving a water consumption target of 110 litres/person/day with low water-consuming fittings.

12.7 Promoting sustainable transport options, such as provisions for cycle storage and car parking.

12.8 Ensuring high build quality beyond minimum Building Regulations standards and using responsibly sourced materials.

12.9 Prioritising health and wellbeing through design and operational procedures, including adequate daylight, indoor air quality, and thermal comfort.

12.10 Enhancing the ecological value of the site through measures such as tree planting and the inclusion of native plant species.

12.11 The energy and sustainability assessment demonstrates that the proposed measures comply with the requirements set out in the Mid Sussex District Local Plan and Part L of the Building Regulations. Therefore, the energy and sustainability strategy supports the Outline planning application for the development at Land at Coombe Farm, Sayers Common.

13.0 DISCLAIMER

13.1 Create Consulting disclaims any responsibility to the Client Welbeck Strategic Land II LLP in respect of any matters outside the scope of this report.

13.2 The copyright of this report is vested in Create Consulting Engineers Ltd and Welbeck Strategic Land II LLP. The Client, or his appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd or Welbeck Strategic Land II LLP.

13.3 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

13.4 Create Consulting Engineers Ltd confirms that this report is not generated using Artificial Intelligence. This report is based on details taken from the site, and information received from architects and consultants which are true, lawful, and based on facts.

APPENDIX A

Carbon Reporting Spreadsheet – Outline Application

GLA Carbon Emissions Reporting Spreadsheet

BACKGROUND AND PURPOSE

From **January 2023** planning applicants for new and refurbishments schemes are required to use this spreadsheet to report the anticipated carbon performance of a development. It should be used for both domestic and non-domestic uses. This spreadsheet ensures a consistent and transparent process for presenting Part L 2021 CO_2 emission performance. The GLA will not accept the use of alternative methodologies or tools. This is to ensure consistency and to minimise the need for clarifications during the planning application determination period.

Planning applicants should use Part L 2021 BRUKL and SAP outputs to fill in this spreadsheet which serves as a the final step in reporting the carbon emission performance of the proposed energy strategy. **It is solely for the purpose of reporting compliance with the London Plan to the GLA and does not replace Part L calculations submitted for Building Regulations approval.**

The spreadsheet has been developed to fit as wide a range of policy compliant approaches for schemes as possible. Any planning applicants with a policy compliant approach that the spreadsheet does not serve should contact the GLA at: **ZeroCarbonPlanning@london.gov.uk**. Applicants must not amend or alter the spreadsheet to suit non-policy compliant strategies. Any unauthorised amendment to the spreadsheet will invalidate the CO_2 emission calculations.

Applicants should note that we will update the spreadsheet from time to time to ensure it remains fit for purpose. Applicants are expected to use the latest version at the time of the planning submission.

Any feedback on this spreadsheet should be sent to: ZeroCarbonPlanning@london.gov.uk.

METHODOLOGY

Applicants are required to complete **all** light blue input cells in the applicable tabs prior to submission ('Development Information', 'Part L Outputs', 'EUI & space heating demand' and 'GLA Summary Tables').

Input Data
For all applications, the input data required includes:
'Development information' tab
- Table 1. Application Completeness Check
- Table 2. Development Details
- Table 3. Bespoke District Heating Carbon Factors (if applicable)
- Table 4. Distribution loss factor (if applicable)
- Table 5. SCoP Calculation Methodology (if applicable)

'Part L Output' tab
- Type of units modelled
- Area of units modelled (m²)
- Number of units modelled
- Total area represented by model (m²)
- TER, DER and BER figures ($kgCO_2/m^2$ p.a.)
- Notional building Energy saving/generation technologies (-) for residential ($kgCO_2$ p.a.)
- Notional building Displaced electricity (-) for non-residential (kWh//m² p.a.)
- TFEE and DFEE figures for residential (kWh//m² p.a.)

'GLA Summary tables' tab
- Unregulated figures (tCO_2 p.a.)
- Actual and notional building cooling demand (MJ/m²)

Note: The total carbon emissions figures in the 'GLA Summary tables' tab are now calculated based on the area input for 'Total area represented by model (m²)'. This input requirement has been added to ensure that the carbon emission figures align with the development area schedule (included within the DAS) rather than the number of representative models.

'EUI & Space Heating Demand' tab
- Confirmation of building type
- Gross Internal Area (GIA) in m^2
- Energy Use Intensity (EUI) per fuel type (kWh p.a.)
- Space heating demand (kWh p.a.)
- Confirmation that both regulated and unregulated energy use has been included
- Confirmation of predicted energy use methodology, including modelling software
- Notes on the assessment, including justification if expected performance differs from Table 4

Note: Applicants can use the ‘be seen’ methodology or an alternative predictive energy modelling methodology to fill in the required EUI & space heating demand information.
Where ‘be seen’ reporting is used the reported EUI and space heating demand should align with energy consumption data reported in the planning stage submission for the ‘be seen’ policy, submitted via the online webform.

Required Part L Outputs for the GLA spreadsheet
Domestic Part L Outputs:
For the domestic conversion applicants are required to use the outputs from the SAP TER and DER worksheets. To assist in the process the required SAP worksheet rows have been referenced in each input cell. Note: The SAP worksheet rows are based on a communal heating system in line with GLA policy and guidance. Applicants proposing individual systems must first seek confirmation from the GLA as to whether the approach will be acceptable.

Non-domestic Part L Outputs:

Regarding the non-domestic uses, the applicant can determine whether each individual unit will be modelled independently and apportioned to the entire scheme or whether a single model will be generated for the entire development. The applicant should, however, include the results from all BRUKL outputs generated for the proposed development under the "NON-RESIDENTIAL CO_2 ANALYSIS" sections. Applicants are generally encouraged to model each individual typology independently.

Validation Check
Applicants must ensure that the calculated TER/DER/BER in this spreadsheet matches the actual values from the Part L 2021 BRUKL and SAP worksheets. The Part L 2021 BRUKL and SAP sheet must accompany the energy assessment so that results can be validated.

TABLE 1. APPLICATION COMPLETENESS CHECK	
Development information tab (Tables 1-4) completed and included in appendix of energy strategy?	yes
Part L outputs tab completed	yes
EUI & space heating demand completed	yes
Confirmation that the planning stage webform will be completed at planning application submission and that the Be Seen process and reporting responsibilities are fully understood, including the requirement for as-built and in-use stage reporting to be undertaken (or where the legal owner changes from one reporting stage to another that the responsible party will be notified).	no

TABLE 2. DEVELOPMENT DETAILS		Further notes	Response	Supporting comments (or signpost sections in the energy assessment)
Application details	Date of Application	Please provide the date the application was submitted to the Local Planning Authority.		
	Local Planning Authority	Please indicate the Local Planning Authority determining the application.		
	Confirmed carbon offset price (£/tonne of carbon dioxide)	Please confirm the agreed carbon offset price for the Local Planning Authority. If no value is entered then the GLA's recommend price of £95 per tonne of carbon dioxide will be used.	*0.00*	
	Evidence of communication on the carbon offset price included in the energy assessment (Y/N).		*N*	
	Residential units number (Part L1)			
	Non-residential floor area in m^2 (Part L2)			
Heat risk	CIBSE TM59 undertaken for residential development (Y/N)		*N*	
	CIBSE TM52 undertaken for non-residential development (Y/N)			
	All sample units meet CIBSE criteria with DSY1 weather file (Y/N)			
	DSY2 and DSY3 included in overheating assessments (Y/N)			
	Residential g-value		*0.40*	
	% Glazing Ratio over façade			
	External shading proposed (Y/N)		*N*	
Energy efficiency measures	Target Fabric Energy Efficiency met (Y/N)			
	Mechanical Ventilation with Heat Recovery included (Y/N)			
	Waste Water Heat Recovery (Y/N)			
	Low energy lighting (Y/N)		*Y*	
District heating connection	Development in a Heat Network Priority Area (HNPA) (Y/N)		*N*	
	District Heating Network connection (Y/N)		*N*	
	Name of District Heating Network			
	Carbon factor ($kgCO_2$/ kWh)			
	Borough energy officer and Heat Network Operator contacted and evidence of correspondence included in the energy strategy (Y/N)	Applicable to all applications.	*N*	
Site heating distribution configuration	Development future proofed for DHN connection (Y/N)	Note that individual heating systems would not be appropriate for developments in HNPAs.		
	Drawings of communal system provided (Y/N)	Applicants should provide a drawings of the energy centre, on-site communal network with all building uses connected and future proofing arrangements detailed, including single point of connection.	*N*	
	Distribution type			
	Flow temperature (°C)			
	Return temperature (°C)			
	Distribution losses modelled (%)	See table 4 below for details.		
Heating system performance	Heat Pump (Y/N)		*Y*	
	Heat Pump source		*ELECTRIC*	
	Centralised Heat Pump capacity (kWth)			
	Heat Pump Seasonal Heating Efficiency (SCoP)			
	Heat Pump SCoP calculation includes heat source and heat distribution temperature and seasonal performance factor (Y/N)	See table 5 below for details.		
	Fraction of heat supplied by heat pump (only for hybrid systems with boilers) (%)			
	Low-emission on-site CHP enabling an area-wide heat network (Y/N)	Only low-emission CHP is suitable and only where it is facilitating an area-wide heat network. Therefore, new gas engine CHP is not suitable for any other purpose for new developments.		
	CHP (kWe)			
	Estimated end user cost (pence/kWh)			
	Energy assessment includes consideration of occupant running costs (Y/N)	Applicants should consider the estimated costs to occupants of the energy assessment and outline how they are committed to protecting the consumer from high prices.		
Solar technologies	Solar PV included (Y/N)		*Y*	
	Roof layout demonstrating solar PV technologies have been maximised included in energy strategy (Y/N)		*Y*	
	kWh generated			
	kWp			
	Total PV panel area (m^2) installed			
	Solar Thermal included (Y/N)		*N*	
	Solar Thermal panel area (m^2) installed			
Flexibility and peak energy demand	Site-wide peak demand, capacity and flexibility potential included in energy assessment (Y/N)	Table 9 in the energy assessment guidance to be completed.		
	Interventions for achieving flexibility included in energy assessment (Y/N)	Table 10 in the energy assessment guidance to be completed.		
	Estimated peak demand (MW)			
	Electrical energy storage (kWh) capacity			
	Heat energy storage (kWh) capacity			
Other technologies	System type (e.g. wind turbine)			
	Capacity (kW)			
Cooling	Cooling proposed - Residential (Y/N)	It is not expected that 'active cooling' will be proposed for any residential developments. It will be expected that applicants can fully demonstrate that all passive design measures have been thoroughly investigated before considering 'active cooling'.	*N*	
	Cooling proposed - Non-residential (Y/N)			
	Residential Cooling consumption (kWh p.a.)	See note in cell C60.		
	Commercial Cooling consumption (MJ p.a.)			

TABLE 3. BESPOKE DH CARBON FACTOR CALCULATION METHODOLOGY
Please provide below details of the calculation methodology followed to establish the bespoke carbon factor, if applicable.

TABLE 4. DISTRIBUTION LOSSES				COMMENTS
Primary network (buried pipe)	Total pipe length (m)			
	Average heat loss rate (W/m)			
Secondary network (buried pipe)	Total pipe length (m)			
	Average heat loss rate (W/m)			
Total losses (MWh/year)				
Total heat supplied (MWh/year)				
Distribution Loss Factor (DLF)				
Calculation included in energy statement (yes/no)				

TABLE 5. SEASONAL COEFFICIENT OF PERFORMANCE (SCOP) CALCULATION METHODOLOGY
Details of the Seasonal Coefficient of Performance (SCOP), the Seasonal Performance Factor (SFP) and Seasonal Energy Efficiency ratio (SEER), which should be used in the energy modelling. This should be based on a dynamic calculation of the system boundaries over the course of a year i.e. incorporating variations in source temperatures and the design sink temperatures (for space heat and hot water). Details of the assumptions should be included in the energy assessment, including manufacturer datasheets showing performance under test conditions for the specific source and sink temperatures of the proposed development and assumptions for hours spent under changing source temperatures.

The applicant should complete all the light blue cells including information on the modelled units, the area per unit, the number of units, the TER/DER/BER and the TFEE/DFEE.

RESIDENTIAL CO_2 ANALYSIS (PART L1)

				Baseline		'Be Lean'	'Be Clean'	'Be Green'	Fabric Energy Efficiency (FEE)		Baseline		'Be Lean'			'Be Clean'			'Be Green'	
Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area	Number of units	Total area represented by model	TER	Energy saving/generation technologies (-)	DER	DER	DER	Target Fabric Energy Efficiency	Dwelling Fabric Energy Efficiency	Part L 2021 CO_2 emissions	Energy saving/generation technologies	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Lean' savings	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Clean' savings	Part L 2021 CO_2 emissions	'Be Green' savings
	(m^2) (Row 4)		(m^2)	($kgCO_2$ / m^2) (Row 273)	($kgCO_2$ p.a.) (Row 269)	($kgCO_2$ / m^2) (Row 273 or 384)	($kgCO_2$ / m^2) (Row 273 or 384)	($kgCO_2$ / m^2) (Row 273 or 384)	(kWh/m^2)	(kWh/m^2)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)
1 Bedroom Units I	*53.09*	*17*	*902.53*	**14.58**	**-47.33**	**10.86**	**10.89**	**2.58**	35.23	30.18	**13,159**	**-805**	**9,801**	**8,997**	**4,162**	**9,829**	**9,024**	**-27**	**2,329**	**6,695**
2 Bedroom Units I	*73.35*	*29*	*2127.15*	**11.52**	**-63.97**	**8.40**	**8.40**	**3.11**	28.31	25.41	**24,505**	**-1,855**	**17,868**	**16,013**	**8,492**	**17,868**	**16,013**	**0**	**6,615**	**9,397**
1 Bedroom Prope	*53.74*	*17*	*913.58*	**11.66**	**-105.80**	**7.51**	**7.51**	**3.56**	42.66	40.86	**10,652**	**-1,799**	**6,861**	**5,062**	**5,590**	**6,861**	**5,062**	**0**	**3,252**	**1,810**
2 Bedroom Prope	*101.18*	*40*	*4047.2*	**9.96**	**-129.97**	**7.38**	**7.38**	**1.94**	34.76	31.76	**40,310**	**-5,199**	**29,868**	**24,670**	**15,641**	**29,868**	**24,670**	**0**	**7,852**	**16,818**
3 Bedroom Prope	*145*	*69*	*10005*	**9.99**	**-169.62**	**8.84**	**8.84**	**2.20**	41.72	38.06	**99,950**	**-11,704**	**88,444**	**76,740**	**23,210**	**88,444**	**76,740**	**0**	**22,011**	**54,729**
4 Bedroom Prope	*160.69*	*38*	*6106.22*	**9.19**	**-173.45**	**7.59**	**7.59**	**1.92**	38.37	33.74	**56,116**	**-6,591**	**46,346**	**39,755**	**16,361**	**46,346**	**39,755**	**0**	**11,724**	**28,031**
Sum		**210**	**24,102**	**10.2**	**-147.6**	**8.3**	**8.3**	**2.2**	**38.3**	**34.6**	***244,692***	***-27,952***	***199,189***	***171,237***	***73,455***	***199,216***	***171,264***	***-27***	***53,783***	***117,481***

NON-RESIDENTIAL CO_2 ANALYSIS (PART L2)

				Baseline		'Be Lean'	'Be Clean'	'Be Green'			Baseline		'Be Lean'			'Be Clean'			'Be Green'	
Building Use	Model Area	Number of units	Total area represented by model	BRUKL TER	BRUKL Displaced electricity (-)	BRUKL BER	BRUKL BER	BRUKL BER			Part L 2021 CO_2 emissions	Energy saving/generation technologies	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Lean' savings	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Clean' savings	Part L 2021 CO_2 emissions	'Be Green' savings
	(m^2)		(m^2)	($kgCO_2$ / m^2)	(kWh / m^2)	($kgCO_2$ / m^2)	($kgCO_2$ / m^2)	($kgCO_2$ / m^2)			($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)
Sum		**0**	**0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**			***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS																				
Total Sum			**24,102**	**-**	**-**	**-**	**-**	**-**			***244,692***	***-27,952***	***199,189***	***171,237***	***73,455***	***199,216***	***171,264***	***-27***	***53,783***	***117,481***

Applicants can use the 'be seen' methodology or an alternative predictive energy modelling methodology to fill in this tab.
Where 'be seen' reporting is used the reported EUI and space heating demand should align with energy consumption data reported in the planning stage submission for the 'be seen' policy, submitted via the online webform.

Residential predicted energy use

Building type	GIA (m^2)	EUI & space heating demand (kWh/year)									Has the following energy use been included?		Results		Table 4 of the guidance comparison		Methodology used		
		Space heating demand	Annual Electricity Use	Annual Gas Use	Annual Oil Use	Annual Biomass Use	Annual District Htg Use	Annual District Clg Use	Elec Generation, Gross	Solar Thermal Generation	Regulated	Unregulated	EUI (kWh/m^2/year) (excluding renewable energy)	Space heating demand (kWh/m^2/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Software	Operational energy use assessment	notes (if expected performance differs from the Table 4 values in the guidance or other software used)
					if applicable	if applicable	if applicable	if applicable	if applicable	if applicable									
Residential use (total)																			
Landlord Circulation (in Residential Blocks)																			
Total	0	0	0	0	0	0	0	0	0	0									

Non-residential predicted energy use

Building type	GIA (m^2)	EUI & space heating demand (kWh/year)									Has the following energy use been included?		Results		Table 4 of the guidance comparison		Methodology used		
		Space heating demand	Annual Electricity Use	Annual Gas Use	Annual Oil Use	Annual Biomass Use	Annual District Htg Use	Annual District Clg Use	Elec Generation, Gross	Solar Thermal Generation	Regulated	Unregulated	EUI (kWh/m^2/year) (excluding renewable energy)	Space heating demand (kWh/m^2/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Software	Operational energy use assessment	notes (if expected performance differs from the Table 4 values in the guidance or other software used)
					if applicable	if applicable	if applicable	if applicable	if applicable	if applicable									
Total	0	0	0	0	0	0	0	0	0	0									

Part L 2021 Performance

Residential

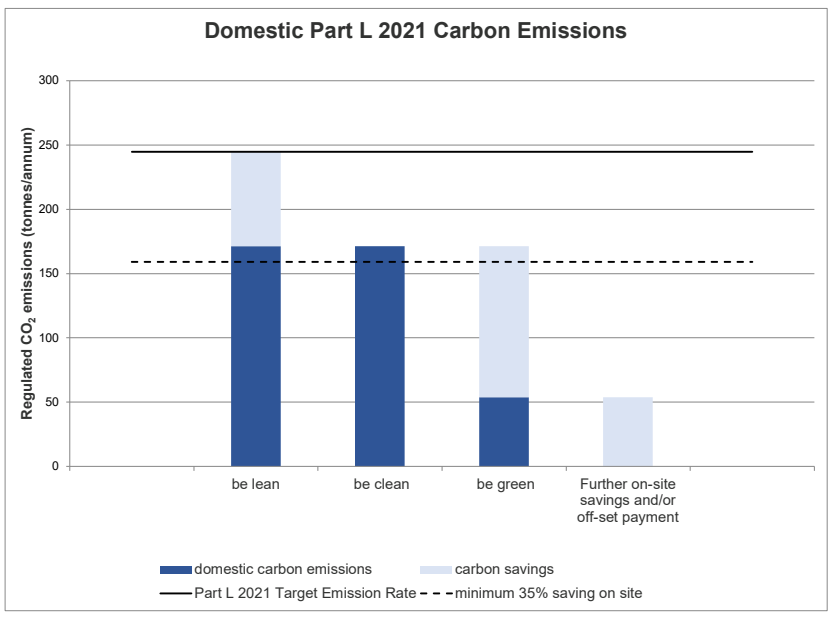
Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

	Carbon Dioxide Emissions for residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	244.7	15.5
After energy demand reduction (be lean)	171.2	15.5
After heat network connection (be clean)	171.3	15.5
After renewable energy (be green)	53.8	15.5

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for residential buildings

	Regulated residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	73.5	30%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	117.5	48%
Cumulative on site savings	**190.9**	**78%**
Annual savings from off-set payment	53.8	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**1,613**	-
Cash in-lieu contribution (£)	**153,281**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



Non-residential

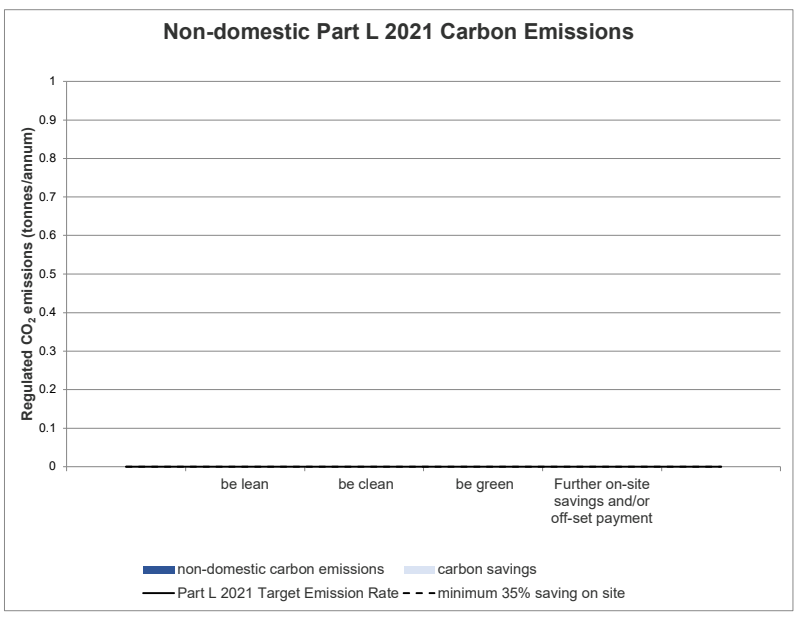
Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Total Cumulative Savings	**0.0**	**0%**
Annual savings from off-set payment	0.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**0**	-
Cash in-lieu contribution (£)	**0**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



SITE-WIDE

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	244.7		
Be lean	171.2	73.5	30%
Be clean	171.3	0.0	0%
Be green	53.8	117.5	48%
Total Savings	-	190.9	78%
	-	CO_2 savings off-set (Tonnes CO_2)	-
Off-set	-	**1,613.5**	-

	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	38.31	34.60	10%

	Area weighted non-residential cooling demand (MJ/m^2)	Total non-residential cooling demand (MJ/year)
Actual		
Notional		

EUI & space heating demand (predicted energy use)

Residential

Building type	EUI (kWh/m²/year) (excluding renewable energy)	Space heating demand (kWh/m²/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m²/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m²/year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)

Non-residential

Building type	EUI (kWh/m²/year) (excluding renewable energy)	Space heating demand (kWh/m²/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m²/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m²/year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)

APPENDIX B

SAP Worksheets – Baseline & Be Lean Case

Full SAP Calculation Printout

Property Reference	1B2P FLAT	**Issued on Date**	03/09/2025
Assessment Reference	BeLean	**Prop Type Ref**	
Property	1B2P Flat, Land at Combe Farm		

SAP Rating	90 B	**DER**	10.89	**TER**	14.58
Environmental	93 A	**% DER < TER**			25.31
CO_2 Emissions (t/year)	0.5	**DFEE**	30.18	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			14.32
% DPER < TPER	23.70	**DPER**	59.27	**TPER**	77.69

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.0900	(1b)	x 2.6000	(2b) =	138.0340	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0900					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	138.0340	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		73.6000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3232	0.3195	0.3157	0.2970	0.2932	0.2745	0.2745	0.2707	0.2820	0.2932	0.3007	0.3082	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Windows			8.8800	1.0536	9.3563			(27)
GF			53.0900	0.1000	5.3090	110.0000	5839.9000	(28a)
External Wall 1	41.7300	8.8800	32.8500	0.1600	5.2560	110.0000	3613.5000	(29a)
Total net area of external elements Aum(A, m2)			94.8200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.9213			(33)
Main dwelling								
Party Wall 1			41.5200	0.0000	0.0000	70.0000	2906.4000	(32)
Party Ceiling 1			53.0900			30.0000	1592.7000	(32b)
Internal Wall 1			74.4800			75.0000	5586.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	19538.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		368.0260 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.3800	0.0620	0.2716

E3 Sill	1.3800	0.0390	0.0538	
E4 Jamb	8.3800	0.0520	0.4358	
E5 Ground floor (normal)	16.0500	0.0710	1.1395	
E16 Corner (normal)	5.2000	0.0360	0.1872	
E18 Party wall between dwellings	7.8000	0.0495	0.3861	
P1 Party wall - Ground floor	15.9700	0.0800	1.2776	
P2 Party wall - Intermediate floor within a dwelling	15.9700	0.0000	0.0000	
E7 Party floor between dwellings (in blocks of flats)	16.0500	0.0685	1.0994	
E25 Staggered party wall between dwellings	5.2000	0.1010	0.5252	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.3762 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 25.2975 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.7244	14.5536	14.3828	13.5287	13.3579	12.5038	12.5038	12.3330	12.8454	13.3579	13.6995	14.0412	(38)
Heat transfer coeff	40.0220	39.8512	39.6803	38.8262	38.6554	37.8013	37.8013	37.6305	38.1430	38.6554	38.9971	39.3387	(39)

Average = Sum(39)m / 12 = 38.7835

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7539	0.7506	0.7474	0.7313	0.7281	0.7120	0.7120	0.7088	0.7185	0.7281	0.7345	0.7410	(40)
HLP (average)												0.7305	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7812 (42)

Hot water usage for mixer showers

54.0846	53.2718	52.0874	49.8213	48.1490	46.2840	45.2240	46.3994	47.6879	49.6903	52.0051	53.8774	(42a)

Hot water usage for baths

23.3814	23.0341	22.5451	21.6435	20.9684	20.2198	19.8154	20.3010	20.8297	21.6307	22.5509	23.3023	(42b)

Hot water usage for other uses

32.8714	31.6761	30.4808	29.2854	28.0901	26.8948	26.8948	28.0901	29.2854	30.4808	31.6761	32.8714	(42c)

Average daily hot water use (litres/day) 101.4255 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.3374	107.9820	105.1133	100.7503	97.2075	93.3986	91.9342	94.7905	97.8030	101.8018	106.2321	110.0511	(44)
Energy conte	174.7475	153.7650	161.5553	137.9221	130.8600	114.8445	111.1864	117.3704	120.6009	138.1441	151.3471	172.3135	(45)
Energy content (annual)										Total = Sum(45)m =		1684.6566	
Distribution loss (46)m = 0.15 x (45)m	26.2121	23.0647	24.2333	20.6883	19.6290	17.2267	16.6780	17.6056	18.0901	20.7216	22.7021	25.8470	(46)

Water storage loss:

Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3900 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7506 (55)

Total storage loss

23.2686	21.0168	23.2686	22.5180	23.2686	22.5180	23.2686	23.2686	22.5180	23.2686	22.5180	23.2686	(56)

If cylinder contains dedicated solar storage

23.2686	21.0168	23.2686	22.5180	23.2686	22.5180	23.2686	23.2686	22.5180	23.2686	22.5180	23.2686	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

221.2785	195.7930	208.0863	182.9521	177.3910	159.8745	157.7174	163.9014	165.6309	184.6751	196.3771	218.8445	(62)
WWHRS -21.8112	-19.2900	-20.1994	-16.7259	-15.5879	-13.3387	-12.5029	-13.2956	-13.8007	-16.2695	-18.4314	-21.4073	(63a)
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)
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	(63c)
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	(63d)

Output from w/h

199.4673	176.5030	187.8869	166.2262	161.8031	146.5358	145.2145	150.6059	151.8302	168.4055	177.9457	197.4372	(64)

Total per year (kWh/year) = Sum(64)m = 2029.8612 (64)

12Total per year (kWh/year) 2030 (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)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

95.3283	84.7493	90.9419	81.8831	80.7357	74.2098	74.1943	76.2505	76.1238	83.1577	86.3469	94.5190	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.0029	89.6818	81.0029	83.7030	81.0029	83.7030	81.0029	81.0029	83.7030	81.0029	83.7030	81.0029	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.2508	156.8619	152.8022	144.1595	133.2497	122.9960	116.1460	114.5349	118.5947	127.2373	138.1471	148.4008	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	(71)
Water heating gains (Table 5)	128.1295	126.1150	122.2338	113.7265	108.5158	103.0691	99.7235	102.4872	105.7275	111.7711	119.9263	127.0417	(72)
Total internal gains	417.1014	425.3768	408.7570	394.3072	375.4866	359.4864	346.5906	347.7433	357.7434	372.7295	394.4946	409.1636	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	3.1700	36.7938	0.4000	0.7000	0.7700	22.6321	(77)
Northwest	5.7100	11.2829	0.4000	0.7000	0.7700	12.5011	(81)

Solar gains 35.1333	63.9973	98.5934	140.6491	174.4128	180.5739	171.0036	144.6796	112.9784	73.7045	42.8378	29.5775	(83)
Total gains 452.2347	489.3742	507.3505	534.9563	549.8994	540.0603	517.5942	492.4229	470.7218	446.4341	437.3323	438.7411	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	135.6095	136.1908	136.7771	139.7859	140.4036	143.5759	143.5759	144.2276	142.2899	140.4036	139.1736	137.9649	
alpha	10.0406	10.0794	10.1185	10.3191	10.3602	10.5717	10.5717	10.6152	10.4860	10.3602	10.2782	10.1977	
util living area	0.9935	0.9837	0.9560	0.8418	0.6510	0.4479	0.3213	0.3515	0.5586	0.8570	0.9767	0.9948	(86)
MIT	20.6600	20.7513	20.8597	20.9697	20.9976	21.0000	21.0000	21.0000	20.9996	20.9698	20.8211	20.6511	(87)
Th 2	20.6231	20.6247	20.6263	20.6343	20.6359	20.6440	20.6440	20.6456	20.6408	20.6359	20.6327	20.6295	(88)
util rest of house	0.9922	0.9806	0.9483	0.8229	0.6263	0.4230	0.2953	0.3244	0.5297	0.8356	0.9718	0.9937	(89)
MIT 2	20.3056	20.3968	20.5030	20.6104	20.6343	20.6440	20.6440	20.6456	20.6405	20.6128	20.4728	20.3025	(90)
Living area fraction									fLA = Living area / (4) =			0.4238	(91)
MIT	20.4558	20.5470	20.6542	20.7627	20.7883	20.7948	20.7949	20.7958	20.7927	20.7641	20.6205	20.4502	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.3058	20.3970	20.5042	20.6127	20.6383	20.6448	20.6449	20.6458	20.6427	20.6141	20.4705	20.3002	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9785	0.9456	0.8217	0.6264	0.4231	0.2954	0.3245	0.5298	0.8343	0.9693	0.9926	(94)
Useful gains	448.1149	478.8393	479.7398	439.5889	344.4662	228.4882	152.9012	159.7708	249.4071	372.4607	423.9139	435.4979	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	640.5838	617.5751	555.6898	454.7590	345.5132	228.5030	152.9015	159.7715	249.5583	387.0981	521.4085	633.3623	(97)
Space heating kWh	143.1969	93.2304	56.5068	10.9224	0.7790	0.0000	0.0000	0.0000	0.0000	10.8902	70.1961	147.2111	(98a)
Space heating requirement - total per year (kWh/year)												532.9330	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	143.1969	93.2304	56.5068	10.9224	0.7790	0.0000	0.0000	0.0000	10.8902	70.1961	147.2111	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												532.9330	
Space heating per m2										(98c) / (4) =		10.0383	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 79.8000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	143.1969	93.2304	56.5068	10.9224	0.7790	0.0000	0.0000	0.0000	0.0000	10.8902	70.1961	147.2111	(98)
Space heating efficiency (main heating system 1)	79.8000	79.8000	79.8000	79.8000	79.8000	0.0000	0.0000	0.0000	0.0000	79.8000	79.8000	79.8000	(210)
Space heating fuel (main heating system)	179.4447	116.8301	70.8106	13.6873	0.9762	0.0000	0.0000	0.0000	0.0000	13.6469	87.9650	184.4751	(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	0.0000	(215)
Water heating													
Water heating requirement	199.4673	176.5030	187.8869	166.2262	161.8031	146.5358	145.2145	150.6059	151.8302	168.4055	177.9457	197.4372	(64)
Efficiency of water heater												88.8000	(216)
(217)m	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	(217)
Fuel for water heating, kWh/month	224.6253	198.7646	211.5844	187.1917	182.2106	165.0178	163.5299	169.6012	170.9799	189.6459	200.3893	222.3392	(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	18.3171	16.5445	18.3171	17.7262	18.3171	17.7262	18.3171	18.3171	17.7262	18.3171	17.7262	18.3171	(231)
Lighting	15.6612	12.5640	11.3125	8.2880	6.4019	5.2304	5.8400	7.5911	9.8600	12.9369	14.6122	16.0964	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.4611	-23.7670	-34.7939	-40.1867	-44.6325	-42.2266	-41.8742	-39.0126	-34.2234	-27.8381	-18.3863	-14.2088	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-6.2041	-12.7672	-24.3733	-35.2748	-45.7052	-45.5144	-45.1537	-38.8664	-29.4638	-18.0002	-8.2351	-4.9402	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year

Space heating fuel - main system 1 667.8359 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.8000

Water heating fuel used 2285.8798 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700)

mechanical ventilation fans (SFP = 0.7700) 129.6691 (230a)

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year	215.6691	(231)
Electricity for lighting (calculated in Appendix L)	126.3945	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-692.1097	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2603.6696	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	667.8359	0.2100	140.2455	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2285.8798	0.2100	480.0347	(264)
Space and water heating			620.2803	(265)
Pumps, fans and electric keep-hot	215.6691	0.1387	29.9160	(267)
Energy for lighting	126.3945	0.1443	18.2426	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-377.6113	0.1340	-50.5858	
PV Unit electricity exported	-314.4984	0.1268	-39.8833	
Total			-90.4691	(269)
Total CO2, kg/year			577.9697	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.8900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	667.8359	1.1300	754.6545	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2285.8798	1.1300	2583.0441	(278)
Space and water heating			3337.6986	(279)
Pumps, fans and electric keep-hot	215.6691	1.5128	326.2643	(281)
Energy for lighting	126.3945	1.5338	193.8682	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-377.6113	1.4951	-564.5536	
PV Unit electricity exported	-314.4984	0.4655	-146.4127	
Total			-710.9663	(283)
Total Primary energy kWh/year			3146.8647	(286)
Dwelling Primary energy Rate (DPER)			59.2700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		53.0900	(1b) x	2.6000	(2b) =	138.0340	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		138.0340	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1449	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3949	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3949	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													

	0.5035	0.4936	0.4837	0.4344	0.4245	0.3751	0.3751	0.3653	0.3949	0.4245	0.4443	0.4640	(22b)
Effective ac	0.6267	0.6218	0.6170	0.5943	0.5901	0.5704	0.5704	0.5667	0.5780	0.5901	0.5987	0.6076	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opening Type			8.8800	1.1450	10.1679			(27)
GF			53.0900	0.1300	6.9017			(28a)
External Wall 1	41.7300	8.8800	32.8500	0.1800	5.9130			(29a)
Total net area of external elements Aum(A, m2)			94.8200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.9826			(33)
Main dwelling								
Party Wall 1			41.5200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	378.0260	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.3800	0.0500	0.2190
E3 Sill	1.3800	0.0500	0.0690
E4 Jamb	8.3800	0.0500	0.4190
E5 Ground floor (normal)	16.0500	0.1600	2.5680
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	7.8000	0.0600	0.4680
P1 Party wall - Ground floor	15.9700	0.0800	1.2776
P2 Party wall - Intermediate floor within a dwelling	15.9700	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	16.0500	0.0700	1.1235
E25 Staggered party wall between dwellings	5.2000	0.0600	0.3120

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.9241	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	29.9067	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.5492	28.3250	28.1053	27.0731	26.8799	25.9809	25.9809	25.8145	26.3272	26.8799	27.2706	27.6791	(38)
Heat transfer coeff	58.4559	58.2318	58.0120	56.9798	56.7867	55.8877	55.8877	55.7212	56.2340	56.7867	57.1774	57.5858	(39)
Average = Sum(39)m / 12 =												56.9789	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1011	1.0968	1.0927	1.0733	1.0696	1.0527	1.0527	1.0496	1.0592	1.0696	1.0770	1.0847	(40)
HLP (average)												1.0733	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7812	(42)

Hot water usage for mixer showers

54.0846	53.2718	52.0874	49.8213	48.1490	46.2840	45.2240	46.3994	47.6879	49.6903	52.0051	53.8774	(42a)

Hot water usage for baths

23.3814	23.0341	22.5451	21.6435	20.9684	20.2198	19.8154	20.3010	20.8297	21.6307	22.5509	23.3023	(42b)

Hot water usage for other uses

32.8714	31.6761	30.4808	29.2854	28.0901	26.8948	26.8948	28.0901	29.2854	30.4808	31.6761	32.8714	(42c)

Average daily hot water use (litres/day)	101.4255	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.3374	107.9820	105.1133	100.7503	97.2075	93.3986	91.9342	94.7905	97.8030	101.8018	106.2321	110.0511	(44)
Energy conte	174.7475	153.7650	161.5553	137.9221	130.8600	114.8445	111.1864	117.3704	120.6009	138.1441	151.3471	172.3135	(45)
Energy content (annual)										Total = Sum(45)m =		1684.6566	
Distribution loss (46)m = 0.15 x (45)m	26.2121	23.0647	24.2333	20.6883	19.6290	17.2267	16.6780	17.6056	18.0901	20.7216	22.7021	25.8470	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	221.3424	195.8507	208.1502	183.0139	177.4549	159.9363	157.7813	163.9653	165.6927	184.7390	196.4389	218.9084	(62)
WWHRS	-24.7252	-21.8672	-22.8981	-18.9605	-17.6705	-15.1208	-14.1733	-15.0719	-15.6445	-18.4432	-20.8939	-24.2673	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	196.6171	173.9835	185.2521	164.0534	159.7844	144.8155	143.6080	148.8934	150.0482	166.2958	175.5450	194.6410	(64)
										Total per year (kWh/year) = Sum(64)m =		2003.5375	(64)
12Total per year (kWh/year)												2004	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.3795	84.7954	90.9930	81.9326	80.7869	74.2593	74.2454	76.3016	76.1733	83.2088	86.3964	94.5702	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.0029	89.6818	81.0029	83.7030	81.0029	83.7030	81.0029	81.0029	83.7030	81.0029	83.7030	81.0029	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.2508	156.8619	152.8022	144.1595	133.2497	122.9960	116.1460	114.5349	118.5947	127.2373	138.1471	148.4008	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	(71)
Water heating gains (Table 5)													
	128.1982	126.1837	122.3025	113.7952	108.5845	103.1379	99.7922	102.5559	105.7962	111.8398	119.9950	127.1104	(72)
Total internal gains													
	417.1702	425.4455	408.8258	394.3760	375.5553	359.5551	346.6593	347.8120	357.8121	372.7982	394.5633	409.2323	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	3.1700	36.7938	0.6300	0.7000	0.7700	35.6456	(77)
Northwest	5.7100	11.2829	0.6300	0.7000	0.7700	19.6893	(81)

Solar gains	55.3349	100.7958	155.2846	221.5223	274.7001	284.4039	269.3307	227.8704	177.9410	116.0846	67.4695	46.5845	(83)
Total gains	472.5051	526.2414	564.1104	615.8982	650.2555	643.9590	615.9900	575.6824	535.7531	488.8829	462.0328	455.8168	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.3681	95.7353	96.0979	97.8388	98.1715	99.7507	99.7507	100.0487	99.1364	98.1715	97.5007	96.8092	
alpha	7.3579	7.3824	7.4065	7.5226	7.5448	7.6500	7.6500	7.6699	7.6091	7.5448	7.5000	7.4539	
util living area													
	0.9975	0.9938	0.9823	0.9261	0.7740	0.5527	0.3990	0.4447	0.7060	0.9483	0.9928	0.9981	(86)
MIT	20.2697	20.4000	20.5843	20.8271	20.9639	20.9974	20.9998	20.9996	20.9858	20.8156	20.5123	20.2571	(87)
Th 2	20.0000	20.0034	20.0068	20.0227	20.0257	20.0397	20.0397	20.0422	20.0343	20.0257	20.0197	20.0134	(88)
util rest of house													
	0.9963	0.9908	0.9738	0.8949	0.7079	0.4713	0.3120	0.3525	0.6164	0.9189	0.9887	0.9971	(89)
MIT 2	19.1703	19.3384	19.5716	19.8688	20.0025	20.0387	20.0396	20.0422	20.0278	19.8654	19.4948	19.1649	(90)
Living area fraction									fLA = Living area / (4) =			0.4238	(91)
MIT	19.6362	19.7883	20.0008	20.2750	20.4099	20.4450	20.4466	20.4479	20.4338	20.2681	19.9260	19.6278	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6362	19.7883	20.0008	20.2750	20.4099	20.4450	20.4466	20.4479	20.4338	20.2681	19.9260	19.6278	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9900	0.9737	0.9039	0.7351	0.5059	0.3489	0.3916	0.6545	0.9274	0.9882	0.9966	(94)
Useful gains	470.4879	520.9738	549.2839	556.7135	477.9776	325.7661	214.9305	225.4512	350.6653	453.3975	456.5796	454.2771	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	896.4945	866.9729	783.2074	648.1434	494.6087	326.6636	214.9750	225.5550	356.1728	549.0187	733.3591	888.4226	(97)
Space heating kWh													
	316.9489	232.5114	174.0391	65.8295	12.3735	0.0000	0.0000	0.0000	0.0000	71.1421	199.2813	323.0042	(98a)
Space heating requirement - total per year (kWh/year)												1395.1300	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	316.9489	232.5114	174.0391	65.8295	12.3735	0.0000	0.0000	0.0000	0.0000	71.1421	199.2813	323.0042	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1395.1300	
Space heating per m2											(98c) / (4) =	26.2786	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	316.9489	232.5114	174.0391	65.8295	12.3735	0.0000	0.0000	0.0000	0.0000	71.1421	199.2813	323.0042	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	343.3900	251.9083	188.5580	71.3212	13.4058	0.0000	0.0000	0.0000	0.0000	77.0771	215.9060	349.9504	(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	0.0000	(215)
Water heating													
Water heating requirement													
	196.6171	173.9835	185.2521	164.0534	159.7844	144.8155	143.6080	148.8934	150.0482	166.2958	175.5450	194.6410	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1245	84.7109	83.9200	82.1853	80.3856	79.8000	79.8000	79.8000	79.8000	82.2992	84.3449	85.1874	(217)
Fuel for water heating, kWh/month													
	230.9760	205.3851	220.7485	199.6141	198.7725	181.4731	179.9599	186.5833	188.0303	202.0624	208.1276	228.4856	(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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	16.8308	13.5023	12.1573	8.9070	6.8800	5.6210	6.2762	8.1580	10.5964	13.9031	15.7035	17.2986	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3597	-21.3475	-32.3428	-38.4053	-43.2291	-41.0377	-40.5588	-37.3961	-32.1215	-25.3163	-16.1809	-12.2910	(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	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-5.0738	-10.9185	-22.1593	-33.9568	-45.5553	-45.9945	-45.4323	-38.1481	-27.5594	-15.8109	-6.8383	-3.9928	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year		
Space heating fuel - main system 1	1511.5168	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2430.2185	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	135.8342	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-656.0266	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3507.5430	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1511.5168	0.2100	317.4185	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2430.2185	0.2100	510.3459	(264)
Space and water heating			827.7644	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	135.8342	0.1443	19.6051	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-354.5866	0.1335	-47.3264	
PV Unit electricity exported	-301.4400	0.1253	-37.7775	
Total			-85.1039	(269)
Total CO2, kg/year			774.1949	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.5800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1511.5168	1.1300	1708.0140	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2430.2185	1.1300	2746.1469	(278)
Space and water heating			4454.1609	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	135.8342	1.5338	208.3471	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-354.5866	1.4932	-529.4743	
PV Unit electricity exported	-301.4400	0.4600	-138.6616	
Total			-668.1358	(283)
Total Primary energy kWh/year			4124.4730	(286)
Target Primary Energy Rate (TPER)			77.6900	(287)

Full SAP Calculation Printout

Property Reference	1B2P SD Bungalow	**Issued on Date**	03/09/2025
Assessment Reference	BeLean	**Prop Type Ref**	
Property	1B2P, Land at Combe Farm		

SAP Rating	99 A	**DER**	7.51	**TER**	11.45
Environmental	95 A	**% DER < TER**			34.41
CO_2 Emissions (t/year)	0.29	**DFEE**	36.16	**TFEE**	42.66
Compliance Check	See BREL	**% DFEE < TFEE**			15.26
% DPER < TPER	32.07	**DPER**	41.60	**TPER**	61.25

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area		Storey height		Volume	
Main dwelling		(m2)		(m)		(m3)	
Ground floor		53.7400	(1b)	x 2.4000	(2b) =	128.9760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7400						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	128.9760	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	73.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3232	0.3195	0.3157	0.2970	0.2932	0.2745	0.2745	0.2707	0.2820	0.2932	0.3007	0.3082	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Windows			7.5400	1.0536	7.9444			(27)
Front Door			1.9400	1.0000	1.9400			(26)
Heatloss Floor 1			53.7400	0.1000	5.3740	110.0000	5911.4000	(28a)
External Wall 1	50.8600	9.4800	41.3800	0.1600	6.6208	140.0000	5793.2000	(29a)
External Roof 1	53.7400		53.7400	0.1000	5.3740	9.0000	483.6600	(30)
Total net area of external elements Aum(A, m2)			158.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.2532			(33)
Main dwelling								
Party Wall 1			20.1800	0.0000	0.0000	180.0000	3632.4000	(32)
Internal Wall 1			66.1400			9.0000	595.2600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16415.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		305.4693 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	9.7400	0.0620	0.6039	
E3 Sill	7.2800	0.0390	0.2839	
E4 Jamb	24.8200	0.0520	1.2906	
E5 Ground floor (normal)	21.1900	0.0710	1.5045	
E10 Eaves (insulation at ceiling level)	21.1900	0.0500	1.0595	
P1 Party wall - Ground floor	8.4100	0.0800	0.6728	
P4 Party wall - Roof (insulation at ceiling level)	8.4100	0.0385	0.3238	
E16 Corner (normal)	4.8000	0.0360	0.1728	
E18 Party wall between dwellings	4.8000	0.0495	0.2376	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.1494	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	33.4027	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.7582	13.5986	13.4390	12.6409	12.4813	11.6833	11.6833	11.5237	12.0025	12.4813	12.8005	13.1198	(38)
Heat transfer coeff	47.1609	47.0012	46.8416	46.0436	45.8840	45.0860	45.0860	44.9263	45.4052	45.8840	46.2032	46.5224	(39)
Average = Sum(39)m / 12 =												46.0037	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8776	0.8746	0.8716	0.8568	0.8538	0.8390	0.8390	0.8360	0.8449	0.8538	0.8598	0.8657	(40)
HLP (average)												0.8560	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.8004	(42)
Hot water usage for mixer showers	54.4056	53.5879	52.3965	50.1170	48.4347	46.5587	45.4923	46.6747	47.9709	49.9851	52.3137	54.1971	(42a)
Hot water usage for baths	23.5194	23.1701	22.6782	21.7713	21.0922	20.3391	19.9324	20.4208	20.9527	21.7584	22.6840	23.4399	(42b)
Hot water usage for other uses	33.0674	31.8650	30.6625	29.4601	28.2576	27.0552	27.0552	28.2576	29.4601	30.6625	31.8650	33.0674	(42c)
Average daily hot water use (litres/day)												102.0276	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.9924	108.6230	105.7373	101.3483	97.7845	93.9530	92.4799	95.3532	98.3836	102.4061	106.8627	110.7044	(44)
Energy conte	175.7848	154.6777	162.5143	138.7408	131.6367	115.5262	111.8464	118.0672	121.3168	138.9641	152.2455	173.3364	(45)
Energy content (annual)										Total = Sum(45)m =		1694.6569	
Distribution loss (46)m = 0.15 x (45)m	26.3677	23.2017	24.3771	20.8111	19.7455	17.3289	16.7770	17.7101	18.1975	20.8446	22.8368	26.0005	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7506	(55)
Total storage loss	23.2686	21.0168	23.2686	22.5180	23.2686	22.5180	23.2686	23.2686	22.5180	23.2686	22.5180	23.2686	(56)
If cylinder contains dedicated solar storage	23.2686	21.0168	23.2686	22.5180	23.2686	22.5180	23.2686	23.2686	22.5180	23.2686	22.5180	23.2686	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	222.3158	196.7057	209.0453	183.7708	178.1677	160.5562	158.3774	164.5982	166.3468	185.4951	197.2755	219.8674	(62)
WWHRS	-21.9406	-19.4045	-20.3192	-16.8251	-15.6804	-13.4178	-12.5771	-13.3745	-13.8826	-16.3661	-18.5408	-21.5343	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	200.3752	177.3013	188.7260	166.9457	162.4873	147.1383	145.8003	151.2237	152.4642	169.1291	178.7347	198.3331	(64)
										Total per year (kWh/year) = Sum(64)m =		2038.6589	(64)
12Total per year (kWh/year)												2039	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.6732	85.0527	91.2608	82.1553	80.9940	74.4364	74.4137	76.4821	76.3618	83.4304	86.6456	94.8591	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.8781	93.9722	84.8781	87.7073	84.8781	87.7073	84.8781	84.8781	87.7073	84.8781	87.7073	84.8781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.9328	158.5612	154.4575	145.7213	134.6933	124.3285	117.4042	115.7758	119.8795	128.6157	139.6437	150.0085	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	(71)
Water heating gains (Table 5)	128.5931	126.5666	122.6624	114.1046	108.8629	103.3840	100.0185	102.7986	106.0581	112.1376	120.3412	127.4988	(72)
Total internal gains	423.4092	432.1053	415.0033	400.5385	381.4396	365.4251	352.3061	353.4577	363.6502	378.6367	400.6975	415.3907	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.6000	11.2829	0.4000	0.7000	0.7700	5.6923	(75)
Southwest	4.9400	36.7938	0.4000	0.7000	0.7700	35.2690	(79)

Solar gains	40.9613	71.6630	103.0746	136.1323	160.1631	162.3845	155.1495	136.7049	114.4414	80.5570	49.4065	34.8315	(83)
Total gains	464.3705	503.7683	518.0779	536.6709	541.6026	527.8097	507.4556	490.1626	478.0916	459.1937	450.1041	450.2223	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	96.6899	97.0182	97.3488	99.0361	99.3806	101.1397	101.1397	101.4990	100.4286	99.3806	98.6940	98.0168	
alpha	7.4460	7.4679	7.4899	7.6024	7.6254	7.7426	7.7426	7.7666	7.6952	7.6254	7.5796	7.5345	
util living area	0.9919	0.9835	0.9653	0.8996	0.7568	0.5444	0.3908	0.4213	0.6463	0.9003	0.9788	0.9933	(86)
MIT	20.4206	20.5368	20.6824	20.8678	20.9700	20.9978	20.9999	20.9997	20.9924	20.8866	20.6416	20.4064	(87)
Th 2	20.5612	20.5627	20.5642	20.5716	20.5731	20.5805	20.5805	20.5820	20.5775	20.5731	20.5701	20.5672	(88)
util rest of house	0.9904	0.9806	0.9594	0.8844	0.7286	0.5095	0.3536	0.3832	0.6095	0.8825	0.9747	0.9921	(89)
MIT 2	20.0173	20.1334	20.2773	20.4600	20.5508	20.5792	20.5805	20.5819	20.5727	20.4800	20.2438	20.0084	(90)
Living area fraction										fLA = Living area / (4) =		0.4137	(91)
MIT	20.1842	20.3003	20.4449	20.6287	20.7242	20.7524	20.7539	20.7547	20.7463	20.6482	20.4084	20.1730	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.0342	20.1503	20.2949	20.4787	20.5742	20.6024	20.6039	20.6047	20.5963	20.4982	20.2584	20.0230	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9884	0.9775	0.9553	0.8808	0.7286	0.5113	0.3557	0.3852	0.6111	0.8791	0.9712	0.9903	(94)
Useful gains	458.9677	492.4446	494.8972	472.7009	394.6346	269.8726	180.4825	188.8326	292.1752	403.6951	437.1518	445.8521	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	742.0360	716.7830	646.1741	533.1242	407.1841	270.6227	180.5214	188.9032	294.9650	454.1672	607.9580	736.1245	(97)
Space heating kWh	210.6028	150.7554	112.5500	43.5048	9.3368	0.0000	0.0000	0.0000	0.0000	37.5513	122.9805	215.9627	(98a)
Space heating requirement - total per year (kWh/year)												903.2442	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	210.6028	150.7554	112.5500	43.5048	9.3368	0.0000	0.0000	0.0000	0.0000	37.5513	122.9805	215.9627	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												903.2442	
Space heating per m2											(98c) / (4) =	16.8077	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 79.8000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	210.6028	150.7554	112.5500	43.5048	9.3368	0.0000	0.0000	0.0000	0.0000	37.5513	122.9805	215.9627	(98)
Space heating efficiency (main heating system 1)	79.8000	79.8000	79.8000	79.8000	79.8000	0.0000	0.0000	0.0000	0.0000	79.8000	79.8000	79.8000	(210)
Space heating fuel (main heating system)	263.9133	188.9166	141.0401	54.5173	11.7003	0.0000	0.0000	0.0000	0.0000	47.0567	154.1109	270.6299	(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	0.0000	(215)
Water heating													
Water heating requirement	200.3752	177.3013	188.7260	166.9457	162.4873	147.1383	145.8003	151.2237	152.4642	169.1291	178.7347	198.3331	(64)
Efficiency of water heater												88.8000	(216)
(217)m	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	(217)
Fuel for water heating, kWh/month	225.6477	199.6636	212.5293	188.0019	182.9812	165.6963	164.1896	170.2970	171.6939	190.4606	201.2779	223.3481	(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	19.7995	17.8834	19.7995	19.1608	19.7995	19.1608	19.7995	19.7995	19.1608	19.7995	19.1608	19.7995	(231)
Lighting	16.4104	13.1650	11.8536	8.6845	6.7081	5.4806	6.1194	7.9542	10.3317	13.5558	15.3113	16.8665	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.2322	-62.1594	-81.9941	-85.4948	-87.8939	-80.9546	-80.2861	-77.9906	-73.5554	-67.8645	-51.1652	-42.5672	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-44.1075	-86.6836	-159.0575	-221.9410	-280.1484	-276.5088	-274.2719	-239.2945	-185.9110	-118.8842	-57.2928	-35.4471	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year

Space heating fuel - main system 1 1131.8850 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.8000

Water heating fuel used 2295.7871 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 0.9350)

mechanical ventilation fans (SFP = 0.9350) 147.1229 (230a)

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year	233.1229	(231)
Electricity for lighting (calculated in Appendix L)	132.4412	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2819.7061	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	973.5301	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1131.8850	0.2100	237.6958	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2295.7871	0.2100	482.1153	(264)
Space and water heating			719.8111	(265)
Pumps, fans and electric keep-hot	233.1229	0.1387	32.3370	(267)
Energy for lighting	132.4412	0.1443	19.1154	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-840.1578	0.1362	-114.4092	
PV Unit electricity exported	-1979.5483	0.1280	-253.3653	
Total			-367.7744	(269)
Total CO2, kg/year			403.4891	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.5100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1131.8850	1.1300	1279.0300	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2295.7871	1.1300	2594.2394	(278)
Space and water heating			3873.2694	(279)
Pumps, fans and electric keep-hot	233.1229	1.5128	352.6684	(281)
Energy for lighting	132.4412	1.5338	203.1428	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-840.1578	1.5034	-1263.0625	
PV Unit electricity exported	-1979.5483	0.4699	-930.1995	
Total			-2193.2619	(283)
Total Primary energy kWh/year			2235.8186	(286)
Dwelling Primary energy Rate (DPER)			41.6000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		53.7400 (1b)	x	2.4000 (2b)	=	128.9760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7400						(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)			=	128.9760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1551	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4051	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4051	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													

	0.5165	0.5063	0.4962	0.4456	0.4354	0.3848	0.3848	0.3747	0.4051	0.4354	0.4557	0.4760	(22b)
Effective ac	0.6334	0.6282	0.6231	0.5993	0.5948	0.5740	0.5740	0.5702	0.5820	0.5948	0.6038	0.6133	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.9400	1.0000	1.9400			(26)
TER Opening Type			7.5400	1.1450	8.6336			(27)
Heatloss Floor 1			53.7400	0.1300	6.9862			(28a)
External Wall 1	50.8600	9.4800	41.3800	0.1800	7.4484			(29a)
External Roof 1	53.7400		53.7400	0.1100	5.9114			(30)
Total net area of external elements Aum(A, m2)			158.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.9196			(33)
Main dwelling								
Party Wall 1			20.1800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	305.4693	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	9.7400	0.0500	0.4870	
E3 Sill	7.2800	0.0500	0.3640	
E4 Jamb	24.8200	0.0500	1.2410	
E5 Ground floor (normal)	21.1900	0.1600	3.3904	
E10 Eaves (insulation at ceiling level)	21.1900	0.0600	1.2714	
P1 Party wall - Ground floor	8.4100	0.0800	0.6728	
P4 Party wall - Roof (insulation at ceiling level)	8.4100	0.1200	1.0092	
E16 Corner (normal)	4.8000	0.0900	0.4320	
E18 Party wall between dwellings	4.8000	0.0600	0.2880	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1558	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	40.0754	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.9574	26.7370	26.5209	25.5061	25.3162	24.4324	24.4324	24.2687	24.7728	25.3162	25.7003	26.1019	(38)
Heat transfer coeff	67.0328	66.8123	66.5963	65.5815	65.3916	64.5078	64.5078	64.3441	64.8482	65.3916	65.7757	66.1773	(39)

Average = Sum(39)m / 12 =	65.5806	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2474	1.2433	1.2392	1.2203	1.2168	1.2004	1.2004	1.1973	1.2067	1.2168	1.2240	1.2314	(40)
HLP (average)												1.2203	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8004	(42)

Hot water usage for mixer showers

54.4056	53.5879	52.3965	50.1170	48.4347	46.5587	45.4923	46.6747	47.9709	49.9851	52.3137	54.1971	(42a)

Hot water usage for baths

23.5194	23.1701	22.6782	21.7713	21.0922	20.3391	19.9324	20.4208	20.9527	21.7584	22.6840	23.4399	(42b)

Hot water usage for other uses

33.0674	31.8650	30.6625	29.4601	28.2576	27.0552	27.0552	28.2576	29.4601	30.6625	31.8650	33.0674	(42c)

Average daily hot water use (litres/day)	102.0276	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.9924	108.6230	105.7373	101.3483	97.7845	93.9530	92.4799	95.3532	98.3836	102.4061	106.8627	110.7044	(44)
Energy conte	175.7848	154.6777	162.5143	138.7408	131.6367	115.5262	111.8464	118.0672	121.3168	138.9641	152.2455	173.3364	(45)
Energy content (annual)										Total = Sum(45)m =		1694.6569	
Distribution loss (46)m = 0.15 x (45)m	26.3677	23.2017	24.3771	20.8111	19.7455	17.3289	16.7770	17.7101	18.1975	20.8446	22.8368	26.0005	(46)

Water storage loss:		
Store volume	150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7527	(55)

Total storage loss

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

222.3797	196.7635	209.1092	183.8326	178.2316	160.6180	158.4413	164.6621	166.4087	185.5590	197.3374	219.9313	(62)
WWHRS -24.8719	-21.9970	-23.0339	-19.0730	-17.7754	-15.2105	-14.2574	-15.1613	-15.7374	-18.5526	-21.0179	-24.4114	(63a)
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)
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	(63c)
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	(63d)
Output from w/h													
197.5078	174.7665	186.0752	164.7596	160.4563	145.4075	144.1839	149.5007	150.6713	167.0064	176.3195	195.5199	(64)
									Total per year (kWh/year) = Sum(64)m =		2012.1746	(64)
12Total per year (kWh/year)												2012	(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)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

95.7244	85.0989	91.3119	82.2048	81.0451	74.4859	74.4649	76.5333	76.4113	83.4815	86.6951	94.9103	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.8781	93.9722	84.8781	87.7073	84.8781	87.7073	84.8781	84.8781	87.7073	84.8781	87.7073	84.8781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.9328	158.5612	154.4575	145.7213	134.6933	124.3285	117.4042	115.7758	119.8795	128.6157	139.6437	150.0085	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	(69)

Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	(71)
Water heating gains (Table 5)	128.6618	126.6353	122.7311	114.1733	108.9316	103.4527	100.0872	102.8673	106.1268	112.2063	120.4099	127.5676	(72)
Total internal gains	423.4779	432.1740	415.0720	400.6072	381.5083	365.4939	352.3748	353.5264	363.7190	378.7054	400.7663	415.4594	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.6000	11.2829	0.6300	0.7000	0.7700	8.9654	(75)
Southwest	4.9400	36.7938	0.6300	0.7000	0.7700	55.5487	(79)

Solar gains	64.5140	112.8692	162.3425	214.4084	252.2568	255.7557	244.3605	215.3102	180.2452	126.8772	77.8153	54.8597	(83)
Total gains	487.9920	545.0432	577.4145	615.0157	633.7651	621.2495	596.7353	568.8366	543.9642	505.5827	478.5815	470.3191	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.0261	68.2505	68.4719	69.5315	69.7334	70.6888	70.6888	70.8686	70.3177	69.7334	69.3262	68.9055	
alpha	5.5351	5.5500	5.5648	5.6354	5.6489	5.7126	5.7126	5.7246	5.6878	5.6489	5.6217	5.5937	
util living area	0.9943	0.9885	0.9762	0.9344	0.8315	0.6415	0.4720	0.5143	0.7567	0.9442	0.9873	0.9953	(86)
MIT	19.9396	20.1018	20.3271	20.6326	20.8637	20.9759	20.9964	20.9942	20.9397	20.6595	20.2588	19.9213	(87)
Th 2	19.8823	19.8856	19.8887	19.9038	19.9066	19.9197	19.9197	19.9221	19.9146	19.9066	19.9009	19.8949	(88)
util rest of house	0.9921	0.9841	0.9667	0.9082	0.7710	0.5439	0.3582	0.3972	0.6642	0.9162	0.9815	0.9935	(89)
MIT 2	18.6801	18.8877	19.1725	19.5525	19.8031	19.9083	19.9189	19.9206	19.8806	19.5933	19.0995	18.6661	(90)
Living area fraction										fLA = Living area / (4) =		0.4137	(91)
MIT	19.2011	19.3900	19.6501	19.9993	20.2418	20.3499	20.3646	20.3647	20.3187	20.0343	19.5790	19.1853	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2011	19.3900	19.6501	19.9993	20.2418	20.3499	20.3646	20.3647	20.3187	20.0343	19.5790	19.1853	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9816	0.9641	0.9109	0.7912	0.5840	0.4055	0.4460	0.7009	0.9201	0.9793	0.9918	(94)
Useful gains	483.2130	534.9873	556.6966	560.1996	501.4167	362.8082	241.9957	253.6731	381.2901	465.1836	468.6894	466.4812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	998.8617	968.1080	875.7481	727.9063	558.5621	370.9139	242.8448	255.1073	403.2735	616.9255	820.8162	991.6875	(97)
Space heating kWh	383.6427	291.0571	237.3743	120.7488	42.5162	0.0000	0.0000	0.0000	0.0000	112.8960	253.5313	390.7534	(98a)
Space heating requirement - total per year (kWh/year)												1832.5199	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	383.6427	291.0571	237.3743	120.7488	42.5162	0.0000	0.0000	0.0000	0.0000	112.8960	253.5313	390.7534	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1832.5199	
Space heating per m2											(98c) / (4) =	34.0997	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	383.6427	291.0571	237.3743	120.7488	42.5162	0.0000	0.0000	0.0000	0.0000	112.8960	253.5313	390.7534	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	415.6475	315.3381	257.1769	130.8221	46.0631	0.0000	0.0000	0.0000	0.0000	122.3142	274.6818	423.3515	(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	0.0000	(215)
Water heating													
Water heating requirement	197.5078	174.7665	186.0752	164.7596	160.4563	145.4075	144.1839	149.5007	150.6713	167.0064	176.3195	195.5199	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5220	85.1951	84.6069	83.3737	81.5309	79.8000	79.8000	79.8000	79.8000	83.2012	84.8736	85.5811	(217)
Fuel for water heating, kWh/month	230.9439	205.1368	219.9291	197.6157	196.8043	182.2149	180.6816	187.3443	188.8111	200.7260	207.7436	228.4616	(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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.6360	14.1482	12.7389	9.3331	7.2091	5.8899	6.5764	8.5483	11.1034	14.5682	16.4548	18.1261	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.5718	-56.4706	-76.4661	-80.9020	-83.2893	-76.4787	-75.6159	-73.3091	-68.6713	-62.1741	-45.5674	-37.2477	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-36.1142	-74.1738	-144.2113	-212.0901	-276.1961	-275.9123	-272.5595	-232.5672	-172.9751	-104.3488	-47.6369	-28.6849	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year		
Space heating fuel - main system 1	1985.3953	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2426.4127	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	142.3325	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2656.2341	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1983.9064	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1985.3953	0.2100	416.9330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2426.4127	0.2100	509.5467	(264)
Space and water heating			926.4797	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	142.3325	0.1443	20.5430	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-778.7639	0.1359	-105.8040	
PV Unit electricity exported	-1877.4702	0.1265	-237.5674	
Total			-343.3714	(269)
Total CO2, kg/year			615.5805	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1985.3953	1.1300	2243.4967	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2426.4127	1.1300	2741.8464	(278)
Space and water heating			4985.3431	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	142.3325	1.5338	218.3144	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-778.7639	1.5022	-1169.8515	
PV Unit electricity exported	-1877.4702	0.4645	-872.0904	
Total			-2041.9419	(283)
Total Primary energy kWh/year			3291.8163	(286)
Target Primary Energy Rate (TPER)			61.2500	(287)

Full SAP Calculation Printout

Property Reference	2B4P FLAT	**Issued on Date**	03/09/2025
Assessment Reference	BeLean	**Prop Type Ref**	
Property	Land at Combe Farm		

SAP Rating	86 B	**DER**	8.40	**TER**	11.52
Environmental	93 A	**% DER < TER**			27.08
CO_2 Emissions (t/year)	0.53	**DFEE**	25.41	**TFEE**	28.31
Compliance Check	See BREL	**% DFEE < TFEE**			10.25
% DPER < TPER	24.56	**DPER**	45.99	**TPER**	60.96

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	73.3500	(1b)	x 2.5000	(2b) =	183.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.3500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	183.3750	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	73.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3232	0.3195	0.3157	0.2970	0.2932	0.2745	0.2745	0.2707	0.2820	0.2932	0.3007	0.3082	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Window North			5.9000	1.0536	6.2165			(27)
Door			3.4100	1.0000	3.4100			(26)
Window S			5.6400	1.0536	5.9425			(27)
External Wall	48.5800	14.9500	33.6300	0.1600	5.3808	190.0000	6389.7000	(29a)
Total net area of external elements Aum(A, m2)			48.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.9498			(33)
Main dwelling								
Party Wall 1			56.3700	0.0000	0.0000	180.0000	10146.6000	(32)
Party Floor 1			73.3500			40.0000	2934.0000	(32d)
Party Ceiling 1			73.3500			30.0000	2200.5000	(32b)
Internal Wall 1			73.1500			75.0000	5486.2500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 27157.0500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	370.2393	(35)
List of Thermal Bridges		

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.5200	0.0620	0.3422
E3 Sill	5.5200	0.0390	0.2153
E4 Jamb	25.3200	0.0520	1.3166
E7 Party floor between dwellings (in blocks of flats)	19.4300	0.0685	1.3310
E7 Party floor between dwellings (in blocks of flats)	19.4300	0.0685	1.3310
E16 Corner (normal)	12.5000	0.0360	0.4500
E25 Staggered party wall between dwellings	2.5000	0.1010	0.2525
E18 Party wall between dwellings	17.5000	0.0495	0.8663
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.5500	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.5500	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	10.0000	-0.0900	-0.9000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2048 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 26.1546 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.5611	19.3341	19.1072	17.9726	17.7457	16.6110	16.6110	16.3841	17.0649	17.7457	18.1995	18.6534	(38)
Heat transfer coeff	45.7157	45.4888	45.2618	44.1272	43.9003	42.7656	42.7656	42.5387	43.2195	43.9003	44.3541	44.8080	(39)
Average = Sum(39)m / 12 =												44.0705	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6233	0.6202	0.6171	0.6016	0.5985	0.5830	0.5830	0.5799	0.5892	0.5985	0.6047	0.6109	(40)
HLP (average)												0.6008	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3246 (42)
Hot water usage for mixer showers

63.1961	62.2464	60.8625	58.2146	56.2605	54.0814	52.8427	54.2162	55.7217	58.0615	60.7662	62.9540	(42a)

Hot water usage for baths

27.2996	26.8942	26.3232	25.2705	24.4823	23.6082	23.1361	23.7030	24.3203	25.2556	26.3300	27.2073	(42b)

Hot water usage for other uses

38.4366	37.0389	35.6412	34.2435	32.8458	31.4481	31.4481	32.8458	34.2435	35.6412	37.0389	38.4366	(42c)

Average daily hot water use (litres/day) 118.5181 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.9323	126.1795	122.8269	117.7286	113.5886	109.1377	107.4269	110.7650	114.2856	118.9583	124.1351	128.5979	(44)
Energy conte	204.1973	179.6779	188.7804	161.1646	152.9121	134.1975	129.9236	137.1502	140.9255	161.4253	176.8532	201.3532	(45)
Energy content (annual)										Total = Sum(45)m =		1968.5608	
Distribution loss (46)m = 0.15 x (45)m	30.6296	26.9517	28.3171	24.1747	22.9368	20.1296	19.4885	20.5725	21.1388	24.2138	26.5280	30.2030	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7506	(55)
Total storage loss	23.2686	21.0168	23.2686	22.5180	23.2686	22.5180	23.2686	23.2686	22.5180	23.2686	22.5180	23.2686	(56)
If cylinder contains dedicated solar storage	23.2686	21.0168	23.2686	22.5180	23.2686	22.5180	23.2686	23.2686	22.5180	23.2686	22.5180	23.2686	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.7283	221.7059	235.3114	206.1946	199.4431	179.2275	176.4546	183.6812	185.9555	207.9563	221.8832	247.8842	(62)
WWHRS	-25.4857	-22.5397	-23.6023	-19.5436	-18.2140	-15.5858	-14.6092	-15.5354	-16.1257	-19.0104	-21.5365	-25.0137	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	225.2426	199.1661	211.7091	186.6510	181.2291	163.6417	161.8453	168.1458	169.8298	188.9459	200.3468	222.8705	(64)
										Total per year (kWh/year) = Sum(64)m =		2279.6237	(64)
12Total per year (kWh/year)												2280	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	105.1204	93.3653	99.9943	89.6112	88.0681	80.6447	80.4244	82.8273	82.8817	90.8987	94.8277	104.1747	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.2292	119.8252	108.2292	111.8369	108.2292	111.8369	108.2292	108.2292	111.8369	108.2292	111.8369	108.2292	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.9862	207.1133	201.7530	190.3417	175.9369	162.3984	153.3539	151.2267	156.5870	167.9984	182.4032	195.9416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	(71)
Water heating gains (Table 5)	141.2908	138.9364	134.4009	124.4600	118.3711	112.0065	108.0973	111.3269	115.1135	122.1757	131.7051	140.0198	(72)
Total internal gains	515.3757	526.7444	505.2526	487.5080	463.4066	444.1112	427.5499	428.6524	441.4069	459.2727	486.8147	505.0602	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9000	10.6334	0.4000	0.7000	0.7700	12.1735	(74)
North	1.8800	10.6334	0.4000	0.7000	0.7700	3.8790	(74)
East	3.7600	19.6403	0.4000	0.7000	0.7700	14.3293	(76)

Solar gains	30.3818	58.7084	98.2914	151.0576	195.3045	205.2135	193.1483	158.5147	116.3647	69.7786	37.6698	25.1659	(83)
Total gains	545.7576	585.4528	603.5441	638.5656	658.7112	649.3247	620.6981	587.1671	557.7716	529.0513	524.4845	530.2261	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	165.0117	165.8349	166.6663	170.9518	171.8355	176.3945	176.3945	177.3355	174.5422	171.8355	170.0772	168.3545	
alpha	12.0008	12.0557	12.1111	12.3968	12.4557	12.7596	12.7596	12.8224	12.6361	12.4557	12.3385	12.2236	
util living area													
	0.9949	0.9857	0.9563	0.8198	0.6192	0.4215	0.3032	0.3333	0.5346	0.8411	0.9770	0.9959	(86)
MIT	20.7491	20.8232	20.9099	20.9880	20.9995	21.0000	21.0000	21.0000	20.9999	20.9868	20.8812	20.7438	(87)
Th 2	20.6884	20.6899	20.6915	20.6992	20.7007	20.7085	20.7085	20.7100	20.7054	20.7007	20.6977	20.6946	(88)
util rest of house													
	0.9938	0.9831	0.9491	0.8025	0.5994	0.4023	0.2831	0.3123	0.5118	0.8216	0.9725	0.9951	(89)
MIT 2	20.4530	20.5275	20.6123	20.6899	20.7004	20.7085	20.7085	20.7100	20.7054	20.6907	20.5915	20.4535	(90)
Living area fraction										fLA = Living area / (4) =		0.3887	(91)
MIT	20.5681	20.6424	20.7280	20.8058	20.8167	20.8218	20.8218	20.8227	20.8199	20.8058	20.7041	20.5663	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.4181	20.4924	20.5780	20.6558	20.6667	20.6718	20.6718	20.6727	20.6699	20.6558	20.5541	20.4163	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9812	0.9462	0.8000	0.5972	0.3999	0.2805	0.3095	0.5090	0.8185	0.9700	0.9942	(94)
Useful gains	541.8215	574.4387	571.0864	510.8569	393.3803	259.6627	174.1328	181.7567	283.9184	433.0486	508.7543	527.1336	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	736.8502	709.2802	637.1947	518.7488	393.6404	259.6640	174.1328	181.7567	283.9459	441.4524	596.7449	726.6212	(97)
Space heating kWh													
	145.1013	90.6135	49.1846	5.6822	0.1935	0.0000	0.0000	0.0000	0.0000	6.2525	63.3532	148.4187	(98a)
Space heating requirement - total per year (kWh/year)												508.7995	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	145.1013	90.6135	49.1846	5.6822	0.1935	0.0000	0.0000	0.0000	0.0000	6.2525	63.3532	148.4187	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												508.7995	
Space heating per m2											(98c) / (4) =	6.9366	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												79.8000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	145.1013	90.6135	49.1846	5.6822	0.1935	0.0000	0.0000	0.0000	0.0000	6.2525	63.3532	148.4187	(98)
Space heating efficiency (main heating system 1)													
	79.8000	79.8000	79.8000	79.8000	79.8000	0.0000	0.0000	0.0000	0.0000	79.8000	79.8000	79.8000	(210)
Space heating fuel (main heating system)													
	181.8313	113.5507	61.6348	7.1205	0.2425	0.0000	0.0000	0.0000	0.0000	7.8352	79.3900	185.9884	(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	0.0000	(215)
Water heating													
Water heating requirement													
	225.2426	199.1661	211.7091	186.6510	181.2291	163.6417	161.8453	168.1458	169.8298	188.9459	200.3468	222.8705	(64)
Efficiency of water heater												88.8000	(216)
(217)m	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	(217)
Fuel for water heating, kWh/month													
	253.6516	224.2862	238.4111	210.1925	204.0868	184.2812	182.2583	189.3534	191.2498	212.7769	225.6157	250.9803	(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	21.9346	19.8119	21.9346	21.2271	21.9346	21.2271	21.9346	21.9346	21.2271	21.9346	21.2271	21.9346	(231)
Lighting	25.8580	20.7442	18.6779	13.6842	10.5701	8.6358	9.6424	12.5335	16.2798	21.3600	24.1261	26.5766	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-22.2401	-32.0399	-46.7829	-53.8639	-59.6452	-56.3408	-55.8673	-52.1500	-45.8868	-37.4627	-24.8165	-19.2049	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-8.5398	-17.5744	-33.5676	-48.6147	-63.0356	-62.8137	-62.3187	-53.6117	-40.6020	-24.7868	-11.3362	-6.7999	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)
Annual totals kWh/year													
Space heating fuel - main system 1												637.5933	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												88.8000	
Water heating fuel used												2567.1438	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700)		
mechanical ventilation fans (SFP = 0.7700)	172.2625	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	258.2625	(231)
Electricity for lighting (calculated in Appendix L)	208.6886	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-939.9020	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2731.7862	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	637.5933	0.2100	133.8946	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2567.1438	0.2100	539.1002	(264)
Space and water heating			672.9948	(265)
Pumps, fans and electric keep-hot	258.2625	0.1387	35.8242	(267)
Energy for lighting	208.6886	0.1443	30.1202	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-506.3010	0.1340	-67.8588	
PV Unit electricity exported	-433.6010	0.1268	-54.9766	
Total			-122.8353	(269)
Total CO2, kg/year			616.1039	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.4000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	637.5933	1.1300	720.4805	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2567.1438	1.1300	2900.8725	(278)
Space and water heating			3621.3529	(279)
Pumps, fans and electric keep-hot	258.2625	1.5128	390.6995	(281)
Energy for lighting	208.6886	1.5338	320.0936	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-506.3010	1.4953	-757.0786	
PV Unit electricity exported	-433.6010	0.4654	-201.8194	
Total			-958.8979	(283)
Total Primary energy kWh/year			3373.2481	(286)
Dwelling Primary energy Rate (DPER)			45.9900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	73.3500	(1b) x	2.5000	(2b) =	183.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.3500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	183.3750	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1636	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4136	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.5273	0.5170	0.5067	0.4550	0.4446	0.3929	0.3929	0.3826	0.4136	0.4446	0.4653	0.4860	(22b)
Effective ac	0.6390	0.6336	0.6284	0.6035	0.5988	0.5772	0.5772	0.5732	0.5855	0.5988	0.6083	0.6181	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			3.4100	1.0000	3.4100			(26)
TER Opening Type			11.5400	1.1450	13.2137			(27)
External Wall	48.5800	14.9500	33.6300	0.1800	6.0534			(29a)
Total net area of external elements Aum(A, m2)			48.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.6771			(33)
Main dwelling								
Party Wall 1			56.3700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 380.2393 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.5200	0.0500	0.2760
E3 Sill	5.5200	0.0500	0.2760
E4 Jamb	25.3200	0.0500	1.2660
E7 Party floor between dwellings (in blocks of flats)	19.4300	0.0700	1.3601
E7 Party floor between dwellings (in blocks of flats)	19.4300	0.0700	1.3601
E16 Corner (normal)	12.5000	0.0900	1.1250
E25 Staggered party wall between dwellings	2.5000	0.0600	0.1500
E18 Party wall between dwellings	17.5000	0.0600	1.0500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.5500	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.5500	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	10.0000	-0.0900	-0.9000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9632 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 28.6403 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.6709	38.3442	38.0239	36.5197	36.2382	34.9281	34.9281	34.6855	35.4327	36.2382	36.8076	37.4028	(38)
Heat transfer coeff													
	67.3112	66.9845	66.6643	65.1600	64.8786	63.5684	63.5684	63.3258	64.0731	64.8786	65.4479	66.0432	(39)
Average = Sum(39)m / 12 =												65.1587	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9177	0.9132	0.9089	0.8883	0.8845	0.8666	0.8666	0.8633	0.8735	0.8845	0.8923	0.9004	(40)
HLP (average)												0.8883	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3246 (42)

Hot water usage for mixer showers

63.1961	62.2464	60.8625	58.2146	56.2605	54.0814	52.8427	54.2162	55.7217	58.0615	60.7662	62.9540	(42a)

Hot water usage for baths

27.2996	26.8942	26.3232	25.2705	24.4823	23.6082	23.1361	23.7030	24.3203	25.2556	26.3300	27.2073	(42b)

Hot water usage for other uses

38.4366	37.0389	35.6412	34.2435	32.8458	31.4481	31.4481	32.8458	34.2435	35.6412	37.0389	38.4366	(42c)

Average daily hot water use (litres/day) 118.5181 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	128.9323	126.1795	122.8269	117.7286	113.5886	109.1377	107.4269	110.7650	114.2856	118.9583	124.1351	128.5979	(44)
Energy conte	204.1973	179.6779	188.7804	161.1646	152.9121	134.1975	129.9236	137.1502	140.9255	161.4253	176.8532	201.3532	(45)
Energy content (annual)										Total = Sum(45)m =		1968.5608	
Distribution loss (46)m = 0.15 x (45)m													
	30.6296	26.9517	28.3171	24.1747	22.9368	20.1296	19.4885	20.5725	21.1388	24.2138	26.5280	30.2030	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	250.7922	221.7636	235.3753	206.2564	199.5070	179.2894	176.5185	183.7451	186.0174	208.0202	221.9451	247.9481	(62)
WWHRS	-28.8906	-25.5511	-26.7556	-22.1547	-20.6474	-17.6681	-16.5611	-17.6110	-18.2801	-21.5503	-24.4138	-28.3556	(63a)
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)
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	(63c)
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	(63d)
Output from w/h													
	221.9015	196.2125	208.6196	184.1017	178.8596	161.6212	159.9574	166.1341	167.7372	186.4699	197.5313	219.5925	(64)
										Total per year (kWh/year) = Sum(64)m =		2248.7385	(64)
12Total per year (kWh/year)												2249	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.1715	93.4115	100.0454	89.6607	88.1192	80.6941	80.4755	82.8784	82.9312	90.9498	94.8772	104.2259	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	108.2292	119.8252	108.2292	111.8369	108.2292	111.8369	108.2292	108.2292	111.8369	108.2292	111.8369	108.2292	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
204.9862 207.1133 201.7530 190.3417 175.9369 162.3984 153.3539 151.2267 156.5870 167.9984 182.4032 195.9416 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
34.6232 34.6232 34.6232 34.6232 34.6232 34.6232 34.6232 34.6232 34.6232 34.6232 34.6232 34.6232 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-92.9853 -92.9853 -92.9853 -92.9853 -92.9853 -92.9853 -92.9853 -92.9853 -92.9853 -92.9853 -92.9853 -92.9853 (71)
Water heating gains (Table 5)
141.3596 139.0052 134.4696 124.5288 118.4398 112.0752 108.1660 111.3957 115.1822 122.2444 131.7739 140.0885 (72)
Total internal gains
515.4444 526.8131 505.3214 487.5768 463.4753 444.1799 427.6186 428.7211 441.4756 459.3415 486.8834 505.1289 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.7800	10.6334	0.6300	0.7000	0.7700	25.2827	(74)
East	3.7600	19.6403	0.6300	0.7000	0.7700	22.5687	(76)

Solar gains 47.8514 92.4657 154.8090 237.9157 307.6046 323.2113 304.2085 249.6607 183.2745 109.9013 59.3300 39.6363 (83)
Total gains 563.2958 619.2789 660.1304 725.4924 771.0800 767.3912 731.8271 678.3818 624.7501 569.2427 546.2134 544.7652 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	115.0978	115.6592	116.2148	118.8977	119.4134	121.8746	121.8746	122.3415	120.9147	119.4134	118.3746	117.3078	
alpha	8.6732	8.7106	8.7477	8.9265	8.9609	9.1250	9.1250	9.1561	9.0610	8.9609	8.8916	8.8205	
util living area	0.9988	0.9966	0.9884	0.9324	0.7618	0.5294	0.3822	0.4293	0.6983	0.9582	0.9957	0.9990	(86)
MIT	20.4008	20.5075	20.6644	20.8800	20.9829	20.9994	21.0000	20.9999	20.9938	20.8615	20.6083	20.3954	(87)
Th 2	20.1525	20.1563	20.1600	20.1774	20.1807	20.1959	20.1959	20.1988	20.1901	20.1807	20.1741	20.1672	(88)
util rest of house	0.9981	0.9949	0.9828	0.9049	0.7033	0.4633	0.3123	0.3546	0.6213	0.9344	0.9932	0.9986	(89)
MIT 2	19.4613	19.6003	19.8010	20.0697	20.1698	20.1957	20.1959	20.1988	20.1872	20.0573	19.7438	19.4665	(90)
Living area fraction										fLA = Living area / (4) =		0.3887	(91)
MIT	19.8265	19.9529	20.1366	20.3847	20.4858	20.5081	20.5085	20.5102	20.5007	20.3699	20.0798	19.8275	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8265	19.9529	20.1366	20.3847	20.4858	20.5081	20.5085	20.5102	20.5007	20.3699	20.0798	19.8275	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9944	0.9826	0.9126	0.7257	0.4890	0.3395	0.3836	0.6514	0.9408	0.9929	0.9983	(94)
Useful gains	562.0727	615.8274	648.6194	662.1011	559.5817	375.2847	248.4457	260.2543	406.9585	535.5574	542.3215	543.8461	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1045.1049	1008.3111	909.0712	748.3431	570.0117	375.5674	248.4543	260.2792	410.1125	633.8565	849.5017	1032.0913	(97)
Space heating kWh	359.3759	263.7491	193.7761	62.0942	7.7599	0.0000	0.0000	0.0000	0.0000	73.1345	221.1697	363.2544	(98a)
Space heating requirement - total per year (kWh/year)												1544.3139	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	359.3759	263.7491	193.7761	62.0942	7.7599	0.0000	0.0000	0.0000	0.0000	73.1345	221.1697	363.2544	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1544.3139	
Space heating per m2											(98c) / (4) =	21.0540	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.3000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	359.3759	263.7491	193.7761	62.0942	7.7599	0.0000	0.0000	0.0000	0.0000	73.1345	221.1697	363.2544	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	389.3564	285.7520	209.9416	67.2743	8.4072	0.0000	0.0000	0.0000	0.0000	79.2357	239.6205	393.5584	(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	0.0000	(215)
Water heating													
Water heating requirement	221.9015	196.2125	208.6196	184.1017	178.8596	161.6212	159.9574	166.1341	167.7372	186.4699	197.5313	219.5925	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1346	84.7238	83.8946	81.8934	80.1377	79.8000	79.8000	79.8000	79.8000	82.1454	84.3139	85.1805	(217)
Fuel for water heating, kWh/month	260.6479	231.5906	248.6688	224.8066	223.1902	202.5329	200.4479	208.1881	210.1970	226.9997	234.2808	257.7965	(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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.4879	18.0406	16.2436	11.9007	9.1925	7.5103	8.3857	10.9000	14.1581	18.5761	20.9817	23.1129	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233a)m	-19.6330	-29.0747	-43.8727	-51.8635	-58.1494	-55.0904	-54.4210	-50.2749	-43.3460	-34.3570	-22.0756	-16.8151	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-7.2167	-15.5046	-31.4282	-48.1131	-64.5165	-65.1547	-64.3856	-54.0981	-39.1101	-22.4650	-9.7282	-5.6828	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year		
Space heating fuel - main system 1	1673.1462	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2729.3470	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	181.4902	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-906.3769	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3763.6065	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1673.1462	0.2100	351.3607	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2729.3470	0.2100	573.1629	(264)
Space and water heating			924.5236	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	181.4902	0.1443	26.1946	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-478.9732	0.1336	-63.9743	
PV Unit electricity exported	-427.4037	0.1253	-53.5711	
Total			-117.5453	(269)
Total CO2, kg/year			845.1021	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.5200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1673.1462	1.1300	1890.6552	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2729.3470	1.1300	3084.1621	(278)
Space and water heating			4974.8173	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	181.4902	1.5338	278.3757	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-478.9732	1.4936	-715.3834	
PV Unit electricity exported	-427.4037	0.4601	-196.6313	
Total			-912.0148	(283)
Total Primary energy kWh/year			4471.2790	(286)
Target Primary Energy Rate (TPER)			60.9600	(287)

Full SAP Calculation Printout

Property Reference	2B4P	**Issued on Date**	03/09/2025
Assessment Reference	BeLean	**Prop Type Ref**	
Property	2B4P, Land at Coombe Farm, Sayers Common, BN6 9HY		

SAP Rating	96 A	**DER**	7.38	**TER**	9.96
Environmental	94 A	**% DER < TER**			25.90
CO_2 Emissions (t/year)	0.56	**DFEE**	31.76	**TFEE**	34.76
Compliance Check	See BREL	**% DFEE < TFEE**			8.62
% DPER < TPER	23.35	**DPER**	39.74	**TPER**	51.85

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.5500 (1b)	x	2.4000 (2b)	=	121.3200	(1b) - (3b)
First floor	50.6300 (1c)	x	2.4000 (2c)	=	121.5120	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	242.8320	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		73.6000 (23c)

Effective ac	0.3232	0.3195	0.3157	0.2970	0.2932	0.2745	0.2745	0.2707	0.2820	0.2932	0.3007	0.3082	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
FD			2.0500	1.0000	2.0500			(26)
Window			15.8500	1.0536	16.7002			(27)
GF			50.5500	0.1000	5.0550	110.0000	5560.5000	(28a)
External Wall 1	97.9000	17.9000	80.0000	0.1600	12.8000	140.0000	11200.0000	(29a)
External Roof	50.6300		50.6300	0.1000	5.0630	9.0000	455.6700	(30)
Total net area of external elements Aum(A, m2)			199.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6682			(33)
Main dwelling								
Party Wall 1			44.9700	0.0000	0.0000	0.0000	0.0000	(32)
Internal Wall 1			137.5600			75.0000	10317.0000	(32c)
Internal Floor 1			50.6300			18.0000	911.3400	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	28444.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		281.1278 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.8600	0.0620	0.6733
E3 Sill	6.2800	0.0390	0.2449
E4 Jamb	25.4200	0.0520	1.3218
E5 Ground floor (normal)	20.3500	0.0710	1.4448
E6 Intermediate floor within a dwelling	20.4400	0.0630	1.2877
E10 Eaves (insulation at ceiling level)	6.1200	0.0500	0.3060
E12 Gable (insulation at ceiling level)	9.3700	0.0570	0.5341
E16 Corner (normal)	4.8000	0.0660	0.3168
E18 Party wall between dwellings	4.8000	0.0320	0.1536
P1 Party wall - Ground floor	9.3700	0.0800	0.7496
P4 Party wall - Roof (insulation at ceiling level)	9.3700	0.0450	0.4216

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4544 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.1226 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.9035	25.6030	25.3025	23.8000	23.4995	21.9969	21.9969	21.6964	22.5979	23.4995	24.1005	24.7015	(38)
Heat transfer coeff	75.0261	74.7256	74.4251	72.9225	72.6220	71.1195	71.1195	70.8190	71.7205	72.6220	73.2231	73.8241	(39)

Average = Sum(39)m / 12 = 72.8474

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7415	0.7385	0.7356	0.7207	0.7178	0.7029	0.7029	0.6999	0.7088	0.7178	0.7237	0.7296	(40)
HLP (average)												0.7200	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7502 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.3313	69.2744	67.7342	64.7874	62.6127	60.1875	58.8090	60.3375	62.0130	64.6170	67.6271	70.0619	(42a)
Hot water usage for baths	30.3680	29.9170	29.2819	28.1108	27.2340	26.2617	25.7365	26.3672	27.0539	28.0943	29.2894	30.2653	(42b)
Hot water usage for other uses	42.7946	41.2385	39.6823	38.1261	36.5700	35.0138	35.0138	36.5700	38.1261	39.6823	41.2385	42.7946	(42c)

Average daily hot water use (litres/day) 131.9033 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.4940	140.4299	136.6984	131.0244	126.4166	121.4630	119.5593	123.2746	127.1930	132.3935	138.1550	143.1218	(44)
Energy conte	227.2594	199.9702	210.1003	179.3658	170.1811	149.3529	144.5966	152.6398	156.8417	179.6568	196.8271	224.0942	(45)
Energy content (annual)										Total = Sum(45)m =		2190.8859	
Distribution loss (46)m = 0.15 x (45)m	34.0889	29.9955	31.5151	26.9049	25.5272	22.4029	21.6895	22.8960	23.5263	26.9485	29.5241	33.6141	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1500	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1610	(55)
Total storage loss	35.9910	32.5080	35.9910	34.8300	35.9910	34.8300	35.9910	35.9910	34.8300	35.9910	34.8300	35.9910	(56)
If cylinder contains dedicated solar storage	35.9910	32.5080	35.9910	34.8300	35.9910	34.8300	35.9910	35.9910	34.8300	35.9910	34.8300	35.9910	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	286.5128	253.4894	269.3537	236.7078	229.4345	206.6949	203.8500	211.8932	214.1837	238.9102	254.1691	283.3476	(62)
WWHRS	-28.3631	-25.0846	-26.2671	-21.7502	-20.2704	-17.3456	-16.2587	-17.2895	-17.9464	-21.1568	-23.9681	-27.8379	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	258.1496	228.4048	243.0866	214.9576	209.1640	189.3493	187.5913	194.6037	196.2374	217.7534	230.2010	255.5097	(64)
										Total per year (kWh/year) = Sum(64)m =		2625.0084	(64)
12Total per year (kWh/year)												2625	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	122.9665	109.3055	117.2611	105.5127	103.9879	95.5334	95.4811	98.1554	98.0235	107.1386	111.3186	121.9140	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.4549	151.0751	136.4549	141.0034	136.4549	141.0034	136.4549	136.4549	141.0034	136.4549	141.0034	136.4549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.2214	260.9009	254.1486	239.7737	221.6280	204.5735	193.1801	190.5006	197.2529	211.6278	229.7736	246.8280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	(71)
Water heating gains (Table 5)	165.2775	162.6569	157.6090	146.5454	139.7687	132.6853	128.3348	131.9294	136.1437	144.0035	154.6092	163.8630	(72)
Total internal gains	627.2066	641.8857	615.4653	594.5753	565.1043	542.5150	522.2226	523.1376	538.6528	559.3390	592.6389	614.3986	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.1700	36.7938	0.4000	0.7000	0.7700	44.0506	(77)
South	2.1700	46.7521	0.4000	0.7000	0.7700	19.6857	(78)

Northwest				7.5100		11.2829		0.4000		0.7000		0.7700	16.4420 (81)
Solar gains	80.1783	140.7427	204.0324	272.6514	323.9643	329.9131	314.6119	274.9816	227.5406	158.6037	96.7850	68.1357 (83)	
Total gains	707.3848	782.6284	819.4977	867.2267	889.0686	872.4281	836.8344	798.1192	766.1934	717.9427	689.4239	682.5343 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	105.3134	105.7369	106.1639	108.3513	108.7997	111.0982	111.0982	111.5697	110.1672	108.7997	107.9066	107.0282	
alpha	8.0209	8.0491	8.0776	8.2234	8.2533	8.4065	8.4065	8.4380	8.3445	8.2533	8.1938	8.1352	
util living area													
	0.9955	0.9888	0.9716	0.8991	0.7392	0.5207	0.3739	0.4080	0.6398	0.9131	0.9864	0.9965 (86)	
MIT	20.4323	20.5557	20.7070	20.8934	20.9811	20.9990	20.9999	20.9999	20.9952	20.8964	20.6494	20.4193 (87)	
Th 2	20.6292	20.6307	20.6322	20.6396	20.6411	20.6485	20.6485	20.6500	20.6456	20.6411	20.6382	20.6352 (88)	
util rest of house													
	0.9948	0.9870	0.9672	0.8857	0.7148	0.4924	0.3440	0.3771	0.6087	0.8987	0.9839	0.9959 (89)	
MIT 2	20.0898	20.2135	20.3638	20.5483	20.6267	20.6480	20.6485	20.6500	20.6424	20.5539	20.3133	20.0820 (90)	
Living area fraction										fLA = Living area / (4) =		0.2184 (91)	
MIT	20.1646	20.2883	20.4387	20.6237	20.7041	20.7246	20.7253	20.7264	20.7194	20.6287	20.3867	20.1557 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	20.0146	20.1383	20.2887	20.4737	20.5541	20.5746	20.5753	20.5764	20.5694	20.4787	20.2367	20.0057 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9933	0.9842	0.9624	0.8791	0.7087	0.4865	0.3378	0.3705	0.6019	0.8916	0.9806	0.9947 (94)	
Useful gains	702.6362	770.2484	788.6712	762.3612	630.0891	424.3977	282.6998	295.7265	461.1802	640.1178	676.0490	678.8960 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W													
	1179.0048	1138.6891	1026.2272	843.9827	643.0052	424.9135	282.7202	295.7693	463.9910	717.4115	961.9109	1166.8381 (97)	
Space heating kWh													
	354.4182	247.5922	176.7416	58.7675	9.6096	0.0000	0.0000	0.0000	0.0000	57.5065	205.8206	363.0289 (98a)	
Space heating requirement - total per year (kWh/year)												1473.4851	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	354.4182	247.5922	176.7416	58.7675	9.6096	0.0000	0.0000	0.0000	0.0000	57.5065	205.8206	363.0289 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1473.4851	
Space heating per m2											(98c) / (4) =	14.5630 (99)	

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)	
Fraction of space heat from main system(s)												1.0000 (202)	
Efficiency of main space heating system 1 (in %)												79.8000 (206)	
Efficiency of main space heating system 2 (in %)												0.0000 (207)	
Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	354.4182	247.5922	176.7416	58.7675	9.6096	0.0000	0.0000	0.0000	0.0000	57.5065	205.8206	363.0289 (98)	
Space heating efficiency (main heating system 1)													
	79.8000	79.8000	79.8000	79.8000	79.8000	0.0000	0.0000	0.0000	0.0000	79.8000	79.8000	79.8000 (210)	
Space heating fuel (main heating system)													
	444.1331	310.2659	221.4808	73.6435	12.0421	0.0000	0.0000	0.0000	0.0000	72.0633	257.9205	454.9234 (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	0.0000 (215)	
Water heating													
Water heating requirement													
	258.1496	228.4048	243.0866	214.9576	209.1640	189.3493	187.5913	194.6037	196.2374	217.7534	230.2010	255.5097 (64)	
Efficiency of water heater												88.8000 (216)	
(217)m	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000 (217)	
Fuel for water heating, kWh/month													
	290.7090	257.2127	273.7462	242.0693	235.5451	213.2312	211.2515	219.1483	220.9880	245.2178	259.2354	287.7362 (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	30.8300	27.8465	30.8300	29.8355	30.8300	29.8355	30.8300	30.8300	29.8355	30.8300	29.8355	30.8300 (231)	
Lighting	29.8507	23.9473	21.5619	15.7972	12.2022	9.9693	11.1313	14.4688	18.7936	24.6582	27.8514	30.6803 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-53.1404	-72.2500	-100.0351	-109.3050	-116.3190	-108.3286	-107.3746	-102.3720	-93.4856	-81.4279	-57.7340	-46.4048 (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	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-33.8828	-68.0231	-127.1377	-180.4300	-230.5330	-228.5536	-226.7694	-196.6451	-151.0418	-94.5686	-44.4793	-27.1177 (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 (234b)	
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	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)	
Annual totals kWh/year													
Space heating fuel - main system 1												1846.4726 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												88.8000	
Water heating fuel used												2956.0906 (219)	
Space cooling fuel												0.0000 (221)	

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 0.9350)

mechanical ventilation fans (SFP = 0.9350)	276.9985	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	362.9985	(231)
Electricity for lighting (calculated in Appendix L)	240.9123	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-2657.3594	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2749.1145	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1846.4726	0.2100	387.7592	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2956.0906	0.2100	620.7790	(264)
Space and water heating			1008.5383	(265)
Pumps, fans and electric keep-hot	362.9985	0.1387	50.3524	(267)
Energy for lighting	240.9123	0.1443	34.7711	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1048.1771	0.1351	-141.6569	
PV Unit electricity exported	-1609.1822	0.1274	-205.0608	
Total			-346.7177	(269)
Total CO2, kg/year			746.9440	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.3800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1846.4726	1.1300	2086.5140	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2956.0906	1.1300	3340.3823	(278)
Space and water heating			5426.8964	(279)
Pumps, fans and electric keep-hot	362.9985	1.5128	549.1441	(281)
Energy for lighting	240.9123	1.5338	369.5193	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1048.1771	1.4995	-1571.7458	
PV Unit electricity exported	-1609.1822	0.4678	-752.8215	
Total			-2324.5673	(283)
Total Primary energy kWh/year			4020.9924	(286)
Dwelling Primary energy Rate (DPER)			39.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.5500 (1b)	x	2.4000 (2b)	=	121.3200	(1b) - (3b)
First floor	50.6300 (1c)	x	2.4000 (2c)	=	121.5120	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 101.1800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	242.8320	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1647 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4147 (18)
Number of sides sheltered		0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.4147 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5288	0.5184	0.5080	0.4562	0.4458	0.3940	0.3940	0.3836	0.4147	0.4458	0.4666	0.4873	(22b)
Effective ac	0.6398	0.6344	0.6291	0.6041	0.5994	0.5776	0.5776	0.5736	0.5860	0.5994	0.6088	0.6187	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.0500	1.0000	2.0500			(26)
TER Opening Type			15.8500	1.1450	18.1489			(27)
GF			50.5500	0.1300	6.5715			(28a)
External Wall 1	97.9000	17.9000	80.0000	0.1800	14.4000			(29a)
External Roof	50.6300		50.6300	0.1100	5.5693			(30)
Total net area of external elements Aum(A, m2)			199.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7397			(33)
Main dwelling								
Party Wall 1			44.9700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 281.1278 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	10.8600	0.0500	0.5430	
E3 Sill	6.2800	0.0500	0.3140	
E4 Jamb	25.4200	0.0500	1.2710	
E5 Ground floor (normal)	20.3500	0.1600	3.2560	
E6 Intermediate floor within a dwelling	20.4400	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	6.1200	0.0600	0.3672	
E12 Gable (insulation at ceiling level)	9.3700	0.0600	0.5622	
E16 Corner (normal)	4.8000	0.0900	0.4320	
E18 Party wall between dwellings	4.8000	0.0600	0.2880	
P1 Party wall - Ground floor	9.3700	0.0800	0.7496	
P4 Party wall - Roof (insulation at ceiling level)	9.3700	0.1200	1.1244	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9074 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 55.6471 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2701	50.8351	50.4087	48.4058	48.0311	46.2867	46.2867	45.9637	46.9587	48.0311	48.7892	49.5817	(38)
Heat transfer coeff	106.9171	106.4821	106.0557	104.0529	103.6782	101.9338	101.9338	101.6108	102.6057	103.6782	104.4362	105.2287	(39)
Average = Sum(39)m / 12 =												104.0511	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0567	1.0524	1.0482	1.0284	1.0247	1.0075	1.0075	1.0043	1.0141	1.0247	1.0322	1.0400	(40)
HLP (average)												1.0284	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7502 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.3313	69.2744	67.7342	64.7874	62.6127	60.1875	58.8090	60.3375	62.0130	64.6170	67.6271	70.0619	(42a)
Hot water usage for baths	30.3680	29.9170	29.2819	28.1108	27.2340	26.2617	25.7365	26.3672	27.0539	28.0943	29.2894	30.2653	(42b)
Hot water usage for other uses	42.7946	41.2385	39.6823	38.1261	36.5700	35.0138	35.0138	36.5700	38.1261	39.6823	41.2385	42.7946	(42c)
Average daily hot water use (litres/day)												131.9033	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.4940	140.4299	136.6984	131.0244	126.4166	121.4630	119.5593	123.2746	127.1930	132.3935	138.1550	143.1218	(44)
Energy conte	227.2594	199.9702	210.1003	179.3658	170.1811	149.3529	144.5966	152.6398	156.8417	179.6568	196.8271	224.0942	(45)
Energy content (annual)											Total = Sum(45)m =	2190.8859	
Distribution loss (46)m = 0.15 x (45)m	34.0889	29.9955	31.5151	26.9049	25.5272	22.4029	21.6895	22.8960	23.5263	26.9485	29.5241	33.6141	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.6525 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8924 (55)

Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	278.1854	245.9680	261.0264	228.6491	221.1072	198.6362	195.5227	203.5658	206.1250	230.5828	246.1104	275.0203	(62)
WWHRS	-32.1526	-28.4360	-29.7765	-24.6561	-22.9786	-19.6630	-18.4309	-19.5994	-20.3441	-23.9834	-27.1703	-31.5571	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	246.0329	217.5320	231.2499	203.9929	198.1285	178.9732	177.0918	183.9664	185.7810	206.5994	218.9401	243.4631	(64)
										Total per year (kWh/year) = Sum(64)m =		2491.7513	(64)
12Total per year (kWh/year)												2492	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	116.3046	103.2883	110.5992	99.0658	97.3261	89.0865	88.8192	91.4936	91.5765	100.4767	104.8716	115.2522	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	136.4549	151.0751	136.4549	141.0034	136.4549	141.0034	136.4549	136.4549	141.0034	136.4549	141.0034	136.4549	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	258.2214	260.9009	254.1486	239.7737	221.6280	204.5735	193.1801	190.5006	197.2529	211.6278	229.7736	246.8280	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	(71)

Water heating gains (Table 5)

	156.3234	153.7028	148.6549	137.5913	130.8146	123.7312	119.3807	122.9752	127.1896	135.0494	145.6551	154.9088	(72)

Total internal gains

	618.2525	632.9316	606.5111	585.6212	556.1502	533.5609	513.2685	514.1835	529.6987	550.3848	583.6848	605.4445	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.1700	36.7938	0.6300	0.7000	0.7700	69.3796	(77)
South	2.1700	46.7521	0.6300	0.7000	0.7700	31.0050	(78)
Northwest	7.5100	11.2829	0.6300	0.7000	0.7700	25.8961	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	126.2808	221.6697	321.3511	429.4260	510.2438	519.6131	495.5137	433.0960	358.3764	249.8008	152.4363	107.3138	(83)
Total gains	744.5332	854.6013	927.8622	1015.0472	1066.3940	1053.1740	1008.7821	947.2795	888.0751	800.1857	736.1211	712.7583	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.9007	74.2026	74.5010	75.9350	76.2094	77.5136	77.5136	77.7600	77.0060	76.2094	75.6562	75.0865	
alpha	5.9267	5.9468	5.9667	6.0623	6.0806	6.1676	6.1676	6.1840	6.1337	6.0806	6.0437	6.0058	
util living area	0.9967	0.9920	0.9799	0.9328	0.8121	0.6067	0.4429	0.4902	0.7470	0.9522	0.9918	0.9974	(86)
MIT	19.9778	20.1504	20.3833	20.6927	20.9033	20.9868	20.9983	20.9970	20.9560	20.6884	20.2901	19.9616	(87)
Th 2	20.0363	20.0399	20.0434	20.0597	20.0628	20.0771	20.0771	20.0798	20.0716	20.0628	20.0566	20.0501	(88)
util rest of house	0.9955	0.9891	0.9726	0.9092	0.7569	0.5251	0.3510	0.3940	0.6663	0.9301	0.9883	0.9965	(89)
MIT 2	18.8531	19.0752	19.3712	19.7587	19.9871	20.0704	20.0767	20.0789	20.0450	19.7635	19.2669	18.8429	(90)
Living area fraction									fLA = Living area / (4) =			0.2184	(91)
MIT	19.0987	19.3100	19.5923	19.9627	20.1872	20.2706	20.2780	20.2794	20.2440	19.9655	19.4904	19.0873	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0987	19.3100	19.5923	19.9627	20.1872	20.2706	20.2780	20.2794	20.2440	19.9655	19.4904	19.0873	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9861	0.9681	0.9063	0.7648	0.5426	0.3711	0.4151	0.6823	0.9273	0.9855	0.9952	(94)
Useful gains	739.9863	842.7390	898.2993	919.9768	815.6294	571.4889	374.3844	393.1714	605.9318	741.9911	725.4265	709.3141	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1582.2368	1534.4082	1388.5106	1151.1071	879.9405	578.0235	374.9107	394.1903	630.4101	970.9967	1294.0048	1566.5674	(97)
Space heating kWh	626.6344	464.8017	364.7172	166.4138	47.8475	0.0000	0.0000	0.0000	0.0000	170.3802	409.3764	637.7965	(98a)
Space heating requirement - total per year (kWh/year)												2887.9678	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	626.6344	464.8017	364.7172	166.4138	47.8475	0.0000	0.0000	0.0000	0.0000	170.3802	409.3764	637.7965	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2887.9678	
Space heating per m2											(98c) / (4) =	28.5429	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	626.6344	464.8017	364.7172	166.4138	47.8475	0.0000	0.0000	0.0000	0.0000	170.3802	409.3764	637.7965	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	678.9105	503.5771	395.1433	180.2967	51.8391	0.0000	0.0000	0.0000	0.0000	184.5939	443.5281	691.0038	(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	0.0000	(215)
Water heating													
Water heating requirement	246.0329	217.5320	231.2499	203.9929	198.1285	178.9732	177.0918	183.9664	185.7810	206.5994	218.9401	243.4631	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0635	85.7180	85.0769	83.6070	81.4049	79.8000	79.8000	79.8000	79.8000	83.6309	85.4422	86.1168	(217)

Fuel for water heating, kWh/month

	285.8738	253.7764	271.8129	243.9903	243.3865	224.2772	221.9195	230.5344	232.8082	247.0373	256.2436	282.7128 (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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.3526	22.7455	20.4798	15.0044	11.5898	9.4690	10.5726	13.7427	17.8504	23.4207	26.4536	29.1406 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-46.2217	-64.6161	-92.0924	-102.6143	-109.8366	-102.1862	-100.8775	-95.6062	-86.2167	-73.4092	-50.6029	-40.0221 (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	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)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 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-27.7935	-58.2732	-115.4857	-172.9858	-228.3097	-229.2870	-226.6303	-192.1133	-141.0857	-83.2289	-37.0689	-21.9967 (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 (234b)
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	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(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)

Annual totals kWh/year	
Space heating fuel - main system 1	3128.8925 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2994.3729 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	228.8220 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2498.5604 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3939.5270 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3128.8925	0.2100	657.0674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2994.3729	0.2100	628.8183	(264)
Space and water heating			1285.8857	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	228.8220	0.1443	33.0261	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-964.3018	0.1348	-129.9695	
PV Unit electricity exported	-1534.2586	0.1260	-193.2722	
Total			-323.2416	(269)
Total CO2, kg/year			1007.5995	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3128.8925	1.1300	3535.6485	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2994.3729	1.1300	3383.6414	(278)
Space and water heating			6919.2899	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	228.8220	1.5338	350.9748	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-964.3018	1.4981	-1444.6575	
PV Unit electricity exported	-1534.2586	0.4624	-709.4464	
Total			-2154.1039	(283)
Total Primary energy kWh/year			5246.2616	(286)
Target Primary Energy Rate (TPER)			51.8500	(287)

Full SAP Calculation Printout

Property Reference	3B6P	**Issued on Date**	03/09/2025
Assessment Reference	BeLean	**Prop Type Ref**	
Property	3B6P, Land at Coombe Farm, Sayers Common, BN6 9HY		

SAP Rating	94 A	**DER**	8.84	**TER**	9.99
Environmental	91 B	**% DER < TER**			11.51
CO_2 Emissions (t/year)	0.99	**DFEE**	38.06	**TFEE**	41.72
Compliance Check	See BREL	**% DFEE < TFEE**			8.78
% DPER < TPER	7.79	**DPER**	48.25	**TPER**	52.32

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.8600 (1b)	x	2.6100 (2b)	=	132.7446	(1b) - (3b)
First floor	47.0700 (1c)	x	2.7000 (2c)	=	127.0890	(1c) - (3c)
Second floor	47.0700 (1d)	x	2.4000 (2d)	=	112.9680	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	372.8016	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3312	0.3275	0.3237	0.3050	0.3013	0.2825	0.2825	0.2788	0.2900	0.3013	0.3087	0.3163	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Window			26.4000	1.0536	27.8161			(27)
Front Door			2.0700	1.0000	2.0700			(26)
GF			50.8600	0.1000	5.0860	110.0000	5594.6000	(28a)
External Wall 1	179.6900	28.4700	151.2200	0.1600	24.1952	140.0000	21170.8000	(29a)
External Roof 1	47.0700		47.0700	0.1000	4.7070	9.0000	423.6300	(30)
Flat Roof	25.2400		25.2400	0.1000	2.5240	9.0000	227.1600	(30)
Total net area of external elements Aum(A, m2)			302.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.3983			(33)
Main dwelling								
Party Wall 1			59.5800	0.0000	0.0000	0.0000	0.0000	(32)
Internal Wall 1			195.7000			75.0000	14677.5000	(32c)
Internal Floor 1			47.0700			18.0000	847.2600	(32d)
Internal Floor 2			47.0700			18.0000	847.2600	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 43788.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 301.9877 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	14.2400	0.0620	0.8829
E3	Sill	8.5800	0.0390	0.3346
E4	Jamb	31.6000	0.0520	1.6432
E5	Ground floor (normal)	30.2900	0.0710	2.1506
E6	Intermediate floor within a dwelling	19.7300	0.0630	1.2430
E6	Intermediate floor within a dwelling	19.7300	0.0630	1.2430
E16	Corner (normal)	18.0300	0.0360	0.6491
E17	Corner (inverted - internal area greater than external area)	2.6100	-0.0450	-0.1174
E18	Party wall between dwellings	15.4200	0.0495	0.7633
P1	Party wall - Ground floor	7.0000	0.0800	0.5600
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	16.2000	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	11.5400	0.0500	0.5770
E12	Gable (insulation at ceiling level)	8.1000	0.0570	0.4617
P4	Party wall - Roof (insulation at ceiling level)	8.1000	0.0385	0.3118
E20	Exposed floor (normal)	3.4300	0.0800	0.2744
E21	Exposed floor (inverted)	11.9600	0.0440	0.5262
E24	Eaves (insulation at ceiling level - inverted)	5.8000	0.0460	0.2668
E14	Flat roof	10.1400	0.0700	0.7098

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.4800 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.8783 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.7519	40.2905	39.8292	37.5225	37.0611	34.7544	34.7544	34.2931	35.6771	37.0611	37.9838	38.9065	(38)
Heat transfer coeff	119.6301	119.1688	118.7075	116.4008	115.9394	113.6327	113.6327	113.1714	114.5554	115.9394	116.8621	117.7848	(39)

Average = Sum(39)m / 12 = 116.2854

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8250	0.8219	0.8187	0.8028	0.7996	0.7837	0.7837	0.7805	0.7900	0.7996	0.8059	0.8123	(40)
HLP (average)												0.8020	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9261 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2803	72.1790	70.5742	67.5038	65.2380	62.7111	61.2748	62.8674	64.6132	67.3263	70.4626	72.9995	(42a)
Hot water usage for baths	31.6361	31.1663	30.5047	29.2847	28.3712	27.3583	26.8112	27.4682	28.1836	29.2674	30.5125	31.5292	(42b)
Hot water usage for other uses	44.5958	42.9741	41.3525	39.7308	38.1091	36.4875	36.4875	38.1091	39.7308	41.3525	42.9741	44.5958	(42c)

Average daily hot water use (litres/day) 137.4352 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.5122	146.3194	142.4313	136.5193	131.7183	126.5569	124.5735	128.4448	132.5276	137.9462	143.9493	149.1244	(44)
Energy conte	236.7907	208.3569	218.9117	186.8882	177.3182	155.6164	150.6608	159.0414	163.4197	187.1917	205.0821	233.4928	(45)

Energy content (annual) Total = Sum(45)m = 2282.7706

Distribution loss (46)m = 0.15 x (45)m	35.5186	31.2535	32.8368	28.0332	26.5977	23.3425	22.5991	23.8562	24.5130	28.0787	30.7623	35.0239	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.2500 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.2150 (55)

Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	297.7181	263.3881	279.8391	245.8502	238.2456	214.5784	211.5882	219.9688	222.3817	248.1191	264.0441	294.4202	(62)
WWHRS	-29.5524	-26.1364	-27.3685	-22.6622	-21.1204	-18.0728	-16.9404	-18.0144	-18.6989	-22.0439	-24.9730	-29.0051	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	268.1657	237.2517	252.4706	223.1880	217.1252	196.5056	194.6478	201.9544	203.6829	226.0752	239.0711	265.4151	(64)

Total per year (kWh/year) = Sum(64)m = 2725.5533 (64)
12Total per year (kWh/year) 2726 (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)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	127.4748	113.3036	121.5300	109.3099	107.7002	98.9121	98.8366	101.6232	101.5067	110.9831	115.3594	126.3783	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.9979	179.3548	161.9979	167.3978	161.9979	167.3978	161.9979	161.9979	167.3978	161.9979	167.3978	161.9979	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	315.0288	318.2978	310.0600	292.5227	270.3850	249.5787	235.6787	232.4097	240.6475	258.1849	280.3226	301.1289	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	(71)
Water heating gains (Table 5)	171.3371	168.6066	163.3468	151.8193	144.7584	137.3779	132.8450	136.5903	140.9815	149.1709	160.2214	169.8633	(72)
Total internal gains	718.2547	736.1501	705.2956	681.6307	647.0321	621.2452	597.4125	597.8888	615.9177	639.2445	677.8327	702.8810	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.3500	11.2829	0.4000	0.7000	0.7700	16.0917	(75)
Southwest	19.0500	36.7938	0.4000	0.7000	0.7700	136.0070	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	152.0987	264.4253	375.9955	489.6735	570.1957	575.6265	550.9894	489.4555	415.1334	296.0742	183.1525	129.5349	(83)
Total gains	870.3534	1000.5754	1081.2911	1171.3042	1217.2278	1196.8718	1148.4019	1087.3444	1031.0512	935.3188	860.9852	832.4159	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	101.6750	102.0686	102.4653	104.4958	104.9116	107.0413	107.0413	107.4776	106.1791	104.9116	104.0833	103.2679	
alpha	7.7783	7.8046	7.8310	7.9664	7.9941	8.1361	8.1361	8.1652	8.0786	7.9941	7.9389	7.8845	
util living area	0.9991	0.9970	0.9901	0.9521	0.8280	0.6034	0.4351	0.4782	0.7437	0.9672	0.9969	0.9994	(86)
MIT	20.2453	20.3836	20.5643	20.8031	20.9527	20.9966	20.9998	20.9996	20.9841	20.7977	20.4860	20.2312	(87)
Th 2	20.5875	20.5891	20.5907	20.5986	20.6002	20.6082	20.6082	20.6098	20.6050	20.6002	20.5970	20.5938	(88)
util rest of house	0.9990	0.9965	0.9881	0.9432	0.8032	0.5679	0.3965	0.4379	0.7074	0.9594	0.9963	0.9993	(89)
MIT 2	19.8657	20.0051	20.1861	20.4261	20.5638	20.6061	20.6081	20.6095	20.5943	20.4242	20.1142	19.8571	(90)
Living area fraction									fLA = Living area / (4) =			0.1979	(91)
MIT	19.9408	20.0800	20.2609	20.5007	20.6408	20.6834	20.6856	20.6867	20.6715	20.4981	20.1878	19.9311	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.7908	19.9300	20.1109	20.3507	20.4908	20.5334	20.5356	20.5367	20.5215	20.3481	20.0378	19.7811	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9953	0.9853	0.9369	0.7960	0.5610	0.3893	0.4303	0.6994	0.9536	0.9950	0.9989	(94)
Useful gains	869.0597	995.8539	1065.4330	1097.3775	968.9125	671.4519	447.0854	467.8860	721.1598	891.8772	856.7146	831.5223	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1853.1707	1791.1044	1615.7200	1332.8693	1019.1970	674.2279	447.2124	468.1600	735.6147	1130.1898	1511.9377	1835.2182	(97)
Space heating kWh	732.1785	534.4084	409.4135	169.5541	37.4117	0.0000	0.0000	0.0000	0.0000	177.3046	471.7606	746.7497	(98a)
Space heating requirement - total per year (kWh/year)												3278.7811	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	732.1785	534.4084	409.4135	169.5541	37.4117	0.0000	0.0000	0.0000	0.0000	177.3046	471.7606	746.7497	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3278.7811	
Space heating per m2										(98c) / (4) =		22.6123	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	79.8000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	732.1785	534.4084	409.4135	169.5541	37.4117	0.0000	0.0000	0.0000	0.0000	177.3046	471.7606	746.7497	(98)
Space heating efficiency (main heating system 1)	79.8000	79.8000	79.8000	79.8000	79.8000	0.0000	0.0000	0.0000	0.0000	79.8000	79.8000	79.8000	(210)
Space heating fuel (main heating system)	917.5170	669.6847	513.0495	212.4738	46.8818	0.0000	0.0000	0.0000	0.0000	222.1862	591.1787	935.7766	(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	0.0000	(215)
Water heating													
Water heating requirement	268.1657	237.2517	252.4706	223.1880	217.1252	196.5056	194.6478	201.9544	203.6829	226.0752	239.0711	265.4151	(64)
Efficiency of water heater												88.8000	(216)
(217)m	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	(217)
Fuel for water heating, kWh/month	301.9884	267.1753	284.3137	251.3378	244.5104	221.2901	219.1980	227.4261	229.3726	254.5892	269.2242	298.8909	(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	48.6751	43.9646	48.6751	47.1049	48.6751	47.1049	48.6751	48.6751	47.1049	48.6751	47.1049	48.6751	(231)
Lighting	36.7831	29.5088	26.5694	19.4659	15.0360	12.2845	13.7163	17.8290	23.1581	30.3847	34.3195	37.8054	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.0936	-77.6144	-109.2323	-121.3294	-130.7894	-122.4279	-121.4180	-114.9953	-103.7614	-88.5430	-61.4613	-48.8232	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-31.2094	-63.1098	-118.6710	-169.3372	-217.1778	-215.5375	-213.8005	-184.9833	-141.5523	-88.0194	-41.0807	-24.9358	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4108.7482	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.8000	
Water heating fuel used	3069.3168	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0710)		
mechanical ventilation fans (SFP = 1.0710)	487.1100	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	573.1100	(231)
Electricity for lighting (calculated in Appendix L)	296.8608	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2665.9039	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5382.1319	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4108.7482	0.2100	862.8371	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3069.3168	0.2100	644.5565	(264)
Space and water heating			1507.3937	(265)
Pumps, fans and electric keep-hot	573.1100	0.1387	79.4974	(267)
Energy for lighting	296.8608	0.1443	42.8462	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1156.4893	0.1348	-155.8762	
PV Unit electricity exported	-1509.4146	0.1273	-192.0923	
Total			-347.9686	(269)
Total CO2, kg/year			1281.7687	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4108.7482	1.1300	4642.8855	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3069.3168	1.1300	3468.3279	(278)
Space and water heating			8111.2135	(279)
Pumps, fans and electric keep-hot	573.1100	1.5128	867.0008	(281)
Energy for lighting	296.8608	1.5338	455.3351	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1156.4893	1.4981	-1732.5904	
PV Unit electricity exported	-1509.4146	0.4672	-705.2026	
Total			-2437.7930	(283)
Total Primary energy kWh/year			6995.7564	(286)
Dwelling Primary energy Rate (DPER)			48.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.8600 (1b)	x	2.6100 (2b)	=	132.7446	(1b) - (3b)
First floor	47.0700 (1c)	x	2.7000 (2c)	=	127.0890	(1c) - (3c)
Second floor	47.0700 (1d)	x	2.4000 (2d)	=	112.9680	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	372.8016	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1073	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3573	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3573	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4556	0.4466	0.4377	0.3930	0.3841	0.3394	0.3394	0.3305	0.3573	0.3841	0.4020	0.4198	(22b)
Effective ac	0.6038	0.5997	0.5958	0.5772	0.5738	0.5576	0.5576	0.5546	0.5638	0.5738	0.5808	0.5881	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.0700	1.0000	2.0700			(26)
TER Opening Type			26.4000	1.1450	30.2290			(27)
GF			50.8600	0.1300	6.6118			(28a)
External Wall 1	179.6900	28.4700	151.2200	0.1800	27.2196			(29a)
External Roof 1	47.0700		47.0700	0.1100	5.1777			(30)
Flat Roof	25.2400		25.2400	0.1100	2.7764			(30)
Total net area of external elements Aum(A, m2)			302.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.0845			(33)
Main dwelling								
Party Wall 1			59.5800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	301.9877 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.2400	0.0500	0.7120
E3 Sill	8.5800	0.0500	0.4290
E4 Jamb	31.6000	0.0500	1.5800
E5 Ground floor (normal)	30.2900	0.1600	4.8464
E6 Intermediate floor within a dwelling	19.7300	0.0000	0.0000
E6 Intermediate floor within a dwelling	19.7300	0.0000	0.0000
E16 Corner (normal)	18.0300	0.0900	1.6227
E17 Corner (inverted - internal area greater than external area)	2.6100	-0.0900	-0.2349
E18 Party wall between dwellings	15.4200	0.0600	0.9252
P1 Party wall - Ground floor	7.0000	0.0800	0.5600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.2000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	11.5400	0.0600	0.6924
E12 Gable (insulation at ceiling level)	8.1000	0.0600	0.4860
P4 Party wall - Roof (insulation at ceiling level)	8.1000	0.1200	0.9720
E20 Exposed floor (normal)	3.4300	0.3200	1.0976
E21 Exposed floor (inverted)	11.9600	0.3200	3.8272
E24 Eaves (insulation at ceiling level - inverted)	5.8000	0.2400	1.3920
E14 Flat roof	10.1400	0.0800	0.8112

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		19.7188 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	93.8033 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.2778	73.7821	73.2962	71.0140	70.5870	68.5993	68.5993	68.2312	69.3649	70.5870	71.4508	72.3539	(38)
Heat transfer coeff	168.0811	167.5854	167.0995	164.8173	164.3903	162.4026	162.4026	162.0345	163.1682	164.3903	165.2541	166.1572	(39)
Average = Sum(39)m / 12 =												164.8153	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1592	1.1558	1.1524	1.1367	1.1337	1.1200	1.1200	1.1175	1.1253	1.1337	1.1397	1.1459	(40)
HLP (average)												1.1367	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9261	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2803	72.1790	70.5742	67.5038	65.2380	62.7111	61.2748	62.8674	64.6132	67.3263	70.4626	72.9995	(42a)
Hot water usage for baths	31.6361	31.1663	30.5047	29.2847	28.3712	27.3583	26.8112	27.4682	28.1836	29.2674	30.5125	31.5292	(42b)
Hot water usage for other uses	44.5958	42.9741	41.3525	39.7308	38.1091	36.4875	36.4875	38.1091	39.7308	41.3525	42.9741	44.5958	(42c)
Average daily hot water use (litres/day)												137.4352	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.5122	146.3194	142.4313	136.5193	131.7183	126.5569	124.5735	128.4448	132.5276	137.9462	143.9493	149.1244	(44)
Energy conte	236.7907	208.3569	218.9117	186.8882	177.3182	155.6164	150.6608	159.0414	163.4197	187.1917	205.0821	233.4928	(45)
Energy content (annual)										Total = Sum(45)m =		2282.7706	
Distribution loss (46)m = 0.15 x (45)m	35.5186	31.2535	32.8368	28.0332	26.5977	23.3425	22.5991	23.8562	24.5130	28.0787	30.7623	35.0239	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	291.6975	257.9501	273.8185	240.0238	232.2250	208.7520	205.5676	213.9482	216.5553	242.0984	258.2177	288.3996	(62)
WWHRS	-33.5007	-29.6283	-31.0250	-25.6899	-23.9421	-20.4874	-19.2037	-20.4212	-21.1971	-24.9890	-28.3095	-32.8803	(63a)
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)

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	(63c)
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	(63d)
Output from w/h	258.1968	228.3218	242.7934	214.3338	208.2829	188.2646	186.3639	193.5270	195.3583	217.1094	229.9082	255.5193	(64)
									Total per year (kWh/year) = Sum(64)m =			2617.9796	(64)
12Total per year (kWh/year)												2618	(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)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	122.6583	108.9532	116.7136	104.6488	102.8837	94.2509	94.0202	96.8067	96.8455	106.1667	110.6983	121.5618	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.9979	179.3548	161.9979	167.3978	161.9979	167.3978	161.9979	161.9979	167.3978	161.9979	167.3978	161.9979	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	315.0288	318.2978	310.0600	292.5227	270.3850	249.5787	235.6787	232.4097	240.6475	258.1849	280.3226	301.1289	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	(71)
Water heating gains (Table 5)	164.8634	162.1328	156.8731	145.3455	138.2846	130.9041	126.3712	130.1165	134.5077	142.6971	153.7476	163.3895	(72)
Total internal gains	711.7810	729.6763	698.8219	675.1570	640.5583	614.7715	590.9387	591.4151	609.4440	632.7708	671.3589	696.4072	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.3500	11.2829	0.6300	0.7000	0.7700	25.3444	(75)
Southwest	19.0500	36.7938	0.6300	0.7000	0.7700	214.2110	(79)

Solar gains	239.5554	416.4698	592.1929	771.2357	898.0582	906.6118	867.8083	770.8924	653.8352	466.3169	288.4652	204.0175	(83)
Total gains	951.3364	1146.1462	1291.0148	1446.3927	1538.6166	1521.3833	1458.7470	1362.3075	1263.2791	1099.0877	959.8241	900.4247	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.3662	72.5803	72.7913	73.7992	73.9909	74.8965	74.8965	75.0667	74.5451	73.9909	73.6042	73.2041	
alpha	5.8244	5.8387	5.8528	5.9199	5.9327	5.9931	5.9931	6.0044	5.9697	5.9327	5.9069	5.8803	
util living area	0.9988	0.9961	0.9881	0.9540	0.8530	0.6595	0.4864	0.5404	0.8029	0.9728	0.9966	0.9991	(86)
MIT	19.8228	20.0127	20.2719	20.6091	20.8623	20.9770	20.9967	20.9942	20.9289	20.5923	20.1476	19.7981	(87)
Th 2	19.9528	19.9556	19.9583	19.9710	19.9734	19.9845	19.9845	19.9866	19.9802	19.9734	19.9686	19.9635	(88)
util rest of house	0.9983	0.9945	0.9831	0.9345	0.7981	0.5657	0.3761	0.4251	0.7181	0.9573	0.9950	0.9988	(89)
MIT 2	18.5850	18.8296	19.1604	19.5848	19.8655	19.9733	19.9837	19.9849	19.9374	19.5742	19.0125	18.5614	(90)
Living area fraction										fLA = Living area / (4) =		0.1979	(91)
MIT	18.8300	19.0638	19.3804	19.7875	20.0628	20.1719	20.1842	20.1847	20.1336	19.7757	19.2372	18.8062	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8300	19.0638	19.3804	19.7875	20.0628	20.1719	20.1842	20.1847	20.1336	19.7757	19.2372	18.8062	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9926	0.9793	0.9302	0.8035	0.5838	0.3981	0.4481	0.7322	0.9533	0.9933	0.9982	(94)
Useful gains	948.9382	1137.6388	1264.2657	1345.4046	1236.2403	888.1613	580.6635	610.4449	924.9901	1047.7763	953.3466	898.7595	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2442.2232	2373.6465	2152.3050	1794.4506	1374.7615	904.8966	582.0870	613.2513	984.4994	1508.3926	2005.7185	2426.9200	(97)
Space heating kWh	1111.0041	830.5971	660.7012	323.3131	103.0597	0.0000	0.0000	0.0000	0.0000	342.6985	757.7078	1136.9514	(98a)
Space heating requirement - total per year (kWh/year)												5266.0329	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1111.0041	830.5971	660.7012	323.3131	103.0597	0.0000	0.0000	0.0000	0.0000	342.6985	757.7078	1136.9514	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5266.0329	
Space heating per m2											(98c) / (4) =	36.3175	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1111.0041	830.5971	660.7012	323.3131	103.0597	0.0000	0.0000	0.0000	0.0000	342.6985	757.7078	1136.9514	(98)
Space heating efficiency (main heating system 1)													

	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)												
	1203.6880	899.8885	715.8193	350.2851	111.6573	0.0000	0.0000	0.0000	0.0000	371.2877	820.9185	1231.8000 (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	0.0000 (215)
Water heating												
Water heating requirement												
	258.1968	228.3218	242.7934	214.3338	208.2829	188.2646	186.3639	193.5270	195.3583	217.1094	229.9082	255.5193 (64)
Efficiency of water heater												79.8000 (216)
(217)m	86.9507	86.6918	86.1879	84.9793	82.5701	79.8000	79.8000	79.8000	79.8000	85.0787	86.5282	86.9995 (217)
Fuel for water heating, kWh/month												
	296.9461	263.3717	281.7026	252.2189	252.2496	235.9206	233.5387	242.5151	244.8099	255.1867	265.7031	293.7021 (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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	33.6600	27.0033	24.3135	17.8131	13.7593	11.2415	12.5517	16.3152	21.1918	27.8048	31.4055	34.5955 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-62.5868	-86.2371	-121.1469	-132.9605	-140.5965	-130.1264	-128.3735	-122.4419	-111.7144	-96.9119	-68.0329	-54.3350 (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	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)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 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-41.7079	-86.9262	-171.3513	-255.3876	-335.8855	-336.9523	-333.1177	-282.9837	-208.5773	-123.8068	-55.5053	-33.0557 (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 (234b)
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	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(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)

Annual totals kWh/year	
Space heating fuel - main system 1	5705.3444 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	3117.8651 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	271.6552 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3520.7212 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5660.1435 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5705.3444	0.2100	1198.1223	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3117.8651	0.2100	654.7517	(264)
Space and water heating			1852.8740	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	271.6552	0.1443	39.2082	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1255.4639	0.1351	-169.6240	
PV Unit electricity exported	-2265.2573	0.1261	-285.6832	
Total			-455.3072	(269)
Total CO2, kg/year			1448.7043	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5705.3444	1.1300	6447.0392	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3117.8651	1.1300	3523.1876	(278)
Space and water heating			9970.2268	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	271.6552	1.5338	416.6738	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1255.4639	1.4994	-1882.4022	
PV Unit electricity exported	-2265.2573	0.4629	-1048.6746	
Total			-2931.0769	(283)
Total Primary energy kWh/year			7585.9245	(286)
Target Primary Energy Rate (TPER)			52.3200	(287)

Full SAP Calculation Printout

Property Reference	4B7P	**Issued on Date**	03/09/2025
Assessment Reference	BeLean	**Prop Type Ref**	
Property	4B7P, Land at Coombe Farm, Sayers Common, BN6 9HY		

SAP Rating	94 A	**DER**	7.59	**TER**	9.12
Environmental	93 A	**% DER < TER**			16.78
CO_2 Emissions (t/year)	0.93	**DFEE**	33.74	**TFEE**	38.37
Compliance Check	See BREL	**% DFEE < TFEE**			12.05
% DPER < TPER	12.86	**DPER**	41.56	**TPER**	47.69

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.8600 (1b)	x	2.4000 (2b)	=	122.0640	(1b) - (3b)
First floor	54.8800 (1c)	x	2.7000 (2c)	=	148.1760	(1c) - (3c)
Second floor	54.9500 (1d)	x	2.1000 (2d)	=	115.3950	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	160.6900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	385.6350	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3312	0.3275	0.3237	0.3050	0.3013	0.2825	0.2825	0.2788	0.2900	0.3013	0.3087	0.3163	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.0700	1.0000	2.0700			(26)
Window			25.8600	1.0536	27.2471			(27)
GF			50.8600	0.1000	5.0860	110.0000	5594.6000	(28a)
External Wall 1	170.5600	27.9300	142.6300	0.1600	22.8208	140.0000	19968.2000	(29a)
External Roof 1	54.9500		54.9500	0.1000	5.4950	9.0000	494.5500	(30)
Flat roof	20.6300		20.6300	0.1000	2.0630	9.0000	185.6700	(30)
Total net area of external elements Aum(A, m2)			297.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		64.7819			(33)
Main dwelling								
Internal Wall 1			238.8800			75.0000	17916.0000	(32c)
Internal Floor 1			54.8800			18.0000	987.8400	(32d)
Internal Floor 2			54.9500			18.0000	989.1000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 46135.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 287.1116 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.9800	0.0620	0.9908
E3 Sill	10.7800	0.0390	0.4204
E4 Jamb	39.5200	0.0520	2.0550
E5 Ground floor (normal)	28.9500	0.0560	1.6212
E6 Intermediate floor within a dwelling	42.1200	0.0050	0.2106
E16 Corner (normal)	16.8000	0.0360	0.6048
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0450	-0.1080
E18 Party wall between dwellings	14.4000	0.0495	0.7128
P1 Party wall - Ground floor	7.0000	0.0800	0.5600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	11.5800	0.0500	0.5790
E12 Gable (insulation at ceiling level)	9.4800	0.0570	0.5404
P4 Party wall - Roof (insulation at ceiling level)	13.0400	0.0385	0.5020
E20 Exposed floor (normal)	3.4600	0.0800	0.2768
E21 Exposed floor (inverted)	11.9600	0.0440	0.5262
E14 Flat roof	10.1400	0.0700	0.7098
E24 Eaves (insulation at ceiling level - inverted)	5.8000	0.0460	0.2668

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.4687 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 75.2506 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.1547	41.6775	41.2003	38.8142	38.3369	35.9508	35.9508	35.4736	36.9053	38.3369	39.2914	40.2458	(38)
Heat transfer coeff	117.4053	116.9281	116.4509	114.0647	113.5875	111.2014	111.2014	110.7242	112.1559	113.5875	114.5420	115.4964	(39)

Average = Sum(39)m / 12 = 113.9454

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7306	0.7277	0.7247	0.7098	0.7069	0.6920	0.6920	0.6891	0.6980	0.7069	0.7128	0.7188	(40)
HLP (average)												0.7091	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9499 (42)
Hot water usage for mixer showers

73.6795	72.5723	70.9588	67.8716	65.5934	63.0528	61.6086	63.2099	64.9652	67.6931	70.8466	73.3972	(42a)

Hot water usage for baths

31.8078	31.3354	30.6702	29.4437	28.5252	27.5068	26.9567	27.6173	28.3366	29.4263	30.6781	31.7003	(42b)

Hot water usage for other uses

44.8396	43.2091	41.5786	39.9480	38.3175	36.6870	36.6870	38.3175	39.9480	41.5786	43.2091	44.8396	(42c)

Average daily hot water use (litres/day) 138.1842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.3270	147.1168	143.2076	137.2633	132.4361	127.2466	125.2524	129.1448	133.2498	138.6980	144.7338	149.9372	(44)
Energy conte	238.0812	209.4924	220.1047	187.9066	178.2845	156.4645	151.4819	159.9082	164.3104	188.2118	206.1998	234.7654	(45)
Energy content (annual)											Total = Sum(45)m =	2295.2113	
Distribution loss (46)m = 0.15 x (45)m	35.7122	31.4239	33.0157	28.1860	26.7427	23.4697	22.7223	23.9862	24.6466	28.2318	30.9300	35.2148	(46)

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3900 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7506 (55)

Total storage loss	23.2686	21.0168	23.2686	22.5180	23.2686	22.5180	23.2686	23.2686	22.5180	23.2686	22.5180	23.2686	(56)
If cylinder contains dedicated solar storage	23.2686	21.0168	23.2686	22.5180	23.2686	22.5180	23.2686	23.2686	22.5180	23.2686	22.5180	23.2686	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	284.6122	251.5204	266.6357	232.9366	224.8155	201.4945	198.0129	206.4392	209.3404	234.7428	251.2298	281.2964	(62)
WWHRS	-29.7134	-26.2788	-27.5176	-22.7857	-21.2354	-18.1713	-17.0327	-18.1126	-18.8007	-22.1640	-25.1091	-29.1631	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	254.8988	225.2416	239.1181	210.1510	203.5801	183.3232	180.9802	188.3266	190.5396	212.5789	226.1207	252.1332	(64)
										Total per year (kWh/year) = Sum(64)m =		2566.9919	(64)
12Total per year (kWh/year)												2567	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	116.3868	103.2786	110.4096	98.5030	96.5044	88.0484	87.5925	90.3943	90.6572	99.8052	104.5854	115.2843	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.4663	193.1591	174.4663	180.2819	174.4663	180.2819	174.4663	174.4663	180.2819	174.4663	180.2819	174.4663	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.9280	335.3724	326.6927	308.2146	284.8893	262.9669	248.3213	244.8770	253.5567	272.0348	295.3600	317.2825	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	(71)
Water heating gains (Table 5)	156.4339	153.6884	148.4000	136.8097	129.7102	122.2895	117.7319	121.4977	125.9128	134.1468	145.2575	154.9520	(72)
Total internal gains	733.0763	752.4680	719.8071	695.5542	659.3140	632.7863	607.7676	608.0890	626.9994	650.8960	691.1475	716.9489	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.9100	11.2829	0.4000	0.7000	0.7700	19.5070	(75)
Southwest	16.9500	36.7938	0.4000	0.7000	0.7700	121.0141	(79)

Solar gains	140.5211	245.8389	353.5781	466.9480	549.3514	556.9608	532.1497	468.9024	392.5602	276.3448	169.4919	119.4933	(83)
Total gains	873.5974	998.3069	1073.3852	1162.5022	1208.6654	1189.7471	1139.9174	1076.9915	1019.5596	927.2408	860.6394	836.4421	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	109.1564	109.6019	110.0511	112.3532	112.8253	115.2462	115.2462	115.7430	114.2655	112.8253	111.8851	110.9605	
alpha	8.2771	8.3068	8.3367	8.4902	8.5217	8.6831	8.6831	8.7162	8.6177	8.5217	8.4590	8.3974	
util living area	0.9993	0.9976	0.9915	0.9543	0.8256	0.5954	0.4291	0.4726	0.7407	0.9697	0.9975	0.9995	(86)
MIT	20.3030	20.4315	20.5995	20.8258	20.9624	20.9979	20.9999	20.9997	20.9880	20.8184	20.5284	20.2908	(87)
Th 2	20.6347	20.6362	20.6377	20.6451	20.6466	20.6540	20.6540	20.6555	20.6510	20.6466	20.6436	20.6406	(88)
util rest of house	0.9992	0.9971	0.9900	0.9464	0.8030	0.5641	0.3954	0.4373	0.7081	0.9629	0.9969	0.9994	(89)
MIT 2	19.9651	20.0947	20.2632	20.4910	20.6172	20.6526	20.6539	20.6553	20.6428	20.4868	20.1979	19.9581	(90)
Living area fraction										fLA = Living area / (4) =		0.1805	(91)
MIT	20.0260	20.1554	20.3239	20.5514	20.6795	20.7149	20.7164	20.7175	20.7051	20.5466	20.2575	20.0181	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.8760	20.0054	20.1739	20.4014	20.5295	20.5649	20.5664	20.5675	20.5551	20.3966	20.1075	19.8681	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9962	0.9875	0.9402	0.7951	0.5560	0.3869	0.4283	0.6989	0.9572	0.9959	0.9992	(94)
Useful gains	872.5879	994.4931	1059.9883	1093.0156	961.0209	661.4653	440.9945	461.2798	712.5727	887.5864	857.1172	835.7519	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1828.7107	1766.2513	1592.3366	1311.9097	1002.9181	663.3098	441.0655	461.4431	723.9774	1112.7728	1489.9090	1809.6117	(97)
Space heating kWh	711.3553	518.6215	396.0672	157.6038	31.1716	0.0000	0.0000	0.0000	0.0000	167.5387	455.6101	724.5517	(98a)
Space heating requirement - total per year (kWh/year)												3162.5198	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	711.3553	518.6215	396.0672	157.6038	31.1716	0.0000	0.0000	0.0000	0.0000	167.5387	455.6101	724.5517	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3162.5198	
Space heating per m2											(98c) / (4) =	19.6809	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	79.8000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	711.3553	518.6215	396.0672	157.6038	31.1716	0.0000	0.0000	0.0000	0.0000	167.5387	455.6101	724.5517	(98)
Space heating efficiency (main heating system 1)	79.8000	79.8000	79.8000	79.8000	79.8000	0.0000	0.0000	0.0000	0.0000	79.8000	79.8000	79.8000	(210)
Space heating fuel (main heating system)	891.4227	649.9016	496.3248	197.4985	39.0621	0.0000	0.0000	0.0000	0.0000	209.9482	570.9400	907.9595	(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	0.0000	(215)
Water heating													
Water heating requirement	254.8988	225.2416	239.1181	210.1510	203.5801	183.3232	180.9802	188.3266	190.5396	212.5789	226.1207	252.1332	(64)
Efficiency of water heater												88.8000	(216)
(217)m	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	88.8000	(217)
Fuel for water heating, kWh/month	287.0482	253.6505	269.2771	236.6565	229.2568	206.4450	203.8065	212.0795	214.5717	239.3906	254.6404	283.9338	(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	50.0993	45.2509	50.0993	48.4832	50.0993	48.4832	50.0993	50.0993	48.4832	50.0993	48.4832	50.0993	(231)
Lighting	40.5796	32.5544	29.3117	21.4750	16.5879	13.5524	15.1320	19.6692	25.5483	33.5208	37.8617	41.7074	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.7432	-78.8158	-111.2976	-124.0136	-133.9802	-125.4934	-124.4568	-117.7430	-106.0267	-90.1200	-62.2823	-49.3512	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-30.5598	-61.9084	-116.6057	-166.6531	-213.9871	-212.4720	-210.7617	-182.2356	-139.2870	-86.4424	-40.2598	-24.4078	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)
Annual totals kWh/year													

Space heating fuel - main system 1	3963.0574	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.8000	
Water heating fuel used	2890.7567	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0710)		
mechanical ventilation fans (SFP = 1.0710)	503.8784	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	589.8784	(231)
Electricity for lighting (calculated in Appendix L)	327.5004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2665.9039	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5105.2889	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3963.0574	0.2100	832.2421	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2890.7567	0.2100	607.0589	(264)
Space and water heating			1439.3010	(265)
Pumps, fans and electric keep-hot	589.8784	0.1387	81.8234	(267)
Energy for lighting	327.5004	0.1443	47.2684	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1180.3237	0.1347	-159.0091	
PV Unit electricity exported	-1485.5802	0.1272	-188.9834	
Total			-347.9925	(269)
Total CO2, kg/year			1220.4003	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.5900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3963.0574	1.1300	4478.2549	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2890.7567	1.1300	3266.5550	(278)
Space and water heating			7744.8099	(279)
Pumps, fans and electric keep-hot	589.8784	1.5128	892.3680	(281)
Energy for lighting	327.5004	1.5338	502.3310	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1180.3237	1.4979	-1767.9993	
PV Unit electricity exported	-1485.5802	0.4670	-693.7861	
Total			-2461.7854	(283)
Total Primary energy kWh/year			6677.7236	(286)
Dwelling Primary energy Rate (DPER)			41.5600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.8600 (1b)	x	2.4000 (2b)	=	122.0640	(1b) - (3b)
First floor	54.8800 (1c)	x	2.7000 (2c)	=	148.1760	(1c) - (3c)
Second floor	54.9500 (1d)	x	2.1000 (2d)	=	115.3950	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 160.6900						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	385.6350	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1037	(8)

Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3537	(18)
Number of sides sheltered	0	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.3537	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4510	0.4422	0.4333	0.3891	0.3803	0.3360	0.3360	0.3272	0.3537	0.3803	0.3979	0.4156	(22b)
Effective ac	0.6017	0.5978	0.5939	0.5757	0.5723	0.5565	0.5565	0.5535	0.5626	0.5723	0.5792	0.5864	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.0700	1.0000	2.0700			(26)
TER Opening Type			25.8600	1.1450	29.6107			(27)
GF			50.8600	0.1300	6.6118			(28a)
External Wall 1	170.5600	27.9300	142.6300	0.1800	25.6734			(29a)
External Roof 1	54.9500		54.9500	0.1100	6.0445			(30)
Flat roof	20.6300		20.6300	0.1100	2.2693			(30)
Total net area of external elements Aum(A, m2)			297.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.2797			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 287.1116 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.9800	0.0500	0.7990
E3 Sill	10.7800	0.0500	0.5390
E4 Jamb	39.5200	0.0500	1.9760
E5 Ground floor (normal)	28.9500	0.1600	4.6320
E6 Intermediate floor within a dwelling	42.1200	0.0000	0.0000
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E18 Party wall between dwellings	14.4000	0.0600	0.8640
P1 Party wall - Ground floor	7.0000	0.0800	0.5600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	11.5800	0.0600	0.6948
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688
P4 Party wall - Roof (insulation at ceiling level)	13.0400	0.1200	1.5648
E20 Exposed floor (normal)	3.4600	0.3200	1.1072
E21 Exposed floor (inverted)	11.9600	0.3200	3.8272
E14 Flat roof	10.1400	0.0800	0.8112
E24 Eaves (insulation at ceiling level - inverted)	5.8000	0.2400	1.3920

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	20.6320	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	92.9117	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.5721	76.0695	75.5769	73.2631	72.8302	70.8150	70.8150	70.4418	71.5912	72.8302	73.7060	74.6215	(38)
Heat transfer coeff	169.4838	168.9812	168.4886	166.1748	165.7419	163.7267	163.7267	163.3535	164.5029	165.7419	166.6177	167.5332	(39)
Average = Sum(39)m / 12 =												166.1727	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0547	1.0516	1.0485	1.0341	1.0314	1.0189	1.0189	1.0166	1.0237	1.0314	1.0369	1.0426	(40)
HLP (average)												1.0341	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9499	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.6795	72.5723	70.9588	67.8716	65.5934	63.0528	61.6086	63.2099	64.9652	67.6931	70.8466	73.3972	(42a)
Hot water usage for baths	31.8078	31.3354	30.6702	29.4437	28.5252	27.5068	26.9567	27.6173	28.3366	29.4263	30.6781	31.7003	(42b)
Hot water usage for other uses	44.8396	43.2091	41.5786	39.9480	38.3175	36.6870	36.6870	38.3175	39.9480	41.5786	43.2091	44.8396	(42c)
Average daily hot water use (litres/day)												138.1842	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.3270	147.1168	143.2076	137.2633	132.4361	127.2466	125.2524	129.1448	133.2498	138.6980	144.7338	149.9372	(44)
Energy conte	238.0812	209.4924	220.1047	187.9066	178.2845	156.4645	151.4819	159.9082	164.3104	188.2118	206.1998	234.7654	(45)
Energy content (annual)										Total = Sum(45)m =		2295.2113	
Distribution loss (46)m = 0.15 x (45)m	35.7122	31.4239	33.0157	28.1860	26.7427	23.4697	22.7223	23.9862	24.6466	28.2318	30.9300	35.2148	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	284.6761	251.5781	266.6996	232.9985	224.8794	201.5563	198.0768	206.5031	209.4022	234.8067	251.2916	281.3603	(62)
WWHRS	-33.6832	-29.7897	-31.1941	-25.8299	-24.0725	-20.5990	-19.3083	-20.5325	-21.3126	-25.1252	-28.4638	-33.0594	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	250.9929	221.7884	235.5055	207.1686	200.8069	180.9573	178.7685	185.9706	188.0896	209.6816	222.8279	248.3008	(64)
Total per year (kWh/year) = Sum(64)m =												2530.8585	(64)

12Total per year (kWh/year) 2531 (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)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

116.4379	103.3248	110.4607	98.5524	96.5555	88.0979	87.6436	90.4454	90.7067	99.8564	104.6349	115.3354	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

174.4663	193.1591	174.4663	180.2819	174.4663	180.2819	174.4663	174.4663	180.2819	174.4663	180.2819	174.4663	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

331.9280	335.3724	326.6927	308.2146	284.8893	262.9669	248.3213	244.8770	253.5567	272.0348	295.3600	317.2825	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	(71)

Water heating gains (Table 5)

156.5026	153.7571	148.4687	136.8784	129.7789	122.3582	117.8006	121.5664	125.9815	134.2155	145.3263	155.0207	(72)

Total internal gains

733.1450	752.5367	719.8758	695.6229	659.3827	632.8551	607.8363	608.1578	627.0681	650.9647	691.2162	717.0176	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.9100	11.2829	0.6300	0.7000	0.7700	30.7236	(75)
Southwest	16.9500	36.7938	0.6300	0.7000	0.7700	190.5972	(79)

Solar gains	221.3208	387.1963	556.8856	735.4431	865.2285	877.2132	838.1358	738.5213	618.2823	435.2431	266.9498	188.2019	(83)
Total gains	954.4658	1139.7330	1276.7614	1431.0660	1524.6111	1510.0683	1445.9722	1346.6791	1245.3505	1086.2078	958.1660	905.2195	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.6152	75.8401	76.0618	77.1209	77.3223	78.2740	78.2740	78.4528	77.9047	77.3223	76.9159	76.4955	
alpha	6.0410	6.0560	6.0708	6.1414	6.1548	6.2183	6.2183	6.2302	6.1936	6.1548	6.1277	6.0997	
util living area	0.9991	0.9970	0.9906	0.9608	0.8649	0.6703	0.4949	0.5514	0.8181	0.9776	0.9974	0.9993	(86)
MIT	19.8618	20.0387	20.2847	20.6132	20.8644	20.9783	20.9971	20.9946	20.9291	20.5971	20.1726	19.8394	(87)
Th 2	20.0380	20.0406	20.0431	20.0550	20.0572	20.0676	20.0676	20.0695	20.0636	20.0572	20.0527	20.0480	(88)
util rest of house	0.9987	0.9958	0.9868	0.9448	0.8158	0.5833	0.3919	0.4435	0.7412	0.9654	0.9961	0.9991	(89)
MIT 2	18.7041	18.9322	19.2470	19.6633	19.9468	20.0563	20.0668	20.0679	20.0183	19.6519	19.1132	18.6829	(90)
Living area fraction									fLA = Living area / (4) =			0.1805	(91)
MIT	18.9130	19.1319	19.4343	19.8347	20.1124	20.2227	20.2347	20.2351	20.1827	19.8225	19.3044	18.8916	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9130	19.1319	19.4343	19.8347	20.1124	20.2227	20.2347	20.2351	20.1827	19.8225	19.3044	18.8916	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9943	0.9835	0.9401	0.8190	0.5983	0.4106	0.4631	0.7521	0.9613	0.9947	0.9986	(94)
Useful gains	952.6154	1133.1845	1255.6935	1345.3561	1248.7053	903.5477	593.6925	623.6187	936.6478	1044.1687	953.1048	903.9366	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2476.6670	2404.9275	2179.2774	1817.0697	1394.2839	920.5852	595.0967	626.4774	1000.6177	1528.5470	2033.4707	2461.3281	(97)
Space heating kWh	1133.8944	854.6113	687.1464	339.6338	108.3105	0.0000	0.0000	0.0000	0.0000	360.3775	777.8635	1158.6992	(98a)

Space heating requirement - total per year (kWh/year) 5420.5366
Solar heating 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 heating contribution - total per year (kWh/year) 0.0000
Space heating kWh

1133.8944	854.6113	687.1464	339.6338	108.3105	0.0000	0.0000	0.0000	0.0000	360.3775	777.8635	1158.6992	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 5420.5366
Space heating per m2 (98c) / (4) = 33.7329 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.3000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1133.8944	854.6113	687.1464	339.6338	108.3105	0.0000	0.0000	0.0000	0.0000	360.3775	777.8635	1158.6992	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	1228.4880	925.9061	744.4706	367.9673	117.3461	0.0000	0.0000	0.0000	0.0000	390.4415	842.7556	1255.3621	(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	0.0000	(215)

Water heating

Water heating requirement

250.9929	221.7884	235.5055	207.1686	200.8069	180.9573	178.7685	185.9706	188.0896	209.6816	222.8279	248.3008	(64)

Efficiency of water heater

											79.8000	(216)
(217)m	87.0213	86.7833	86.3152	85.1611	82.7382	79.8000	79.8000	79.8000	79.8000	85.2630	86.6245	87.0671	(217)

Fuel for water heating, kWh/month

288.4271	255.5657	272.8436	243.2668	242.7015	226.7635	224.0206	233.0459	235.7013	245.9234	257.2341	285.1834	(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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	36.2507	29.0816	26.1848	19.1841	14.8183	12.1067	13.5178	17.5709	22.8229	29.9449	33.8227	37.2582	(232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	-63.2279	-87.5650	-123.6189	-136.3478	-144.7172	-134.1150	-132.3064	-125.9377	-114.4934	-98.7287	-68.8891	-54.8378	(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	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)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	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	-40.6568	-84.9177	-167.7295	-250.4737	-329.8918	-331.1277	-327.3707	-277.8941	-204.5393	-121.1224	-54.1635	-32.2093	(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	(234b)

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	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(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)

Annual totals kWh/year

Space heating fuel - main system 1	5872.7374	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3010.6769	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	292.5635	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3506.8815	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5755.0963	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5872.7374	0.2100	1233.2748	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3010.6769	0.2100	632.2422	(264)
Space and water heating			1865.5170	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	292.5635	0.1443	42.2260	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1284.7851	0.1350	-173.4516	
PV Unit electricity exported	-2222.0965	0.1261	-280.1091	
Total			-453.5608	(269)
Total CO2, kg/year			1466.1115	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.1200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5872.7374	1.1300	6636.1932	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3010.6769	1.1300	3402.0649	(278)
Space and water heating			10038.2581	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	292.5635	1.5338	448.7437	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1284.7851	1.4990	-1925.8631	
PV Unit electricity exported	-2222.0965	0.4627	-1028.2074	
Total			-2954.0705	(283)
Total Primary energy kWh/year			7663.0322	(286)
Target Primary Energy Rate (TPER)			47.6900	(287)

APPENDIX C

SAP Worksheets – Be Green Case

Full SAP Calculation Printout

Property Reference	1B2P FLAT	**Issued on Date**	03/09/2025
Assessment Reference	BeGreen	**Prop Type Ref**	
Property	1B2P Flat, Land at Combe Farm		

SAP Rating	89 B	**DER**	2.58	**TER**	14.58
Environmental	98 A	**% DER < TER**			82.30
CO_2 Emissions (t/year)	0.11	**DFEE**	30.18	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			14.32
% DPER < TPER	65.48	**DPER**	26.82	**TPER**	77.69

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		53.0900	(1b)	x 2.6000	(2b) =	138.0340	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0900						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	138.0340	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	73.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3232	0.3195	0.3157	0.2970	0.2932	0.2745	0.2745	0.2707	0.2820	0.2932	0.3007	0.3082	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Windows			8.8800	1.0536	9.3563			(27)
GF			53.0900	0.1000	5.3090	110.0000	5839.9000	(28a)
External Wall 1	41.7300	8.8800	32.8500	0.1600	5.2560	110.0000	3613.5000	(29a)
Total net area of external elements Aum(A, m2)			94.8200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.9213			(33)
Main dwelling								
Party Wall 1			41.5200	0.0000	0.0000	70.0000	2906.4000	(32)
Party Ceiling 1			53.0900			30.0000	1592.7000	(32b)
Internal Wall 1			74.4800			75.0000	5586.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 19538.5000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	368.0260	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	4.3800	0.0620	0.2716

E3 Sill	1.3800	0.0390	0.0538	
E4 Jamb	8.3800	0.0520	0.4358	
E5 Ground floor (normal)	16.0500	0.0710	1.1395	
E16 Corner (normal)	5.2000	0.0360	0.1872	
E18 Party wall between dwellings	7.8000	0.0495	0.3861	
P1 Party wall - Ground floor	15.9700	0.0800	1.2776	
P2 Party wall - Intermediate floor within a dwelling	15.9700	0.0000	0.0000	
E7 Party floor between dwellings (in blocks of flats)	16.0500	0.0685	1.0994	
E25 Staggered party wall between dwellings	5.2000	0.1010	0.5252	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.3762 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 25.2975 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.7244	14.5536	14.3828	13.5287	13.3579	12.5038	12.5038	12.3330	12.8454	13.3579	13.6995	14.0412	(38)
Heat transfer coeff	40.0220	39.8512	39.6803	38.8262	38.6554	37.8013	37.8013	37.6305	38.1430	38.6554	38.9971	39.3387	(39)

Average = Sum(39)m / 12 = 38.7835

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7539	0.7506	0.7474	0.7313	0.7281	0.7120	0.7120	0.7088	0.7185	0.7281	0.7345	0.7410	(40)
HLP (average)												0.7305	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7812 (42)

Hot water usage for mixer showers

54.0846	53.2718	52.0874	49.8213	48.1490	46.2840	45.2240	46.3994	47.6879	49.6903	52.0051	53.8774	(42a)

Hot water usage for baths

23.3814	23.0341	22.5451	21.6435	20.9684	20.2198	19.8154	20.3010	20.8297	21.6307	22.5509	23.3023	(42b)

Hot water usage for other uses

32.8714	31.6761	30.4808	29.2854	28.0901	26.8948	26.8948	28.0901	29.2854	30.4808	31.6761	32.8714	(42c)

Average daily hot water use (litres/day) 101.4255 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.3374	107.9820	105.1133	100.7503	97.2075	93.3986	91.9342	94.7905	97.8030	101.8018	106.2321	110.0511	(44)
Energy conte	174.7475	153.7650	161.5553	137.9221	130.8600	114.8445	111.1864	117.3704	120.6009	138.1441	151.3471	172.3135	(45)

Energy content (annual) Total = Sum(45)m = 1684.6566

Distribution loss (46)m = 0.15 x (45)m												
26.2121	23.0647	24.2333	20.6883	19.6290	17.2267	16.6780	17.6056	18.0901	20.7216	22.7021	25.8470	(46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6100 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8694 (55)

Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

201.6989	178.1082	188.5067	164.0041	157.8114	140.9265	138.1378	144.3218	146.6829	165.0955	177.4291	199.2649	(62)
WWHRS 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)
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)
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	(63c)
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	(63d)

Output from w/h

201.6989	178.1082	188.5067	164.0041	157.8114	140.9265	138.1378	144.3218	146.6829	165.0955	177.4291	199.2649	(64)

Total per year (kWh/year) = Sum(64)m = 2001.9876 (64)

12Total per year (kWh/year) 2002 (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)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

58.1035	51.1269	53.7171	45.8591	43.5109	38.1858	36.9695	39.0257	40.0998	45.9329	50.3229	57.2942	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.0029	89.6818	81.0029	83.7030	81.0029	83.7030	81.0029	81.0029	83.7030	81.0029	83.7030	81.0029	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.2508	156.8619	152.8022	144.1595	133.2497	122.9960	116.1460	114.5349	118.5947	127.2373	138.1471	148.4008	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	(71)
Water heating gains (Table 5)	78.0961	76.0816	72.2004	63.6932	58.4824	53.0358	49.6902	52.4539	55.6942	61.7378	69.8929	77.0084	(72)
Total internal gains	364.0681	372.3435	355.7237	341.2739	322.4533	309.4531	296.5573	297.7099	307.7100	319.6962	341.4612	356.1303	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	3.1700	36.7938	0.4000	0.7000	0.7700	22.6321	(77)
Northwest	5.7100	11.2829	0.4000	0.7000	0.7700	12.5011	(81)

Solar gains	35.1333	63.9973	98.5934	140.6491	174.4128	180.5739	171.0036	144.6796	112.9784	73.7045	42.8378	29.5775	(83)
Total gains	399.2014	436.3408	454.3171	481.9230	496.8661	490.0270	467.5609	442.3896	420.6885	393.4007	384.2990	385.7077	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	135.6095	136.1908	136.7771	139.7859	140.4036	143.5759	143.5759	144.2276	142.2899	140.4036	139.1736	137.9649	
alpha	10.0406	10.0794	10.1185	10.3191	10.3602	10.5717	10.5717	10.6152	10.4860	10.3602	10.2782	10.1977	
util living area													
	0.9977	0.9933	0.9792	0.8996	0.7163	0.4936	0.3557	0.3913	0.6239	0.9215	0.9913	0.9983	(86)
Living	20.6546	20.7267	20.8172	20.9274	20.9657	20.9704	20.9705	20.9706	20.9694	20.9238	20.7816	20.6478	
Non living	20.2950	20.3680	20.4585	20.5695	20.6029	20.6144	20.6145	20.6162	20.6105	20.5688	20.4302	20.2941	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8233	20.7267	20.8172	20.9274	20.9657	20.9704	20.9705	20.9706	20.9694	20.9238	20.7816	20.6970	(87)
Th 2	20.6231	20.6247	20.6263	20.6343	20.6359	20.6440	20.6440	20.6456	20.6408	20.6359	20.6327	20.6295	(88)
util rest of house													
	0.9972	0.9919	0.9750	0.8839	0.6902	0.4662	0.3269	0.3611	0.5920	0.9055	0.9893	0.9979	(89)
MIT 2	20.4552	20.3680	20.4585	20.5695	20.6029	20.6144	20.6145	20.6162	20.6105	20.5688	20.4302	20.3410	(90)
Living area fraction									fLA = Living area / (4) =			0.4238	(91)
MIT	20.6112	20.5200	20.6105	20.7212	20.7567	20.7653	20.7654	20.7664	20.7626	20.7192	20.5791	20.4919	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6112	20.5200	20.6105	20.7212	20.7567	20.7653	20.7654	20.7664	20.7626	20.7192	20.5791	20.4919	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9915	0.9748	0.8878	0.6990	0.4755	0.3368	0.3714	0.6029	0.9093	0.9889	0.9977	(94)
Useful gains	398.0849	432.6351	442.8542	427.8429	347.2888	233.0094	157.4553	164.3074	253.6212	357.7387	380.0425	384.8390	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	652.8074	622.4762	559.9091	458.9731	350.0906	233.0568	157.4563	164.3102	254.1324	391.1628	525.6464	640.9024	(97)
Space heating kWh													
	189.5136	127.5732	87.0888	22.4137	2.0846	0.0000	0.0000	0.0000	0.0000	24.8676	104.8348	190.5112	(98a)
Space heating requirement - total per year (kWh/year)												748.8875	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	189.5136	127.5732	87.0888	22.4137	2.0846	0.0000	0.0000	0.0000	0.0000	24.8676	104.8348	190.5112	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												748.8875	
Space heating per m2											(98c) / (4) =	14.1060	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Fraction of main heating from main system 2 0.0000 (203)

Fraction of total heating from main system 1 1.0000 (204)

Fraction of total heating from main system 2 0.0000 (205)

Efficiency of main space heating system 1 (in %) 231.1838 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	189.5136	127.5732	87.0888	22.4137	2.0846	0.0000	0.0000	0.0000	0.0000	24.8676	104.8348	190.5112	(98)
Space heating efficiency (main heating system 1)													
	231.1838	231.1838	231.1838	231.1838	231.1838	0.0000	0.0000	0.0000	0.0000	231.1838	231.1838	231.1838	(210)
Space heating fuel (main heating system)													
	81.9753	55.1826	37.6708	9.6952	0.9017	0.0000	0.0000	0.0000	0.0000	10.7566	45.3470	82.4068	(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	0.0000	(215)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	201.6989	178.1082	188.5067	164.0041	157.8114	140.9265	138.1378	144.3218	146.6829	165.0955	177.4291	199.2649	(64)
Efficiency of water heater												324.5200	(216)
(217)m	324.5200	324.5200	324.5200	324.5200	324.5200	324.5200	324.5200	324.5200	324.5200	324.5200	324.5200	324.5200	(217)
Fuel for water heating, kWh/month													
	62.1530	54.8836	58.0878	50.5374	48.6292	43.4261	42.5668	44.4724	45.2000	50.8737	54.6743	61.4030	(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	11.0130	9.9472	11.0130	10.6577	11.0130	10.6577	11.0130	11.0130	10.6577	11.0130	10.6577	11.0130	(231)
Lighting	15.6612	12.5640	11.3125	8.2880	6.4019	5.2304	5.8400	7.5911	9.8600	12.9369	14.6122	16.0964	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.4084	-16.0895	-25.2432	-30.6865	-35.3398	-33.8957	-33.4547	-30.3626	-25.2757	-19.1554	-11.8563	-8.8351	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)
Annual totals kWh/year													
Space heating fuel - main system 1												323.9360	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	324.5200	
Water heating fuel used	616.9073	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700)		
mechanical ventilation fans (SFP = 0.7700)	129.6691	(230a)
Total electricity for the above, kWh/year	129.6691	(231)
Electricity for lighting (calculated in Appendix L)	126.3945	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-280.6030	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	916.3040	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	323.9360	0.1581	51.2029	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	616.9073	0.1411	87.0603	(264)
Space and water heating			138.2632	(265)
Pumps, fans and electric keep-hot	129.6691	0.1387	17.9867	(267)
Energy for lighting	126.3945	0.1443	18.2426	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-280.6030	0.1329	-37.2869	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-37.2869	(269)
Total CO2, kg/year			137.2057	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.5800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	323.9360	1.5851	513.4817	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	616.9073	1.5218	938.8317	(278)
Space and water heating			1452.3134	(279)
Pumps, fans and electric keep-hot	129.6691	1.5128	196.1635	(281)
Energy for lighting	126.3945	1.5338	193.8682	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-280.6030	1.4910	-418.3819	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-418.3819	(283)
Total Primary energy kWh/year			1423.9631	(286)
Dwelling Primary energy Rate (DPER)			26.8200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.0900	(1b)	x 2.6000	(2b) =	138.0340	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		138.0340	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1449	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3949	(18)
Number of sides sheltered		0	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3949 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5035	0.4936	0.4837	0.4344	0.4245	0.3751	0.3751	0.3653	0.3949	0.4245	0.4443	0.4640	(22b)
Effective ac	0.6267	0.6218	0.6170	0.5943	0.5901	0.5704	0.5704	0.5667	0.5780	0.5901	0.5987	0.6076	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			8.8800	1.1450	10.1679			(27)
GF			53.0900	0.1300	6.9017			(28a)
External Wall 1	41.7300	8.8800	32.8500	0.1800	5.9130			(29a)
Total net area of external elements Aum(A, m2)			94.8200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.9826			(33)
Main dwelling								
Party Wall 1			41.5200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		378.0260 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	4.3800	0.0500	0.2190	
E3 Sill	1.3800	0.0500	0.0690	
E4 Jamb	8.3800	0.0500	0.4190	
E5 Ground floor (normal)	16.0500	0.1600	2.5680	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	7.8000	0.0600	0.4680	
P1 Party wall - Ground floor	15.9700	0.0800	1.2776	
P2 Party wall - Intermediate floor within a dwelling	15.9700	0.0000	0.0000	
E7 Party floor between dwellings (in blocks of flats)	16.0500	0.0700	1.1235	
E25 Staggered party wall between dwellings	5.2000	0.0600	0.3120	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.9241 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	29.9067 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.5492	28.3250	28.1053	27.0731	26.8799	25.9809	25.9809	25.8145	26.3272	26.8799	27.2706	27.6791	(38)
Heat transfer coeff	58.4559	58.2318	58.0120	56.9798	56.7867	55.8877	55.8877	55.7212	56.2340	56.7867	57.1774	57.5858	(39)
Average = Sum(39)m / 12 =												56.9789	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1011	1.0968	1.0927	1.0733	1.0696	1.0527	1.0527	1.0496	1.0592	1.0696	1.0770	1.0847	(40)
HLP (average)												1.0733	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7812 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	54.0846	53.2718	52.0874	49.8213	48.1490	46.2840	45.2240	46.3994	47.6879	49.6903	52.0051	53.8774	(42a)
Hot water usage for baths	23.3814	23.0341	22.5451	21.6435	20.9684	20.2198	19.8154	20.3010	20.8297	21.6307	22.5509	23.3023	(42b)
Hot water usage for other uses	32.8714	31.6761	30.4808	29.2854	28.0901	26.8948	26.8948	28.0901	29.2854	30.4808	31.6761	32.8714	(42c)
Average daily hot water use (litres/day)												101.4255	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.3374	107.9820	105.1133	100.7503	97.2075	93.3986	91.9342	94.7905	97.8030	101.8018	106.2321	110.0511	(44)
Energy conte	174.7475	153.7650	161.5553	137.9221	130.8600	114.8445	111.1864	117.3704	120.6009	138.1441	151.3471	172.3135	(45)
Energy content (annual)										Total = Sum(45)m =		1684.6566	
Distribution loss (46)m = 0.15 x (45)m	26.2121	23.0647	24.2333	20.6883	19.6290	17.2267	16.6780	17.6056	18.0901	20.7216	22.7021	25.8470	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	221.3424	195.8507	208.1502	183.0139	177.4549	159.9363	157.7813	163.9653	165.6927	184.7390	196.4389	218.9084	(62)
WWHRS	-24.7252	-21.8672	-22.8981	-18.9605	-17.6705	-15.1208	-14.1733	-15.0719	-15.6445	-18.4432	-20.8939	-24.2673	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	196.6171	173.9835	185.2521	164.0534	159.7844	144.8155	143.6080	148.8934	150.0482	166.2958	175.5450	194.6410	(64)
									Total per year (kWh/year) = Sum(64)m =			2003.5375	(64)
12Total per year (kWh/year)												2004	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.3795	84.7954	90.9930	81.9326	80.7869	74.2593	74.2454	76.3016	76.1733	83.2088	86.3964	94.5702	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	89.0607	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.0029	89.6818	81.0029	83.7030	81.0029	83.7030	81.0029	81.0029	83.7030	81.0029	83.7030	81.0029	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	155.2508	156.8619	152.8022	144.1595	133.2497	122.9960	116.1460	114.5349	118.5947	127.2373	138.1471	148.4008	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	31.9061	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	-71.2485	(71)
Water heating gains (Table 5)													
	128.1982	126.1837	122.3025	113.7952	108.5845	103.1379	99.7922	102.5559	105.7962	111.8398	119.9950	127.1104	(72)
Total internal gains													
	417.1702	425.4455	408.8258	394.3760	375.5553	359.5551	346.6593	347.8120	357.8121	372.7982	394.5633	409.2323	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	3.1700	36.7938	0.6300	0.7000	0.7700	35.6456	(77)
Northwest	5.7100	11.2829	0.6300	0.7000	0.7700	19.6893	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	55.3349	100.7958	155.2846	221.5223	274.7001	284.4039	269.3307	227.8704	177.9410	116.0846	67.4695	46.5845	(83)
Total gains	472.5051	526.2414	564.1104	615.8982	650.2555	643.9590	615.9900	575.6824	535.7531	488.8829	462.0328	455.8168	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	95.3681	95.7353	96.0979	97.8388	98.1715	99.7507	99.7507	100.0487	99.1364	98.1715	97.5007	96.8092	
alpha	7.3579	7.3824	7.4065	7.5226	7.5448	7.6500	7.6500	7.6699	7.6091	7.5448	7.5000	7.4539	
util living area													
	0.9975	0.9938	0.9823	0.9261	0.7740	0.5527	0.3990	0.4447	0.7060	0.9483	0.9928	0.9981	(86)
MIT	20.2697	20.4000	20.5843	20.8271	20.9639	20.9974	20.9998	20.9996	20.9858	20.8156	20.5123	20.2571	(87)
Th 2	20.0000	20.0034	20.0068	20.0227	20.0257	20.0397	20.0397	20.0422	20.0343	20.0257	20.0197	20.0134	(88)
util rest of house													
	0.9963	0.9908	0.9738	0.8949	0.7079	0.4713	0.3120	0.3525	0.6164	0.9189	0.9887	0.9971	(89)
MIT 2	19.1703	19.3384	19.5716	19.8688	20.0025	20.0387	20.0396	20.0422	20.0278	19.8654	19.4948	19.1649	(90)
Living area fraction									fLA = Living area / (4) =			0.4238	(91)
MIT	19.6362	19.7883	20.0008	20.2750	20.4099	20.4450	20.4466	20.4479	20.4338	20.2681	19.9260	19.6278	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6362	19.7883	20.0008	20.2750	20.4099	20.4450	20.4466	20.4479	20.4338	20.2681	19.9260	19.6278	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9900	0.9737	0.9039	0.7351	0.5059	0.3489	0.3916	0.6545	0.9274	0.9882	0.9966	(94)
Useful gains	470.4879	520.9738	549.2839	556.7135	477.9776	325.7661	214.9305	225.4512	350.6653	453.3975	456.5796	454.2771	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	896.4945	866.9729	783.2074	648.1434	494.6087	326.6636	214.9750	225.5550	356.1728	549.0187	733.3591	888.4226	(97)
Space heating kWh													
	316.9489	232.5114	174.0391	65.8295	12.3735	0.0000	0.0000	0.0000	0.0000	71.1421	199.2813	323.0042	(98a)
Space heating requirement - total per year (kWh/year)												1395.1300	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	316.9489	232.5114	174.0391	65.8295	12.3735	0.0000	0.0000	0.0000	0.0000	71.1421	199.2813	323.0042	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1395.1300	
Space heating per m2											(98c) / (4) =	26.2786	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	316.9489	232.5114	174.0391	65.8295	12.3735	0.0000	0.0000	0.0000	0.0000	71.1421	199.2813	323.0042	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	343.3900	251.9083	188.5580	71.3212	13.4058	0.0000	0.0000	0.0000	0.0000	77.0771	215.9060	349.9504	(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	0.0000	(215)
Water heating													
Water heating requirement													
	196.6171	173.9835	185.2521	164.0534	159.7844	144.8155	143.6080	148.8934	150.0482	166.2958	175.5450	194.6410	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1245	84.7109	83.9200	82.1853	80.3856	79.8000	79.8000	79.8000	79.8000	82.2992	84.3449	85.1874	(217)
Fuel for water heating, kWh/month													
	230.9760	205.3851	220.7485	199.6141	198.7725	181.4731	179.9599	186.5833	188.0303	202.0624	208.1276	228.4856	(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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	16.8308	13.5023	12.1573	8.9070	6.8800	5.6210	6.2762	8.1580	10.5964	13.9031	15.7035	17.2986	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3597	-21.3475	-32.3428	-38.4053	-43.2291	-41.0377	-40.5588	-37.3961	-32.1215	-25.3163	-16.1809	-12.2910	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-5.0738	-10.9185	-22.1593	-33.9568	-45.5553	-45.9945	-45.4323	-38.1481	-27.5594	-15.8109	-6.8383	-3.9928	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year		
Space heating fuel - main system 1	1511.5168	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2430.2185	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	135.8342	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-656.0266	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3507.5430	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1511.5168	0.2100	317.4185	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2430.2185	0.2100	510.3459	(264)
Space and water heating			827.7644	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	135.8342	0.1443	19.6051	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-354.5866	0.1335	-47.3264	
PV Unit electricity exported	-301.4400	0.1253	-37.7775	
Total			-85.1039	(269)
Total CO2, kg/year			774.1949	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.5800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1511.5168	1.1300	1708.0140	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2430.2185	1.1300	2746.1469	(278)
Space and water heating			4454.1609	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	135.8342	1.5338	208.3471	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-354.5866	1.4932	-529.4743	
PV Unit electricity exported	-301.4400	0.4600	-138.6616	
Total			-668.1358	(283)
Total Primary energy kWh/year			4124.4730	(286)
Target Primary Energy Rate (TPER)			77.6900	(287)

Full SAP Calculation Printout

Property Reference	1B2P SD Bungalow	**Issued on Date**	03/09/2025
Assessment Reference	BeGreen	**Prop Type Ref**	
Property	1B2P, Land at Combe Farm		

SAP Rating	88 B	**DER**	3.56	**TER**	11.66
Environmental	98 A	**% DER < TER**			69.47
CO_2 Emissions (t/year)	0.16	**DFEE**	36.16	**TFEE**	42.66
Compliance Check	See BREL	**% DFEE < TFEE**			15.26
% DPER < TPER	40.86	**DPER**	36.87	**TPER**	62.35

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		53.7400	(1b)	x 2.4000	(2b) =	128.9760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7400						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	128.9760	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			0 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		73.6000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3232	0.3195	0.3157	0.2970	0.2932	0.2745	0.2745	0.2707	0.2820	0.2932	0.3007	0.3082	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Windows			7.5400	1.0536	7.9444			(27)
Front Door			1.9400	1.0000	1.9400			(26)
Heatloss Floor 1			53.7400	0.1000	5.3740	110.0000	5911.4000	(28a)
External Wall 1	50.8600	9.4800	41.3800	0.1600	6.6208	140.0000	5793.2000	(29a)
External Roof 1	53.7400		53.7400	0.1000	5.3740	9.0000	483.6600	(30)
Total net area of external elements Aum(A, m2)			158.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.2532			(33)
Main dwelling								
Party Wall 1			20.1800	0.0000	0.0000	180.0000	3632.4000	(32)
Internal Wall 1			66.1400			9.0000	595.2600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16415.9200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		305.4693 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	9.7400	0.0620	0.6039	
E3 Sill	7.2800	0.0390	0.2839	
E4 Jamb	24.8200	0.0520	1.2906	
E5 Ground floor (normal)	21.1900	0.0710	1.5045	
E10 Eaves (insulation at ceiling level)	21.1900	0.0500	1.0595	
P1 Party wall - Ground floor	8.4100	0.0800	0.6728	
P4 Party wall - Roof (insulation at ceiling level)	8.4100	0.0385	0.3238	
E16 Corner (normal)	4.8000	0.0360	0.1728	
E18 Party wall between dwellings	4.8000	0.0495	0.2376	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1494 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.4027 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.7582	13.5986	13.4390	12.6409	12.4813	11.6833	11.6833	11.5237	12.0025	12.4813	12.8005	13.1198	(38)
Heat transfer coeff	47.1609	47.0012	46.8416	46.0436	45.8840	45.0860	45.0860	44.9263	45.4052	45.8840	46.2032	46.5224	(39)

Average = Sum(39)m / 12 = 46.0037

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8776	0.8746	0.8716	0.8568	0.8538	0.8390	0.8390	0.8360	0.8449	0.8538	0.8598	0.8657	(40)
HLP (average)												0.8560	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8004 (42)

Hot water usage for mixer showers

68.0069	66.9849	65.4957	62.6462	60.5434	58.1983	56.8654	58.3434	59.9636	62.4814	65.3921	67.7464	(42a)

Hot water usage for baths

23.5194	23.1701	22.6782	21.7713	21.0922	20.3391	19.9324	20.4208	20.9527	21.7584	22.6840	23.4399	(42b)

Hot water usage for other uses

33.0674	31.8650	30.6625	29.4601	28.2576	27.0552	27.0552	28.2576	29.4601	30.6625	31.8650	33.0674	(42c)

Average daily hot water use (litres/day) 114.5676 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.5938	122.0200	118.8364	113.8776	109.8932	105.5926	103.8530	107.0219	110.3763	114.9024	119.9411	124.2537	(44)
Energy conte	197.3261	173.7549	182.6471	155.8927	147.9373	129.8385	125.6012	132.5154	136.1050	155.9215	170.8781	194.5513	(45)

Energy content (annual) Total = Sum(45)m = 1902.9691

Distribution loss (46)m = 0.15 x (45)m												
29.5989	26.0632	27.3971	23.3839	22.1906	19.4758	18.8402	19.8773	20.4158	23.3882	25.6317	29.1827	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8100 (55)

Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

245.6985	217.4461	231.0195	202.7047	196.3097	176.6505	173.9736	180.8878	182.9170	204.2939	217.6901	242.9237	(62)
WWHRS 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)
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)
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	(63c)
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	(63d)

Output from w/h

245.6985	217.4461	231.0195	202.7047	196.3097	176.6505	173.9736	180.8878	182.9170	204.2939	217.6901	242.9237	(64)

Total per year (kWh/year) = Sum(64)m = 2472.5151 (64)

12Total per year (kWh/year) 2473 (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)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

104.3088	92.7265	99.4281	89.2839	87.8871	80.6209	80.4603	82.7593	82.7045	90.5418	94.2666	103.3862	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.8781	93.9722	84.8781	87.7073	84.8781	87.7073	84.8781	84.8781	87.7073	84.8781	87.7073	84.8781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.9328	158.5612	154.4575	145.7213	134.6933	124.3285	117.4042	115.7758	119.8795	128.6157	139.6437	150.0085	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	(71)
Water heating gains (Table 5)	140.2001	137.9858	133.6399	124.0054	118.1278	111.9735	108.1456	111.2356	114.8674	121.6960	130.9258	138.9600	(72)
Total internal gains	432.0162	440.5245	422.9808	407.4394	387.7045	374.0147	360.4332	361.8948	372.4595	385.1951	408.2822	423.8518	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.6000	11.2829	0.4000	0.7000	0.7700	5.6923	(75)
Southwest	4.9400	36.7938	0.4000	0.7000	0.7700	35.2690	(79)

Solar gains	40.9613	71.6630	103.0746	136.1323	160.1631	162.3845	155.1495	136.7049	114.4414	80.5570	49.4065	34.8315	(83)
Total gains	472.9775	512.1875	526.0554	543.5717	547.8675	536.3992	515.5828	498.5996	486.9009	465.7521	457.6887	458.6834	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	96.6899	97.0182	97.3488	99.0361	99.3806	101.1397	101.1397	101.4990	100.4286	99.3806	98.6940	98.0168	
alpha	7.4460	7.4679	7.4899	7.6024	7.6254	7.7426	7.7426	7.7666	7.6952	7.6254	7.5796	7.5345	
util living area	0.9909	0.9818	0.9624	0.8943	0.7499	0.5359	0.3846	0.4142	0.6356	0.8945	0.9767	0.9925	(86)
Living	20.5344	20.6208	20.7285	20.8644	20.9380	20.9583	20.9597	20.9598	20.9544	20.8784	20.6988	20.5242	
Non living	19.7700	19.8565	19.9618	20.0954	20.1542	20.1790	20.1795	20.1821	20.1720	20.1114	19.9443	19.7691	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.7618	20.6208	20.7285	20.8644	20.9380	20.9583	20.9597	20.9598	20.9544	20.8784	20.6988	20.5907	(87)
Th 2	20.1866	20.1891	20.1917	20.2044	20.2069	20.2197	20.2197	20.2222	20.2146	20.2069	20.2018	20.1968	(88)
util rest of house	0.9877	0.9757	0.9499	0.8637	0.6961	0.4716	0.3165	0.3443	0.5669	0.8583	0.9678	0.9898	(89)
MIT 2	19.9735	19.8565	19.9618	20.0954	20.1542	20.1790	20.1795	20.1821	20.1720	20.1114	19.9443	19.8289	(90)
Living area fraction										fLA = Living area / (4) =		0.4137	(91)
MIT	20.2996	20.1727	20.2789	20.4135	20.4784	20.5014	20.5022	20.5038	20.4957	20.4286	20.2564	20.1440	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2996	20.1727	20.2789	20.4135	20.4784	20.5014	20.5022	20.5038	20.4957	20.4286	20.2564	20.1440	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9756	0.9515	0.8724	0.7151	0.4949	0.3412	0.3697	0.5919	0.8693	0.9685	0.9896	(94)
Useful gains	467.4209	499.6726	500.5265	474.2033	391.7999	265.4783	175.9074	184.3177	288.1751	404.8861	443.2644	453.9236	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	754.5545	717.8346	645.4270	530.1244	402.7896	266.0681	175.9355	184.3690	290.3964	450.9776	607.8691	741.7557	(97)
Space heating kWh	213.6275	146.6048	107.8060	40.2632	8.1763	0.0000	0.0000	0.0000	0.0000	34.2921	118.5153	214.1472	(98a)
Space heating requirement - total per year (kWh/year)												883.4324	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	213.6275	146.6048	107.8060	40.2632	8.1763	0.0000	0.0000	0.0000	0.0000	34.2921	118.5153	214.1472	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												883.4324	
Space heating per m2										(98c) / (4) =		16.4390	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 236.5943 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	213.6275	146.6048	107.8060	40.2632	8.1763	0.0000	0.0000	0.0000	0.0000	34.2921	118.5153	214.1472	(98)
Space heating efficiency (main heating system 1)	236.5943	236.5943	236.5943	236.5943	236.5943	0.0000	0.0000	0.0000	0.0000	236.5943	236.5943	236.5943	(210)
Space heating fuel (main heating system)	90.2927	61.9646	45.5657	17.0178	3.4558	0.0000	0.0000	0.0000	0.0000	14.4940	50.0922	90.5124	(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	0.0000	(215)
Water heating													
Water heating requirement	245.6985	217.4461	231.0195	202.7047	196.3097	176.6505	173.9736	180.8878	182.9170	204.2939	217.6901	242.9237	(64)
Efficiency of water heater												192.8759	(216)
(217)m	192.8759	192.8759	192.8759	192.8759	192.8759	192.8759	192.8759	192.8759	192.8759	192.8759	192.8759	192.8759	(217)
Fuel for water heating, kWh/month	127.3868	112.7388	119.7762	105.0959	101.7803	91.5876	90.1997	93.7846	94.8366	105.9198	112.8654	125.9482	(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	12.4954	11.2861	12.4954	12.0923	12.4954	12.0923	12.4954	12.4954	12.0923	12.4954	12.0923	12.4954	(231)
Lighting	34.5240	27.6964	24.9375	18.2703	14.1125	11.5300	12.8739	16.7340	21.7358	28.5185	32.2116	35.4835	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.9133	-52.2758	-77.0745	-87.1955	-94.6737	-88.6874	-87.7015	-82.4743	-72.2334	-59.4537	-39.7502	-30.8510	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)
Annual totals kWh/year													
Space heating fuel - main system 1												373.3954	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												192.8759	
Water heating fuel used												1281.9200	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 0.9350)		
mechanical ventilation fans (SFP = 0.9350)	147.1229	(230a)
Total electricity for the above, kWh/year	147.1229	(231)
Electricity for lighting (calculated in Appendix L)	278.6281	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-808.2843	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1272.7820	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	373.3954	0.1574	58.7820	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1281.9200	0.1409	180.6457	(264)
Space and water heating			239.4276	(265)
Pumps, fans and electric keep-hot	147.1229	0.1387	20.4078	(267)
Energy for lighting	278.6281	0.1443	40.2146	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-808.2843	0.1343	-108.5199	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-108.5199	(269)
Total CO2, kg/year			191.5301	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	373.3954	1.5828	591.0063	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1281.9200	1.5211	1949.8836	(278)
Space and water heating			2540.8899	(279)
Pumps, fans and electric keep-hot	147.1229	1.5128	222.5676	(281)
Energy for lighting	278.6281	1.5338	427.3691	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-808.2843	1.4962	-1209.3445	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1209.3445	(283)
Total Primary energy kWh/year			1981.4821	(286)
Dwelling Primary energy Rate (DPER)			36.8700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.7400	(1b) x	2.4000	(2b) =	128.9760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		128.9760	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1551	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4051	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4051	(21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.5165	0.5063	0.4962	0.4456	0.4354	0.3848	0.3848	0.3747	0.4051	0.4354	0.4557	0.4760 (22b)
Effective ac	0.6334	0.6282	0.6231	0.5993	0.5948	0.5740	0.5740	0.5702	0.5820	0.5948	0.6038	0.6133 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			1.9400	1.0000	1.9400			(26)
TER Opening Type			7.5400	1.1450	8.6336			(27)
Heatloss Floor 1			53.7400	0.1300	6.9862			(28a)
External Wall 1	50.8600	9.4800	41.3800	0.1800	7.4484			(29a)
External Roof 1	53.7400		53.7400	0.1100	5.9114			(30)
Total net area of external elements Aum(A, m2)			158.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.9196			(33)
Main dwelling								
Party Wall 1			20.1800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 305.4693 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	9.7400	0.0500	0.4870	
E3 Sill	7.2800	0.0500	0.3640	
E4 Jamb	24.8200	0.0500	1.2410	
E5 Ground floor (normal)	21.1900	0.1600	3.3904	
E10 Eaves (insulation at ceiling level)	21.1900	0.0600	1.2714	
P1 Party wall - Ground floor	8.4100	0.0800	0.6728	
P4 Party wall - Roof (insulation at ceiling level)	8.4100	0.1200	1.0092	
E16 Corner (normal)	4.8000	0.0900	0.4320	
E18 Party wall between dwellings	4.8000	0.0600	0.2880	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1558 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 40.0754 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.9574	26.7370	26.5209	25.5061	25.3162	24.4324	24.4324	24.2687	24.7728	25.3162	25.7003	26.1019	(38)
Heat transfer coeff	67.0328	66.8123	66.5963	65.5815	65.3916	64.5078	64.5078	64.3441	64.8482	65.3916	65.7757	66.1773	(39)
Average = Sum(39)m / 12 =												65.5806	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2474	1.2433	1.2392	1.2203	1.2168	1.2004	1.2004	1.1973	1.2067	1.2168	1.2240	1.2314	(40)
HLP (average)												1.2203	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8004 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	54.4056	53.5879	52.3965	50.1170	48.4347	46.5587	45.4923	46.6747	47.9709	49.9851	52.3137	54.1971	(42a)
Hot water usage for baths	23.5194	23.1701	22.6782	21.7713	21.0922	20.3391	19.9324	20.4208	20.9527	21.7584	22.6840	23.4399	(42b)
Hot water usage for other uses	33.0674	31.8650	30.6625	29.4601	28.2576	27.0552	27.0552	28.2576	29.4601	30.6625	31.8650	33.0674	(42c)
Average daily hot water use (litres/day)												102.0276	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.9924	108.6230	105.7373	101.3483	97.7845	93.9530	92.4799	95.3532	98.3836	102.4061	106.8627	110.7044	(44)
Energy conte	175.7848	154.6777	162.5143	138.7408	131.6367	115.5262	111.8464	118.0672	121.3168	138.9641	152.2455	173.3364	(45)
Energy content (annual)										Total = Sum(45)m =		1694.6569	
Distribution loss (46)m = 0.15 x (45)m	26.3677	23.2017	24.3771	20.8111	19.7455	17.3289	16.7770	17.7101	18.1975	20.8446	22.8368	26.0005	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	227.5314	201.4166	214.2608	188.8181	183.3833	165.6035	163.5930	169.8138	171.3942	190.7107	202.3229	225.0830	(62)
WWHRS	-24.8719	-21.9970	-23.0339	-19.0730	-17.7754	-15.2105	-14.2574	-15.1613	-15.7374	-18.5526	-21.0179	-24.4114	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	202.6595	179.4196	191.2269	169.7451	165.6080	150.3930	149.3356	154.6524	155.6568	172.1581	181.3050	200.6716	(64)
									Total per year (kWh/year) = Sum(64)m =			2072.8315	(64)
12Total per year (kWh/year)												2073	(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)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	99.8457	88.8214	95.4333	86.1932	85.1665	78.4743	78.5862	80.6546	80.3997	87.6028	90.6835	99.0316	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	90.0178	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.8781	93.9722	84.8781	87.7073	84.8781	87.7073	84.8781	84.8781	87.7073	84.8781	87.7073	84.8781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	156.9328	158.5612	154.4575	145.7213	134.6933	124.3285	117.4042	115.7758	119.8795	128.6157	139.6437	150.0085	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	32.0018	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	-72.0142	(71)
Water heating gains (Table 5)													
	134.2012	132.1748	128.2705	119.7128	114.4711	108.9921	105.6266	108.4067	111.6663	117.7458	125.9493	133.1070	(72)
Total internal gains													
	429.0174	437.7135	420.6114	406.1467	387.0478	371.0333	357.9143	359.0659	369.2584	384.2449	406.3057	420.9989	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.6000	11.2829	0.6300	0.7000	0.7700	8.9654	(75)
Southwest	4.9400	36.7938	0.6300	0.7000	0.7700	55.5487	(79)

Solar gains	64.5140	112.8692	162.3425	214.4084	252.2568	255.7557	244.3605	215.3102	180.2452	126.8772	77.8153	54.8597	(83)
Total gains	493.5314	550.5827	582.9539	620.5551	639.3046	626.7890	602.2748	574.3760	549.5036	511.1221	484.1210	475.8585	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.0261	68.2505	68.4719	69.5315	69.7334	70.6888	70.6888	70.8686	70.3177	69.7334	69.3262	68.9055	
alpha	5.5351	5.5500	5.5648	5.6354	5.6489	5.7126	5.7126	5.7246	5.6878	5.6489	5.6217	5.5937	
util living area													
	0.9940	0.9880	0.9752	0.9322	0.8276	0.6366	0.4679	0.5096	0.7514	0.9418	0.9866	0.9950	(86)
MIT	19.9486	20.1105	20.3352	20.6390	20.8672	20.9767	20.9965	20.9945	20.9418	20.6662	20.2674	19.9303	(87)
Th 2	19.8823	19.8856	19.8887	19.9038	19.9066	19.9197	19.9197	19.9221	19.9146	19.9066	19.9009	19.8949	(88)
util rest of house													
	0.9916	0.9834	0.9653	0.9054	0.7665	0.5394	0.3549	0.3934	0.6587	0.9130	0.9806	0.9931	(89)
MIT 2	18.6914	18.8986	19.1823	19.5595	19.8061	19.9088	19.9189	19.9207	19.8820	19.6007	19.1101	18.6776	(90)
Living area fraction										fLA = Living area / (4) =		0.4137	(91)
MIT	19.2114	19.3999	19.6592	20.0061	20.2450	20.3505	20.3647	20.3649	20.3204	20.0414	19.5888	19.1958	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2114	19.3999	19.6592	20.0061	20.2450	20.3505	20.3647	20.3649	20.3204	20.0414	19.5888	19.1958	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9897	0.9808	0.9628	0.9083	0.7870	0.5794	0.4019	0.4418	0.6956	0.9172	0.9783	0.9914	(94)
Useful gains	488.4550	539.9935	561.2689	563.6539	503.1499	363.1589	242.0400	253.7496	382.2192	468.8030	473.6306	471.7678	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	999.5551	968.7717	876.3544	728.3521	558.7734	370.9548	242.8506	255.1169	403.3829	617.3917	821.4631	992.3786	(97)
Space heating kWh													
	380.2585	288.1389	234.4236	118.5827	41.3838	0.0000	0.0000	0.0000	0.0000	110.5500	250.4394	387.3345	(98a)
Space heating requirement - total per year (kWh/year)												1811.1114	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	380.2585	288.1389	234.4236	118.5827	41.3838	0.0000	0.0000	0.0000	0.0000	110.5500	250.4394	387.3345	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1811.1114	
Space heating per m2											(98c) / (4) =	33.7014	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	380.2585	288.1389	234.4236	118.5827	41.3838	0.0000	0.0000	0.0000	0.0000	110.5500	250.4394	387.3345	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	411.9810	312.1765	253.9801	128.4753	44.8362	0.0000	0.0000	0.0000	0.0000	119.7724	271.3320	419.6473	(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	0.0000	(215)
Water heating													
Water heating requirement													
	202.6595	179.4196	191.2269	169.7451	165.6080	150.3930	149.3356	154.6524	155.6568	172.1581	181.3050	200.6716	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4495	85.1163	84.5176	83.2710	81.4504	79.8000	79.8000	79.8000	79.8000	83.0932	84.7845	85.5088	(217)
Fuel for water heating, kWh/month													
	237.1687	210.7936	226.2568	203.8465	203.3236	188.4624	187.1373	193.8000	195.0586	207.1868	213.8421	234.6795	(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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.6360	14.1482	12.7389	9.3331	7.2091	5.8899	6.5764	8.5483	11.1034	14.5682	16.4548	18.1261	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.5718	-56.4706	-76.4661	-80.9020	-83.2893	-76.4787	-75.6159	-73.3091	-68.6713	-62.1741	-45.5674	-37.2477	(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	(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 generation)												
(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	-36.1142	-74.1738	-144.2113	-212.0901	-276.1961	-275.9123	-272.5595	-232.5672	-172.9751	-104.3488	-47.6369	-28.6849 (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	(234b)
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	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1962.2009	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2501.5559	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	142.3325	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2656.2341	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2035.8551	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1962.2009	0.2100	412.0622	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2501.5559	0.2100	525.3267	(264)
Space and water heating			937.3889	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	142.3325	0.1443	20.5430	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-778.7639	0.1359	-105.8040	
PV Unit electricity exported	-1877.4702	0.1265	-237.5674	
Total			-343.3714	(269)
Total CO2, kg/year			626.4898	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1962.2009	1.1300	2217.2870	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2501.5559	1.1300	2826.7581	(278)
Space and water heating			5044.0452	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	142.3325	1.5338	218.3144	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-778.7639	1.5022	-1169.8515	
PV Unit electricity exported	-1877.4702	0.4645	-872.0904	
Total			-2041.9419	(283)
Total Primary energy kWh/year			3350.5184	(286)
Target Primary Energy Rate (TPER)			62.3500	(287)

Full SAP Calculation Printout

Property Reference	2B4P FLAT	**Issued on Date**	03/09/2025
Assessment Reference	BeGreen	**Prop Type Ref**	
Property	Land at Combe Farm		

SAP Rating	85 B	**DER**	3.11	**TER**	11.52
Environmental	98 A	**% DER < TER**			73.00
CO_2 Emissions (t/year)	0.21	**DFEE**	25.41	**TFEE**	28.31
Compliance Check	See BREL	**% DFEE < TFEE**			10.25
% DPER < TPER	45.87	**DPER**	33.00	**TPER**	60.96

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area		Storey height		Volume	
Main dwelling		(m2)		(m)		(m3)	
Ground floor		73.3500	(1b)	x 2.5000	(2b) =	183.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.3500						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	183.3750	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	73.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3232	0.3195	0.3157	0.2970	0.2932	0.2745	0.2745	0.2707	0.2820	0.2932	0.3007	0.3082	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Window North			5.9000	1.0536	6.2165			(27)
Door			3.4100	1.0000	3.4100			(26)
Window S			5.6400	1.0536	5.9425			(27)
External Wall	48.5800	14.9500	33.6300	0.1600	5.3808	190.0000	6389.7000	(29a)
Total net area of external elements Aum(A, m2)			48.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.9498			(33)
Main dwelling								
Party Wall 1			56.3700	0.0000	0.0000	180.0000	10146.6000	(32)
Party Floor 1			73.3500			40.0000	2934.0000	(32d)
Party Ceiling 1			73.3500			30.0000	2200.5000	(32b)
Internal Wall 1			73.1500			75.0000	5486.2500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	27157.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		370.2393 (35)
List of Thermal Bridges		

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.5200	0.0620	0.3422
E3 Sill	5.5200	0.0390	0.2153
E4 Jamb	25.3200	0.0520	1.3166
E7 Party floor between dwellings (in blocks of flats)	19.4300	0.0685	1.3310
E7 Party floor between dwellings (in blocks of flats)	19.4300	0.0685	1.3310
E16 Corner (normal)	12.5000	0.0360	0.4500
E25 Staggered party wall between dwellings	2.5000	0.1010	0.2525
E18 Party wall between dwellings	17.5000	0.0495	0.8663
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.5500	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.5500	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	10.0000	-0.0900	-0.9000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2048 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 26.1546 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.5611	19.3341	19.1072	17.9726	17.7457	16.6110	16.6110	16.3841	17.0649	17.7457	18.1995	18.6534	(38)
Heat transfer coeff	45.7157	45.4888	45.2618	44.1272	43.9003	42.7656	42.7656	42.5387	43.2195	43.9003	44.3541	44.8080	(39)
Average = Sum(39)m / 12 =												44.0705	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6233	0.6202	0.6171	0.6016	0.5985	0.5830	0.5830	0.5799	0.5892	0.5985	0.6047	0.6109	(40)
HLP (average)												0.6008	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3246 (42)
Hot water usage for mixer showers

63.1961	62.2464	60.8625	58.2146	56.2605	54.0814	52.8427	54.2162	55.7217	58.0615	60.7662	62.9540	(42a)

Hot water usage for baths

27.2996	26.8942	26.3232	25.2705	24.4823	23.6082	23.1361	23.7030	24.3203	25.2556	26.3300	27.2073	(42b)

Hot water usage for other uses

38.4366	37.0389	35.6412	34.2435	32.8458	31.4481	31.4481	32.8458	34.2435	35.6412	37.0389	38.4366	(42c)

Average daily hot water use (litres/day) 118.5181 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.9323	126.1795	122.8269	117.7286	113.5886	109.1377	107.4269	110.7650	114.2856	118.9583	124.1351	128.5979	(44)
Energy conte	204.1973	179.6779	188.7804	161.1646	152.9121	134.1975	129.9236	137.1502	140.9255	161.4253	176.8532	201.3532	(45)
Energy content (annual)										Total = Sum(45)m =		1968.5608	
Distribution loss (46)m = 0.15 x (45)m	30.6296	26.9517	28.3171	24.1747	22.9368	20.1296	19.4885	20.5725	21.1388	24.2138	26.5280	30.2030	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1500	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6210	(55)
Total storage loss	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(56)
If cylinder contains dedicated solar storage	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	246.7107	218.0771	231.2938	202.3066	195.4255	175.3395	172.4370	179.6636	182.0675	203.9387	217.9952	243.8666	(62)
WWHRS	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)
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)
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	(63c)
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	(63d)
Output from w/h	246.7107	218.0771	231.2938	202.3066	195.4255	175.3395	172.4370	179.6636	182.0675	203.9387	217.9952	243.8666	(64)
										Total per year (kWh/year) = Sum(64)m =		2469.1218	(64)
12Total per year (kWh/year)												2469	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	101.9063	90.4623	96.7802	86.5008	84.8540	77.5343	77.2103	79.6132	79.7713	87.6846	91.7173	100.9607	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.2292	119.8252	108.2292	111.8369	108.2292	111.8369	108.2292	108.2292	111.8369	108.2292	111.8369	108.2292	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.9862	207.1133	201.7530	190.3417	175.9369	162.3984	153.3539	151.2267	156.5870	167.9984	182.4032	195.9416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	(71)
Water heating gains (Table 5)	136.9708	134.6164	130.0809	120.1400	114.0511	107.6865	103.7773	107.0069	110.7935	117.8557	127.3851	135.6998	(72)
Total internal gains	508.0557	519.4244	497.9326	480.1880	456.0866	439.7912	423.2299	424.3324	437.0869	451.9527	479.4947	497.7402	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9000	10.6334	0.4000	0.7000	0.7700	12.1735	(74)
North	1.8800	10.6334	0.4000	0.7000	0.7700	3.8790	(74)
East	3.7600	19.6403	0.4000	0.7000	0.7700	14.3293	(76)

Solar gains	30.3818	58.7084	98.2914	151.0576	195.3045	205.2135	193.1483	158.5147	116.3647	69.7786	37.6698	25.1659	(83)
Total gains	538.4376	578.1328	596.2241	631.2456	651.3912	645.0047	616.3781	582.8471	553.4516	521.7313	517.1645	522.9061	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	165.0117	165.8349	166.6663	170.9518	171.8355	176.3945	176.3945	177.3355	174.5422	171.8355	170.0772	168.3545	
alpha	12.0008	12.0557	12.1111	12.3968	12.4557	12.7596	12.7596	12.8224	12.6361	12.4557	12.3385	12.2236	
util living area	0.9955	0.9872	0.9600	0.8275	0.6261	0.4243	0.3053	0.3357	0.5387	0.8502	0.9796	0.9964	(86)
Living	20.7799	20.8361	20.9026	20.9649	20.9745	20.9755	20.9755	20.9756	20.9752	20.9638	20.8807	20.7763	
Non living	20.2112	20.2684	20.3329	20.3972	20.4061	20.4208	20.4208	20.4237	20.4150	20.3998	20.3244	20.2181	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8874	20.8361	20.9026	20.9649	20.9745	20.9755	20.9755	20.9756	20.9752	20.9638	20.8807	20.8076	(87)
Th 2	20.4091	20.4119	20.4147	20.4286	20.4313	20.4453	20.4453	20.4481	20.4397	20.4313	20.4258	20.4202	(88)
util rest of house	0.9936	0.9823	0.9464	0.7945	0.5881	0.3876	0.2668	0.2954	0.4950	0.8126	0.9711	0.9949	(89)
MIT 2	20.3079	20.2684	20.3329	20.3972	20.4061	20.4208	20.4208	20.4237	20.4150	20.3998	20.3244	20.2464	(90)
Living area fraction									fLA = Living area / (4) =			0.3887	(91)
MIT	20.5331	20.4891	20.5543	20.6179	20.6270	20.6364	20.6364	20.6383	20.6327	20.6190	20.5406	20.4645	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5331	20.4891	20.5543	20.6179	20.6270	20.6364	20.6364	20.6383	20.6327	20.6190	20.5406	20.4645	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9831	0.9500	0.8057	0.6012	0.4002	0.2801	0.3093	0.5101	0.8255	0.9730	0.9951	(94)
Useful gains	535.2441	568.3482	566.4037	508.6069	391.6209	258.1503	172.6204	180.2898	282.3140	430.6863	503.2040	520.3206	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	742.1082	709.1280	636.1245	517.0769	391.8997	258.1516	172.6204	180.2899	282.3421	439.8368	596.1476	728.7801	(97)
Space heating kWh	153.9069	94.6040	51.8723	6.0985	0.2075	0.0000	0.0000	0.0000	0.0000	6.8080	66.9194	155.0939	(98a)
Space heating requirement - total per year (kWh/year)												535.5103	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	153.9069	94.6040	51.8723	6.0985	0.2075	0.0000	0.0000	0.0000	0.0000	6.8080	66.9194	155.0939	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												535.5103	
Space heating per m2											(98c) / (4) =	7.3008	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	308.1004	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	153.9069	94.6040	51.8723	6.0985	0.2075	0.0000	0.0000	0.0000	0.0000	6.8080	66.9194	155.0939	(98)
Space heating efficiency (main heating system 1)	308.1004	308.1004	308.1004	308.1004	308.1004	0.0000	0.0000	0.0000	0.0000	308.1004	308.1004	308.1004	(210)
Space heating fuel (main heating system)	49.9535	30.7056	16.8362	1.9794	0.0673	0.0000	0.0000	0.0000	0.0000	2.2097	21.7200	50.3387	(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	0.0000	(215)
Water heating													
Water heating requirement	246.7107	218.0771	231.2938	202.3066	195.4255	175.3395	172.4370	179.6636	182.0675	203.9387	217.9952	243.8666	(64)
Efficiency of water heater												191.6934	(216)
(217)m	191.6934	191.6934	191.6934	191.6934	191.6934	191.6934	191.6934	191.6934	191.6934	191.6934	191.6934	191.6934	(217)
Fuel for water heating, kWh/month	128.7007	113.7635	120.6582	105.5366	101.9469	91.4687	89.9546	93.7245	94.9785	106.3880	113.7208	127.2170	(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	14.6305	13.2147	14.6305	14.1586	14.6305	14.1586	14.6305	14.6305	14.1586	14.6305	14.1586	14.6305	(231)
Lighting	25.8580	20.7442	18.6779	13.6842	10.5701	8.6358	9.6424	12.5335	16.2798	21.3600	24.1261	26.5766	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-6.8161	-12.0246	-21.9706	-30.4634	-37.8063	-37.1734	-36.3937	-31.5356	-23.8732	-15.5079	-8.1422	-5.5706	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)
Annual totals kWh/year													
Space heating fuel - main system 1												173.8103	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	191.6934	
Water heating fuel used	1288.0581	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700)		
mechanical ventilation fans (SFP = 0.7700)	172.2625	(230a)
Total electricity for the above, kWh/year	172.2625	(231)
Electricity for lighting (calculated in Appendix L)	208.6886	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-267.2776	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1575.5419	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	173.8103	0.1594	27.7086	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1288.0581	0.1410	181.6125	(264)
Space and water heating			209.3211	(265)
Pumps, fans and electric keep-hot	172.2625	0.1387	23.8949	(267)
Energy for lighting	208.6886	0.1443	30.1202	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-267.2776	0.1307	-34.9347	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-34.9347	(269)
Total CO2, kg/year			228.4016	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.1100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	173.8103	1.5901	276.3735	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1288.0581	1.5214	1959.6015	(278)
Space and water heating			2235.9751	(279)
Pumps, fans and electric keep-hot	172.2625	1.5128	260.5987	(281)
Energy for lighting	208.6886	1.5338	320.0936	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-267.2776	1.4828	-396.3301	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-396.3301	(283)
Total Primary energy kWh/year			2420.3372	(286)
Dwelling Primary energy Rate (DPER)			33.0000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		73.3500	(1b)	x 2.5000	(2b) =	183.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.3500						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	183.3750	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1636	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4136	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.4136 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5273	0.5170	0.5067	0.4550	0.4446	0.3929	0.3929	0.3826	0.4136	0.4446	0.4653	0.4860	(22b)
Effective ac	0.6390	0.6336	0.6284	0.6035	0.5988	0.5772	0.5772	0.5732	0.5855	0.5988	0.6083	0.6181	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			3.4100	1.0000	3.4100			(26)
TER Opening Type			11.5400	1.1450	13.2137			(27)
External Wall	48.5800	14.9500	33.6300	0.1800	6.0534			(29a)
Total net area of external elements Aum(A, m2)			48.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.6771			(33)
Main dwelling								
Party Wall 1			56.3700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 380.2393 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.5200	0.0500	0.2760
E3 Sill	5.5200	0.0500	0.2760
E4 Jamb	25.3200	0.0500	1.2660
E7 Party floor between dwellings (in blocks of flats)	19.4300	0.0700	1.3601
E7 Party floor between dwellings (in blocks of flats)	19.4300	0.0700	1.3601
E16 Corner (normal)	12.5000	0.0900	1.1250
E25 Staggered party wall between dwellings	2.5000	0.0600	0.1500
E18 Party wall between dwellings	17.5000	0.0600	1.0500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.5500	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.5500	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	10.0000	-0.0900	-0.9000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9632 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 28.6403 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.6709	38.3442	38.0239	36.5197	36.2382	34.9281	34.9281	34.6855	35.4327	36.2382	36.8076	37.4028	(38)
Heat transfer coeff	67.3112	66.9845	66.6643	65.1600	64.8786	63.5684	63.5684	63.3258	64.0731	64.8786	65.4479	66.0432	(39)

Average = Sum(39)m / 12 = 65.1587

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9177	0.9132	0.9089	0.8883	0.8845	0.8666	0.8666	0.8633	0.8735	0.8845	0.8923	0.9004	(40)
HLP (average)												0.8883	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3246 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
63.1961	62.2464	60.8625	58.2146	56.2605	54.0814	52.8427	54.2162	55.7217	58.0615	60.7662	62.9540	(42a)

Hot water usage for baths

27.2996	26.8942	26.3232	25.2705	24.4823	23.6082	23.1361	23.7030	24.3203	25.2556	26.3300	27.2073	(42b)

Hot water usage for other uses

38.4366	37.0389	35.6412	34.2435	32.8458	31.4481	31.4481	32.8458	34.2435	35.6412	37.0389	38.4366	(42c)

Average daily hot water use (litres/day) 118.5181 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.9323	126.1795	122.8269	117.7286	113.5886	109.1377	107.4269	110.7650	114.2856	118.9583	124.1351	128.5979	(44)
Energy conte	204.1973	179.6779	188.7804	161.1646	152.9121	134.1975	129.9236	137.1502	140.9255	161.4253	176.8532	201.3532	(45)
Energy content (annual)										Total = Sum(45)m =		1968.5608	
Distribution loss (46)m = 0.15 x (45)m	30.6296	26.9517	28.3171	24.1747	22.9368	20.1296	19.4885	20.5725	21.1388	24.2138	26.5280	30.2030	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.7922	221.7636	235.3753	206.2564	199.5070	179.2894	176.5185	183.7451	186.0174	208.0202	221.9451	247.9481	(62)
WWHRS -28.8906	-25.5511	-26.7556	-22.1547	-20.6474	-17.6681	-16.5611	-17.6110	-18.2801	-21.5503	-24.4138	-28.3556	(63a)
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)
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	(63c)
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	(63d)

Output from w/h

221.9015	196.2125	208.6196	184.1017	178.8596	161.6212	159.9574	166.1341	167.7372	186.4699	197.5313	219.5925	(64)

Total per year (kWh/year) = Sum(64)m = 2248.7385 (64)

12Total per year (kWh/year) 2249 (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)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

105.1715	93.4115	100.0454	89.6607	88.1192	80.6941	80.4755	82.8784	82.9312	90.9498	94.8772	104.2259	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	116.2316	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	108.2292	119.8252	108.2292	111.8369	108.2292	111.8369	108.2292	108.2292	111.8369	108.2292	111.8369	108.2292	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.9862	207.1133	201.7530	190.3417	175.9369	162.3984	153.3539	151.2267	156.5870	167.9984	182.4032	195.9416	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	34.6232	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	-92.9853	(71)
Water heating gains (Table 5)													
	141.3596	139.0052	134.4696	124.5288	118.4398	112.0752	108.1660	111.3957	115.1822	122.2444	131.7739	140.0885	(72)
Total internal gains													
	515.4444	526.8131	505.3214	487.5768	463.4753	444.1799	427.6186	428.7211	441.4756	459.3415	486.8834	505.1289	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.7800	10.6334	0.6300	0.7000	0.7700	25.2827	(74)
East	3.7600	19.6403	0.6300	0.7000	0.7700	22.5687	(76)

Solar gains	47.8514	92.4657	154.8090	237.9157	307.6046	323.2113	304.2085	249.6607	183.2745	109.9013	59.3300	39.6363	(83)
Total gains	563.2958	619.2789	660.1304	725.4924	771.0800	767.3912	731.8271	678.3818	624.7501	569.2427	546.2134	544.7652	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	115.0978	115.6592	116.2148	118.8977	119.4134	121.8746	121.8746	122.3415	120.9147	119.4134	118.3746	117.3078	
alpha	8.6732	8.7106	8.7477	8.9265	8.9609	9.1250	9.1250	9.1561	9.0610	8.9609	8.8916	8.8205	
util living area													
	0.9988	0.9966	0.9884	0.9324	0.7618	0.5294	0.3822	0.4293	0.6983	0.9582	0.9957	0.9990	(86)
MIT	20.4008	20.5075	20.6644	20.8800	20.9829	20.9994	21.0000	20.9999	20.9938	20.8615	20.6083	20.3954	(87)
Th 2	20.1525	20.1563	20.1600	20.1774	20.1807	20.1959	20.1959	20.1988	20.1901	20.1807	20.1741	20.1672	(88)
util rest of house													
	0.9981	0.9949	0.9828	0.9049	0.7033	0.4633	0.3123	0.3546	0.6213	0.9344	0.9932	0.9986	(89)
MIT 2	19.4613	19.6003	19.8010	20.0697	20.1698	20.1957	20.1959	20.1988	20.1872	20.0573	19.7438	19.4665	(90)
Living area fraction									fLA = Living area / (4) =			0.3887	(91)
MIT	19.8265	19.9529	20.1366	20.3847	20.4858	20.5081	20.5085	20.5102	20.5007	20.3699	20.0798	19.8275	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8265	19.9529	20.1366	20.3847	20.4858	20.5081	20.5085	20.5102	20.5007	20.3699	20.0798	19.8275	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9944	0.9826	0.9126	0.7257	0.4890	0.3395	0.3836	0.6514	0.9408	0.9929	0.9983	(94)
Useful gains	562.0727	615.8274	648.6194	662.1011	559.5817	375.2847	248.4457	260.2543	406.9585	535.5574	542.3215	543.8461	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1045.1049	1008.3111	909.0712	748.3431	570.0117	375.5674	248.4543	260.2792	410.1125	633.8565	849.5017	1032.0913	(97)
Space heating kWh													
	359.3759	263.7491	193.7761	62.0942	7.7599	0.0000	0.0000	0.0000	0.0000	73.1345	221.1697	363.2544	(98a)
Space heating requirement - total per year (kWh/year)												1544.3139	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	359.3759	263.7491	193.7761	62.0942	7.7599	0.0000	0.0000	0.0000	0.0000	73.1345	221.1697	363.2544	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1544.3139	
Space heating per m2											(98c) / (4) =	21.0540	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	359.3759	263.7491	193.7761	62.0942	7.7599	0.0000	0.0000	0.0000	0.0000	73.1345	221.1697	363.2544	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	389.3564	285.7520	209.9416	67.2743	8.4072	0.0000	0.0000	0.0000	0.0000	79.2357	239.6205	393.5584	(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	0.0000	(215)
Water heating													
Water heating requirement													
	221.9015	196.2125	208.6196	184.1017	178.8596	161.6212	159.9574	166.1341	167.7372	186.4699	197.5313	219.5925	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1346	84.7238	83.8946	81.8934	80.1377	79.8000	79.8000	79.8000	79.8000	82.1454	84.3139	85.1805	(217)
Fuel for water heating, kWh/month													
	260.6479	231.5906	248.6688	224.8066	223.1902	202.5329	200.4479	208.1881	210.1970	226.9997	234.2808	257.7965	(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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.4879	18.0406	16.2436	11.9007	9.1925	7.5103	8.3857	10.9000	14.1581	18.5761	20.9817	23.1129	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.6330	-29.0747	-43.8727	-51.8635	-58.1494	-55.0904	-54.4210	-50.2749	-43.3460	-34.3570	-22.0756	-16.8151	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-7.2167	-15.5046	-31.4282	-48.1131	-64.5165	-65.1547	-64.3856	-54.0981	-39.1101	-22.4650	-9.7282	-5.6828	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year		
Space heating fuel - main system 1	1673.1462	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2729.3470	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	181.4902	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-906.3769	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3763.6065	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1673.1462	0.2100	351.3607	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2729.3470	0.2100	573.1629	(264)
Space and water heating			924.5236	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	181.4902	0.1443	26.1946	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-478.9732	0.1336	-63.9743	
PV Unit electricity exported	-427.4037	0.1253	-53.5711	
Total			-117.5453	(269)
Total CO2, kg/year			845.1021	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.5200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1673.1462	1.1300	1890.6552	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2729.3470	1.1300	3084.1621	(278)
Space and water heating			4974.8173	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	181.4902	1.5338	278.3757	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-478.9732	1.4936	-715.3834	
PV Unit electricity exported	-427.4037	0.4601	-196.6313	
Total			-912.0148	(283)
Total Primary energy kWh/year			4471.2790	(286)
Target Primary Energy Rate (TPER)			60.9600	(287)

Full SAP Calculation Printout

Property Reference	2B4P	**Issued on Date**	03/09/2025
Assessment Reference	BeGreen	**Prop Type Ref**	
Property	2B4P, Land at Coombe Farm, Sayers Common, BN6 9HY		

SAP Rating	92 A	**DER**	1.94	**TER**	9.96
Environmental	98 A	**% DER < TER**			80.52
CO_2 Emissions (t/year)	0.16	**DFEE**	31.76	**TFEE**	34.76
Compliance Check	See BREL	**% DFEE < TFEE**			8.62
% DPER < TPER	61.73	**DPER**	19.84	**TPER**	51.85

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.5500 (1b)	x	2.4000 (2b)	=	121.3200	(1b) - (3b)
First floor	50.6300 (1c)	x	2.4000 (2c)	=	121.5120	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	242.8320	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		73.6000 (23c)

Effective ac	0.3232	0.3195	0.3157	0.2970	0.2932	0.2745	0.2745	0.2707	0.2820	0.2932	0.3007	0.3082	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
FD			2.0500	1.0000	2.0500			(26)
Window			15.8500	1.0536	16.7002			(27)
GF			50.5500	0.1000	5.0550	110.0000	5560.5000	(28a)
External Wall 1	97.9000	17.9000	80.0000	0.1600	12.8000	140.0000	11200.0000	(29a)
External Roof	50.6300		50.6300	0.1000	5.0630	9.0000	455.6700	(30)
Total net area of external elements Aum(A, m2)			199.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.6682			(33)
Main dwelling								
Party Wall 1			44.9700	0.0000	0.0000	0.0000	0.0000	(32)
Internal Wall 1			137.5600			75.0000	10317.0000	(32c)
Internal Floor 1			50.6300			18.0000	911.3400	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	28444.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		281.1278 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	10.8600	0.0620	0.6733	
E3 Sill	6.2800	0.0390	0.2449	
E4 Jamb	25.4200	0.0520	1.3218	
E5 Ground floor (normal)	20.3500	0.0710	1.4448	
E6 Intermediate floor within a dwelling	20.4400	0.0630	1.2877	
E10 Eaves (insulation at ceiling level)	6.1200	0.0500	0.3060	
E12 Gable (insulation at ceiling level)	9.3700	0.0570	0.5341	
E16 Corner (normal)	4.8000	0.0660	0.3168	
E18 Party wall between dwellings	4.8000	0.0320	0.1536	
P1 Party wall - Ground floor	9.3700	0.0800	0.7496	
P4 Party wall - Roof (insulation at ceiling level)	9.3700	0.0450	0.4216	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.4544	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	49.1226	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.9035	25.6030	25.3025	23.8000	23.4995	21.9969	21.9969	21.6964	22.5979	23.4995	24.1005	24.7015	(38)
Heat transfer coeff	75.0261	74.7256	74.4251	72.9225	72.6220	71.1195	71.1195	70.8190	71.7205	72.6220	73.2231	73.8241	(39)
Average = Sum(39)m / 12 =												72.8474	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7415	0.7385	0.7356	0.7207	0.7178	0.7029	0.7029	0.6999	0.7088	0.7178	0.7237	0.7296	(40)
HLP (average)												0.7200	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7502	(42)
Hot water usage for mixer showers	70.3313	69.2744	67.7342	64.7874	62.6127	60.1875	58.8090	60.3375	62.0130	64.6170	67.6271	70.0619	(42a)
Hot water usage for baths	30.3680	29.9170	29.2819	28.1108	27.2340	26.2617	25.7365	26.3672	27.0539	28.0943	29.2894	30.2653	(42b)
Hot water usage for other uses	42.7946	41.2385	39.6823	38.1261	36.5700	35.0138	35.0138	36.5700	38.1261	39.6823	41.2385	42.7946	(42c)
Average daily hot water use (litres/day)												131.9033	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.4940	140.4299	136.6984	131.0244	126.4166	121.4630	119.5593	123.2746	127.1930	132.3935	138.1550	143.1218	(44)
Energy conte	227.2594	199.9702	210.1003	179.3658	170.1811	149.3529	144.5966	152.6398	156.8417	179.6568	196.8271	224.0942	(45)
Energy content (annual)										Total = Sum(45)m =		2190.8859	
Distribution loss (46)m = 0.15 x (45)m	34.0889	29.9955	31.5151	26.9049	25.5272	22.4029	21.6895	22.8960	23.5263	26.9485	29.5241	33.6141	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1500	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1610	(55)
Total storage loss	35.9910	32.5080	35.9910	34.8300	35.9910	34.8300	35.9910	35.9910	34.8300	35.9910	34.8300	35.9910	(56)
If cylinder contains dedicated solar storage	35.9910	32.5080	35.9910	34.8300	35.9910	34.8300	35.9910	35.9910	34.8300	35.9910	34.8300	35.9910	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	286.5128	253.4894	269.3537	236.7078	229.4345	206.6949	203.8500	211.8932	214.1837	238.9102	254.1691	283.3476	(62)
WWHRS	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)
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)
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	(63c)
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	(63d)
Output from w/h	286.5128	253.4894	269.3537	236.7078	229.4345	206.6949	203.8500	211.8932	214.1837	238.9102	254.1691	283.3476	(64)
										Total per year (kWh/year) = Sum(64)m =		2888.5469	(64)
12Total per year (kWh/year)												2889	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	122.9665	109.3055	117.2611	105.5127	103.9879	95.5334	95.4811	98.1554	98.0235	107.1386	111.3186	121.9140	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	136.4549	151.0751	136.4549	141.0034	136.4549	141.0034	136.4549	136.4549	141.0034	136.4549	141.0034	136.4549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.2214	260.9009	254.1486	239.7737	221.6280	204.5735	193.1801	190.5006	197.2529	211.6278	229.7736	246.8280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	(71)
Water heating gains (Table 5)	165.2775	162.6569	157.6090	146.5454	139.7687	132.6853	128.3348	131.9294	136.1437	144.0035	154.6092	163.8630	(72)
Total internal gains	624.2066	638.8857	612.4653	591.5753	562.1043	542.5150	522.2226	523.1376	538.6528	556.3390	589.6389	611.3986	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.1700	36.7938	0.4000	0.7000	0.7700	44.0506	(77)
South	2.1700	46.7521	0.4000	0.7000	0.7700	19.6857	(78)

Northwest			7.5100		11.2829		0.4000		0.7000		0.7700		16.4420 (81)
Solar gains	80.1783	140.7427	204.0324	272.6514	323.9643	329.9131	314.6119	274.9816	227.5406	158.6037	96.7850	68.1357	(83)
Total gains	704.3848	779.6284	816.4977	864.2267	886.0686	872.4281	836.8344	798.1192	766.1934	714.9427	686.4239	679.5343	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	105.3134	105.7369	106.1639	108.3513	108.7997	111.0982	111.0982	111.5697	110.1672	108.7997	107.9066	107.0282	
alpha	8.0209	8.0491	8.0776	8.2234	8.2533	8.4065	8.4065	8.4380	8.3445	8.2533	8.1938	8.1352	
util living area	0.9957	0.9891	0.9722	0.9006	0.7412	0.5207	0.3739	0.4080	0.6398	0.9147	0.9867	0.9966	(86)
Living	20.5332	20.6260	20.7398	20.8811	20.9478	20.9622	20.9629	20.9630	20.9591	20.8833	20.6970	20.5239	
Non living	19.8772	19.9710	20.0837	20.2245	20.2789	20.3009	20.3012	20.3040	20.2941	20.2309	20.0531	19.8774	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.7612	20.6260	20.7398	20.8811	20.9478	20.9622	20.9629	20.9630	20.9591	20.8833	20.6970	20.5905	(87)
Th 2	20.3043	20.3069	20.3095	20.3226	20.3252	20.3383	20.3383	20.3409	20.3330	20.3252	20.3200	20.3147	(88)
util rest of house	0.9942	0.9856	0.9634	0.8744	0.6946	0.4674	0.3177	0.3497	0.5807	0.8864	0.9818	0.9955	(89)
MIT 2	20.0858	19.9710	20.0837	20.2245	20.2789	20.3009	20.3012	20.3040	20.2941	20.2309	20.0531	19.9386	(90)
Living area fraction										fLA = Living area / (4) =		0.2184	(91)
MIT	20.2333	20.1140	20.2270	20.3680	20.4250	20.4454	20.4457	20.4479	20.4393	20.3734	20.1937	20.0810	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2333	20.1140	20.2270	20.3680	20.4250	20.4454	20.4457	20.4479	20.4393	20.3734	20.1937	20.0810	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9844	0.9622	0.8764	0.7017	0.4760	0.3268	0.3591	0.5903	0.8887	0.9807	0.9950	(94)
Useful gains	700.1909	767.4657	785.6461	757.3686	621.7571	415.2924	273.4925	286.6370	452.2672	635.3422	673.1949	676.1309	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1195.4151	1136.8766	1021.6318	836.2721	633.6294	415.7208	273.5077	286.6695	454.6598	709.7666	958.7606	1172.3978	(97)
Space heating kWh	368.4468	248.2441	175.5734	56.8106	8.8331	0.0000	0.0000	0.0000	0.0000	55.3717	205.6073	369.2226	(98a)
Space heating requirement - total per year (kWh/year)												1488.1096	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	368.4468	248.2441	175.5734	56.8106	8.8331	0.0000	0.0000	0.0000	0.0000	55.3717	205.6073	369.2226	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1488.1096	
Space heating per m2										(98c) / (4) =		14.7075	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												342.2109	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	368.4468	248.2441	175.5734	56.8106	8.8331	0.0000	0.0000	0.0000	0.0000	55.3717	205.6073	369.2226	(98)
Space heating efficiency (main heating system 1)	342.2109	342.2109	342.2109	342.2109	342.2109	0.0000	0.0000	0.0000	0.0000	342.2109	342.2109	342.2109	(210)
Space heating fuel (main heating system)	107.6666	72.5413	51.3056	16.6010	2.5812	0.0000	0.0000	0.0000	0.0000	16.1806	60.0820	107.8933	(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	0.0000	(215)
Water heating													
Water heating requirement	286.5128	253.4894	269.3537	236.7078	229.4345	206.6949	203.8500	211.8932	214.1837	238.9102	254.1691	283.3476	(64)
Efficiency of water heater												190.9662	(216)
(217)m	190.9662	190.9662	190.9662	190.9662	190.9662	190.9662	190.9662	190.9662	190.9662	190.9662	190.9662	190.9662	(217)
Fuel for water heating, kWh/month	150.0332	132.7405	141.0479	123.9527	120.1440	108.2364	106.7466	110.9585	112.1579	125.1060	133.0964	148.3758	(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	23.5259	21.2492	23.5259	22.7670	23.5259	22.7670	23.5259	23.5259	22.7670	23.5259	22.7670	23.5259	(231)
Lighting	29.8507	23.9473	21.5619	15.7972	12.2022	9.9693	11.1313	14.4688	18.7936	24.6582	27.8514	30.6803	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-52.9167	-76.6236	-112.5185	-127.1785	-138.4559	-130.0018	-128.4042	-120.4631	-105.5210	-86.9821	-58.4416	-45.4905	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)
Annual totals kWh/year													
Space heating fuel - main system 1												434.8516	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.9662	
Water heating fuel used	1512.5959	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 0.9350)		
mechanical ventilation fans (SFP = 0.9350)	276.9985	(230a)
Total electricity for the above, kWh/year	276.9985	(231)
Electricity for lighting (calculated in Appendix L)	240.9123	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1182.9976	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1282.3607	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	434.8516	0.1577	68.5802	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1512.5959	0.1409	213.1035	(264)
Space and water heating			281.6838	(265)
Pumps, fans and electric keep-hot	276.9985	0.1387	38.4231	(267)
Energy for lighting	240.9123	0.1443	34.7711	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1182.9976	0.1343	-158.8510	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-158.8510	(269)
Total CO2, kg/year			196.0270	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.9400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	434.8516	1.5838	688.7294	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1512.5959	1.5209	2300.5746	(278)
Space and water heating			2989.3040	(279)
Pumps, fans and electric keep-hot	276.9985	1.5128	419.0433	(281)
Energy for lighting	240.9123	1.5338	369.5193	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1182.9976	1.4963	-1770.0667	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1770.0667	(283)
Total Primary energy kWh/year			2007.7998	(286)
Dwelling Primary energy Rate (DPER)			19.8400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.5500 (1b)	x	2.4000 (2b)	=	121.3200	(1b) - (3b)
First floor	50.6300 (1c)	x	2.4000 (2c)	=	121.5120	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 101.1800						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	242.8320	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1647 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)

Infiltration rate												0.4147	(18)
Number of sides sheltered												0	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				1.0000	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.4147	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5288	0.5184	0.5080	0.4562	0.4458	0.3940	0.3940	0.3836	0.4147	0.4458	0.4666	0.4873	(22b)
Effective ac	0.6398	0.6344	0.6291	0.6041	0.5994	0.5776	0.5776	0.5736	0.5860	0.5994	0.6088	0.6187	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.0500	1.0000	2.0500			(26)
TER Opening Type			15.8500	1.1450	18.1489			(27)
GF			50.5500	0.1300	6.5715			(28a)
External Wall 1	97.9000	17.9000	80.0000	0.1800	14.4000			(29a)
External Roof	50.6300		50.6300	0.1100	5.5693			(30)
Total net area of external elements Aum(A, m2)			199.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7397			(33)
Main dwelling								
Party Wall 1			44.9700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	281.1278	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.8600	0.0500	0.5430
E3 Sill	6.2800	0.0500	0.3140
E4 Jamb	25.4200	0.0500	1.2710
E5 Ground floor (normal)	20.3500	0.1600	3.2560
E6 Intermediate floor within a dwelling	20.4400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	6.1200	0.0600	0.3672
E12 Gable (insulation at ceiling level)	9.3700	0.0600	0.5622
E16 Corner (normal)	4.8000	0.0900	0.4320
E18 Party wall between dwellings	4.8000	0.0600	0.2880
P1 Party wall - Ground floor	9.3700	0.0800	0.7496
P4 Party wall - Roof (insulation at ceiling level)	9.3700	0.1200	1.1244

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.9074	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	55.6471	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2701	50.8351	50.4087	48.4058	48.0311	46.2867	46.2867	45.9637	46.9587	48.0311	48.7892	49.5817	(38)
Heat transfer coeff	106.9171	106.4821	106.0557	104.0529	103.6782	101.9338	101.9338	101.6108	102.6057	103.6782	104.4362	105.2287	(39)
Average = Sum(39)m / 12 =												104.0511	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0567	1.0524	1.0482	1.0284	1.0247	1.0075	1.0075	1.0043	1.0141	1.0247	1.0322	1.0400	(40)
HLP (average)												1.0284	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7502	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.3313	69.2744	67.7342	64.7874	62.6127	60.1875	58.8090	60.3375	62.0130	64.6170	67.6271	70.0619	(42a)
Hot water usage for baths	30.3680	29.9170	29.2819	28.1108	27.2340	26.2617	25.7365	26.3672	27.0539	28.0943	29.2894	30.2653	(42b)
Hot water usage for other uses	42.7946	41.2385	39.6823	38.1261	36.5700	35.0138	35.0138	36.5700	38.1261	39.6823	41.2385	42.7946	(42c)
Average daily hot water use (litres/day)												131.9033	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.4940	140.4299	136.6984	131.0244	126.4166	121.4630	119.5593	123.2746	127.1930	132.3935	138.1550	143.1218	(44)
Energy conte	227.2594	199.9702	210.1003	179.3658	170.1811	149.3529	144.5966	152.6398	156.8417	179.6568	196.8271	224.0942	(45)
Energy content (annual)											Total = Sum(45)m =	2190.8859	
Distribution loss (46)m = 0.15 x (45)m	34.0889	29.9955	31.5151	26.9049	25.5272	22.4029	21.6895	22.8960	23.5263	26.9485	29.5241	33.6141	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	278.1854	245.9680	261.0264	228.6491	221.1072	198.6362	195.5227	203.5658	206.1250	230.5828	246.1104	275.0203	(62)
WWHRS	-32.1526	-28.4360	-29.7765	-24.6561	-22.9786	-19.6630	-18.4309	-19.5994	-20.3441	-23.9834	-27.1703	-31.5571	(63a)
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)
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	(63c)
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	(63d)
Output from w/h	246.0329	217.5320	231.2499	203.9929	198.1285	178.9732	177.0918	183.9664	185.7810	206.5994	218.9401	243.4631	(64)
										Total per year (kWh/year) = Sum(64)m =		2491.7513	(64)
12Total per year (kWh/year)												2492	(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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	116.3046	103.2883	110.5992	99.0658	97.3261	89.0865	88.8192	91.4936	91.5765	100.4767	104.8716	115.2522	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	136.4549	151.0751	136.4549	141.0034	136.4549	141.0034	136.4549	136.4549	141.0034	136.4549	141.0034	136.4549	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	258.2214	260.9009	254.1486	239.7737	221.6280	204.5735	193.1801	190.5006	197.2529	211.6278	229.7736	246.8280	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	36.7509	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	-110.0074	(71)

Water heating gains (Table 5)

	156.3234	153.7028	148.6549	137.5913	130.8146	123.7312	119.3807	122.9752	127.1896	135.0494	145.6551	154.9088	(72)

Total internal gains

	618.2525	632.9316	606.5111	585.6212	556.1502	533.5609	513.2685	514.1835	529.6987	550.3848	583.6848	605.4445	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.1700	36.7938	0.6300	0.7000	0.7700	69.3796	(77)
South	2.1700	46.7521	0.6300	0.7000	0.7700	31.0050	(78)
Northwest	7.5100	11.2829	0.6300	0.7000	0.7700	25.8961	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	126.2808	221.6697	321.3511	429.4260	510.2438	519.6131	495.5137	433.0960	358.3764	249.8008	152.4363	107.3138	(83)
Total gains	744.5332	854.6013	927.8622	1015.0472	1066.3940	1053.1740	1008.7821	947.2795	888.0751	800.1857	736.1211	712.7583	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.9007	74.2026	74.5010	75.9350	76.2094	77.5136	77.5136	77.7600	77.0060	76.2094	75.6562	75.0865	
alpha	5.9267	5.9468	5.9667	6.0623	6.0806	6.1676	6.1676	6.1840	6.1337	6.0806	6.0437	6.0058	
util living area	0.9967	0.9920	0.9799	0.9328	0.8121	0.6067	0.4429	0.4902	0.7470	0.9522	0.9918	0.9974	(86)
MIT	19.9778	20.1504	20.3833	20.6927	20.9033	20.9868	20.9983	20.9970	20.9560	20.6884	20.2901	19.9616	(87)
Th 2	20.0363	20.0399	20.0434	20.0597	20.0628	20.0771	20.0771	20.0798	20.0716	20.0628	20.0566	20.0501	(88)
util rest of house	0.9955	0.9891	0.9726	0.9092	0.7569	0.5251	0.3510	0.3940	0.6663	0.9301	0.9883	0.9965	(89)
MIT 2	18.8531	19.0752	19.3712	19.7587	19.9871	20.0704	20.0767	20.0789	20.0450	19.7635	19.2669	18.8429	(90)
Living area fraction									fLA = Living area / (4) =			0.2184	(91)
MIT	19.0987	19.3100	19.5923	19.9627	20.1872	20.2706	20.2780	20.2794	20.2440	19.9655	19.4904	19.0873	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0987	19.3100	19.5923	19.9627	20.1872	20.2706	20.2780	20.2794	20.2440	19.9655	19.4904	19.0873	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9861	0.9681	0.9063	0.7648	0.5426	0.3711	0.4151	0.6823	0.9273	0.9855	0.9952	(94)
Useful gains	739.9863	842.7390	898.2993	919.9768	815.6294	571.4889	374.3844	393.1714	605.9318	741.9911	725.4265	709.3141	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1582.2368	1534.4082	1388.5106	1151.1071	879.9405	578.0235	374.9107	394.1903	630.4101	970.9967	1294.0048	1566.5674	(97)
Space heating kWh	626.6344	464.8017	364.7172	166.4138	47.8475	0.0000	0.0000	0.0000	0.0000	170.3802	409.3764	637.7965	(98a)
Space heating requirement - total per year (kWh/year)												2887.9678	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	626.6344	464.8017	364.7172	166.4138	47.8475	0.0000	0.0000	0.0000	170.3802	409.3764	637.7965	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2887.9678	
Space heating per m2											(98c) / (4) =	28.5429	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	626.6344	464.8017	364.7172	166.4138	47.8475	0.0000	0.0000	0.0000	0.0000	170.3802	409.3764	637.7965	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	678.9105	503.5771	395.1433	180.2967	51.8391	0.0000	0.0000	0.0000	0.0000	184.5939	443.5281	691.0038	(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	0.0000	(215)

Water heating

Water heating requirement

	246.0329	217.5320	231.2499	203.9929	198.1285	178.9732	177.0918	183.9664	185.7810	206.5994	218.9401	243.4631	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0635	85.7180	85.0769	83.6070	81.4049	79.8000	79.8000	79.8000	79.8000	83.6309	85.4422	86.1168	(217)
Fuel for water heating, kWh/month													
	285.8738	253.7764	271.8129	243.9903	243.3865	224.2772	221.9195	230.5344	232.8082	247.0373	256.2436	282.7128	(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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	28.3526	22.7455	20.4798	15.0044	11.5898	9.4690	10.5726	13.7427	17.8504	23.4207	26.4536	29.1406	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.2217	-64.6161	-92.0924	-102.6143	-109.8366	-102.1862	-100.8775	-95.6062	-86.2167	-73.4092	-50.6029	-40.0221	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-27.7935	-58.2732	-115.4857	-172.9858	-228.3097	-229.2870	-226.6303	-192.1133	-141.0857	-83.2289	-37.0689	-21.9967	(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	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year		
Space heating fuel - main system 1	3128.8925	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2994.3729	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	228.8220	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2498.5604	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3939.5270	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3128.8925	0.2100	657.0674	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2994.3729	0.2100	628.8183	(264)
Space and water heating			1285.8857	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	228.8220	0.1443	33.0261	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-964.3018	0.1348	-129.9695	
PV Unit electricity exported	-1534.2586	0.1260	-193.2722	
Total			-323.2416	(269)
Total CO2, kg/year			1007.5995	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3128.8925	1.1300	3535.6485	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2994.3729	1.1300	3383.6414	(278)
Space and water heating			6919.2899	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	228.8220	1.5338	350.9748	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-964.3018	1.4981	-1444.6575	
PV Unit electricity exported	-1534.2586	0.4624	-709.4464	
Total			-2154.1039	(283)
Total Primary energy kWh/year			5246.2616	(286)
Target Primary Energy Rate (TPER)			51.8500	(287)

Full SAP Calculation Printout

Property Reference	3B6P	**Issued on Date**	03/09/2025
Assessment Reference	BeGreen	**Prop Type Ref**	
Property	3B6P, Land at Coombe Farm, Sayers Common, BN6 9HY		

SAP Rating	90 B	**DER**	2.20	**TER**	9.99
Environmental	98 A	**% DER < TER**			77.98
CO_2 Emissions (t/year)	0.27	**DFEE**	38.06	**TFEE**	41.72
Compliance Check	See BREL	**% DFEE < TFEE**			8.78
% DPER < TPER	56.78	**DPER**	22.61	**TPER**	52.32

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.8600 (1b)	x	2.6100 (2b)	=	132.7446	(1b) - (3b)
First floor	47.0700 (1c)	x	2.7000 (2c)	=	127.0890	(1c) - (3c)
Second floor	47.0700 (1d)	x	2.4000 (2d)	=	112.9680	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	372.8016	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3312	0.3275	0.3237	0.3050	0.3013	0.2825	0.2825	0.2788	0.2900	0.3013	0.3087	0.3163	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Window			26.4000	1.0536	27.8161			(27)
Front Door			2.0700	1.0000	2.0700			(26)
GF			50.8600	0.1000	5.0860	110.0000	5594.6000	(28a)
External Wall 1	179.6900	28.4700	151.2200	0.1600	24.1952	140.0000	21170.8000	(29a)
External Roof 1	47.0700		47.0700	0.1000	4.7070	9.0000	423.6300	(30)
Flat Roof	25.2400		25.2400	0.1000	2.5240	9.0000	227.1600	(30)
Total net area of external elements Aum(A, m2)			302.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.3983			(33)
Main dwelling								
Party Wall 1			59.5800	0.0000	0.0000	0.0000	0.0000	(32)
Internal Wall 1			195.7000			75.0000	14677.5000	(32c)
Internal Floor 1			47.0700			18.0000	847.2600	(32d)
Internal Floor 2			47.0700			18.0000	847.2600	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 43788.2100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 301.9877 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	14.2400	0.0620	0.8829
E3	Sill	8.5800	0.0390	0.3346
E4	Jamb	31.6000	0.0520	1.6432
E5	Ground floor (normal)	30.2900	0.0710	2.1506
E6	Intermediate floor within a dwelling	19.7300	0.0630	1.2430
E6	Intermediate floor within a dwelling	19.7300	0.0630	1.2430
E16	Corner (normal)	18.0300	0.0360	0.6491
E17	Corner (inverted - internal area greater than external area)	2.6100	-0.0450	-0.1174
E18	Party wall between dwellings	15.4200	0.0495	0.7633
P1	Party wall - Ground floor	7.0000	0.0800	0.5600
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	16.2000	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	11.5400	0.0500	0.5770
E12	Gable (insulation at ceiling level)	8.1000	0.0570	0.4617
P4	Party wall - Roof (insulation at ceiling level)	8.1000	0.0385	0.3118
E20	Exposed floor (normal)	3.4300	0.0800	0.2744
E21	Exposed floor (inverted)	11.9600	0.0440	0.5262
E24	Eaves (insulation at ceiling level - inverted)	5.8000	0.0460	0.2668
E14	Flat roof	10.1400	0.0700	0.7098

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.4800 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.8783 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.7519	40.2905	39.8292	37.5225	37.0611	34.7544	34.7544	34.2931	35.6771	37.0611	37.9838	38.9065	(38)
Heat transfer coeff	119.6301	119.1688	118.7075	116.4008	115.9394	113.6327	113.6327	113.1714	114.5554	115.9394	116.8621	117.7848	(39)

Average = Sum(39)m / 12 = 116.2854

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8250	0.8219	0.8187	0.8028	0.7996	0.7837	0.7837	0.7805	0.7900	0.7996	0.8059	0.8123	(40)
HLP (average)												0.8020	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9261 (42)
Hot water usage for mixer showers

73.2803	72.1790	70.5742	67.5038	65.2380	62.7111	61.2748	62.8674	64.6132	67.3263	70.4626	72.9995	(42a)

Hot water usage for baths

31.6361	31.1663	30.5047	29.2847	28.3712	27.3583	26.8112	27.4682	28.1836	29.2674	30.5125	31.5292	(42b)

Hot water usage for other uses

44.5958	42.9741	41.3525	39.7308	38.1091	36.4875	36.4875	38.1091	39.7308	41.3525	42.9741	44.5958	(42c)

Average daily hot water use (litres/day) 137.4352 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.5122	146.3194	142.4313	136.5193	131.7183	126.5569	124.5735	128.4448	132.5276	137.9462	143.9493	149.1244	(44)
Energy conte	236.7907	208.3569	218.9117	186.8882	177.3182	155.6164	150.6608	159.0414	163.4197	187.1917	205.0821	233.4928	(45)

Energy content (annual) Total = Sum(45)m = 2282.7706
Distribution loss (46)m = 0.15 x (45)m

35.5186	31.2535	32.8368	28.0332	26.5977	23.3425	22.5991	23.8562	24.5130	28.0787	30.7623	35.0239	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.2500 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.2150 (55)
Total storage loss

37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)

If cylinder contains dedicated solar storage

37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

297.7181	263.3881	279.8391	245.8502	238.2456	214.5784	211.5882	219.9688	222.3817	248.1191	264.0441	294.4202	(62)
WWHRS 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)
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)
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	(63c)
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	(63d)

Output from w/h

297.7181	263.3881	279.8391	245.8502	238.2456	214.5784	211.5882	219.9688	222.3817	248.1191	264.0441	294.4202	(64)

Total per year (kWh/year) = Sum(64)m = 3000.1416 (64)
12Total per year (kWh/year) 3000 (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)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

127.4748	113.3036	121.5300	109.3099	107.7002	98.9121	98.8366	101.6232	101.5067	110.9831	115.3594	126.3783	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.9979	179.3548	161.9979	167.3978	161.9979	167.3978	161.9979	161.9979	167.3978	161.9979	167.3978	161.9979	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	315.0288	318.2978	310.0600	292.5227	270.3850	249.5787	235.6787	232.4097	240.6475	258.1849	280.3226	301.1289	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	(71)
Water heating gains (Table 5)	171.3371	168.6066	163.3468	151.8193	144.7584	137.3779	132.8450	136.5903	140.9815	149.1709	160.2214	169.8633	(72)
Total internal gains	715.2547	733.1501	702.2956	678.6307	644.0321	621.2452	597.4125	597.8888	615.9177	636.2445	674.8327	699.8810	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.3500	11.2829	0.4000	0.7000	0.7700	16.0917	(75)
Southwest	19.0500	36.7938	0.4000	0.7000	0.7700	136.0070	(79)

Solar gains	152.0987	264.4253	375.9955	489.6735	570.1957	575.6265	550.9894	489.4555	415.1334	296.0742	183.1525	129.5349	(83)
Total gains	867.3534	997.5754	1078.2911	1168.3042	1214.2278	1196.8718	1148.4019	1087.3444	1031.0512	932.3188	857.9852	829.4159	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	101.6750	102.0686	102.4653	104.4958	104.9116	107.0413	107.0413	107.4776	106.1791	104.9116	104.0833	103.2679	
alpha	7.7783	7.8046	7.8310	7.9664	7.9941	8.1361	8.1361	8.1652	8.0786	7.9941	7.9389	7.8845	
util living area	0.9991	0.9971	0.9903	0.9527	0.8294	0.6034	0.4351	0.4782	0.7437	0.9678	0.9970	0.9994	(86)
Living	20.3925	20.4963	20.6321	20.8122	20.9252	20.9592	20.9616	20.9615	20.9495	20.8082	20.5738	20.3824	
Non living	19.6701	19.7760	19.9126	20.0966	20.1931	20.2283	20.2292	20.2321	20.2180	20.0980	19.8656	19.6699	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.6892	20.4963	20.6321	20.8122	20.9252	20.9592	20.9616	20.9615	20.9495	20.8082	20.5738	20.4688	(87)
Th 2	20.2317	20.2344	20.2372	20.2509	20.2537	20.2675	20.2675	20.2703	20.2620	20.2537	20.2482	20.2427	(88)
util rest of house	0.9988	0.9959	0.9864	0.9350	0.7813	0.5365	0.3628	0.4027	0.6742	0.9520	0.9957	0.9991	(89)
MIT 2	19.9444	19.7760	19.9126	20.0966	20.1931	20.2283	20.2292	20.2321	20.2180	20.0980	19.8656	19.7500	(90)
Living area fraction									fLA = Living area / (4) =			0.1979	(91)
MIT	20.0918	19.9186	20.0550	20.2382	20.3380	20.3729	20.3742	20.3764	20.3628	20.2386	20.0058	19.8923	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0918	19.9186	20.0550	20.2382	20.3380	20.3729	20.3742	20.3764	20.3628	20.2386	20.0058	19.8923	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9954	0.9852	0.9346	0.7872	0.5462	0.3734	0.4137	0.6841	0.9516	0.9951	0.9990	(94)
Useful gains	866.2516	992.9372	1062.3481	1091.9372	955.7799	653.7611	428.7792	449.8236	705.3308	887.1655	853.7581	828.5905	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1889.1793	1789.7462	1609.0825	1319.7788	1001.4850	655.9948	428.8682	450.0199	717.4366	1117.4910	1508.1965	1848.3096	(97)
Space heating kWh	761.0582	535.4556	406.7704	164.0460	34.0046	0.0000	0.0000	0.0000	0.0000	171.3622	471.1956	758.6710	(98a)
Space heating requirement - total per year (kWh/year)												3302.5635	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	761.0582	535.4556	406.7704	164.0460	34.0046	0.0000	0.0000	0.0000	0.0000	171.3622	471.1956	758.6710	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3302.5635	
Space heating per m2										(98c) / (4) =		22.7763	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	365.2612	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	761.0582	535.4556	406.7704	164.0460	34.0046	0.0000	0.0000	0.0000	0.0000	171.3622	471.1956	758.6710	(98)
Space heating efficiency (main heating system 1)	365.2612	365.2612	365.2612	365.2612	365.2612	0.0000	0.0000	0.0000	0.0000	365.2612	365.2612	365.2612	(210)
Space heating fuel (main heating system)	208.3600	146.5953	111.3642	44.9120	9.3097	0.0000	0.0000	0.0000	0.0000	46.9150	129.0024	207.7064	(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	0.0000	(215)
Water heating													
Water heating requirement	297.7181	263.3881	279.8391	245.8502	238.2456	214.5784	211.5882	219.9688	222.3817	248.1191	264.0441	294.4202	(64)
Efficiency of water heater												177.2252	(216)
(217)m	177.2252	177.2252	177.2252	177.2252	177.2252	177.2252	177.2252	177.2252	177.2252	177.2252	177.2252	177.2252	(217)
Fuel for water heating, kWh/month	167.9886	148.6178	157.9003	138.7219	134.4310	121.0767	119.3895	124.1183	125.4798	140.0022	148.9879	166.1278	(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	41.3710	37.3673	41.3710	40.0364	41.3710	40.0364	41.3710	41.3710	40.0364	41.3710	40.0364	41.3710	(231)
Lighting	36.7831	29.5088	26.5694	19.4659	15.0360	12.2845	13.7163	17.8290	23.1581	30.3847	34.3195	37.8054	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-55.5304	-81.7896	-121.9803	-139.4651	-151.9915	-142.6682	-140.9607	-131.3103	-113.7824	-93.3954	-61.8056	-47.5675	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year		
Space heating fuel - main system 1	904.1648	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	177.2252	
Water heating fuel used	1692.8419	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0710)		
mechanical ventilation fans (SFP = 1.0710)	487.1100	(230a)
Total electricity for the above, kWh/year	487.1100	(231)
Electricity for lighting (calculated in Appendix L)	296.8608	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1282.2471	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2098.7304	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	904.1648	0.1569	141.8239	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1692.8419	0.1409	238.5094	(264)
Space and water heating			380.3333	(265)
Pumps, fans and electric keep-hot	487.1100	0.1387	67.5682	(267)
Energy for lighting	296.8608	0.1443	42.8462	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1282.2471	0.1341	-171.9501	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-171.9501	(269)
Total CO2, kg/year			318.7975	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.2000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	904.1648	1.5807	1429.2036	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1692.8419	1.5210	2574.7626	(278)
Space and water heating			4003.9663	(279)
Pumps, fans and electric keep-hot	487.1100	1.5128	736.9000	(281)
Energy for lighting	296.8608	1.5338	455.3351	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1282.2471	1.4956	-1917.7185	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1917.7185	(283)
Total Primary energy kWh/year			3278.4829	(286)
Dwelling Primary energy Rate (DPER)			22.6100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.8600 (1b)	x	2.6100 (2b)	=	132.7446	(1b) - (3b)
First floor	47.0700 (1c)	x	2.7000 (2c)	=	127.0890	(1c) - (3c)
Second floor	47.0700 (1d)	x	2.4000 (2d)	=	112.9680	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	372.8016	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)

Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1073 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3573 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3573 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4556	0.4466	0.4377	0.3930	0.3841	0.3394	0.3394	0.3305	0.3573	0.3841	0.4020	0.4198	(22b)
Effective ac	0.6038	0.5997	0.5958	0.5772	0.5738	0.5576	0.5576	0.5546	0.5638	0.5738	0.5808	0.5881	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.0700	1.0000	2.0700			(26)
TER Opening Type			26.4000	1.1450	30.2290			(27)
GF			50.8600	0.1300	6.6118			(28a)
External Wall 1	179.6900	28.4700	151.2200	0.1800	27.2196			(29a)
External Roof 1	47.0700		47.0700	0.1100	5.1777			(30)
Flat Roof	25.2400		25.2400	0.1100	2.7764			(30)
Total net area of external elements Aum(A, m2)			302.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.0845			(33)
Main dwelling								
Party Wall 1			59.5800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	301.9877 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.2400	0.0500	0.7120
E3 Sill	8.5800	0.0500	0.4290
E4 Jamb	31.6000	0.0500	1.5800
E5 Ground floor (normal)	30.2900	0.1600	4.8464
E6 Intermediate floor within a dwelling	19.7300	0.0000	0.0000
E6 Intermediate floor within a dwelling	19.7300	0.0000	0.0000
E16 Corner (normal)	18.0300	0.0900	1.6227
E17 Corner (inverted - internal area greater than external area)	2.6100	-0.0900	-0.2349
E18 Party wall between dwellings	15.4200	0.0600	0.9252
P1 Party wall - Ground floor	7.0000	0.0800	0.5600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.2000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	11.5400	0.0600	0.6924
E12 Gable (insulation at ceiling level)	8.1000	0.0600	0.4860
P4 Party wall - Roof (insulation at ceiling level)	8.1000	0.1200	0.9720
E20 Exposed floor (normal)	3.4300	0.3200	1.0976
E21 Exposed floor (inverted)	11.9600	0.3200	3.8272
E24 Eaves (insulation at ceiling level - inverted)	5.8000	0.2400	1.3920
E14 Flat roof	10.1400	0.0800	0.8112

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		19.7188 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	93.8033 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.2778	73.7821	73.2962	71.0140	70.5870	68.5993	68.5993	68.2312	69.3649	70.5870	71.4508	72.3539	(38)
Heat transfer coeff	168.0811	167.5854	167.0995	164.8173	164.3903	162.4026	162.4026	162.0345	163.1682	164.3903	165.2541	166.1572	(39)
Average = Sum(39)m / 12 =												164.8153	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1592	1.1558	1.1524	1.1367	1.1337	1.1200	1.1200	1.1175	1.1253	1.1337	1.1397	1.1459	(40)
HLP (average)												1.1367	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9261 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2803	72.1790	70.5742	67.5038	65.2380	62.7111	61.2748	62.8674	64.6132	67.3263	70.4626	72.9995	(42a)

Hot water usage for baths

31.6361	31.1663	30.5047	29.2847	28.3712	27.3583	26.8112	27.4682	28.1836	29.2674	30.5125	31.5292	(42b)

Hot water usage for other uses

44.5958	42.9741	41.3525	39.7308	38.1091	36.4875	36.4875	38.1091	39.7308	41.3525	42.9741	44.5958	(42c)

Average daily hot water use (litres/day)	137.4352 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.5122	146.3194	142.4313	136.5193	131.7183	126.5569	124.5735	128.4448	132.5276	137.9462	143.9493	149.1244	(44)
Energy conte	236.7907	208.3569	218.9117	186.8882	177.3182	155.6164	150.6608	159.0414	163.4197	187.1917	205.0821	233.4928	(45)
Energy content (annual)										Total = Sum(45)m =		2282.7706	

Distribution loss (46)m = 0.15 x (45)m

35.5186	31.2535	32.8368	28.0332	26.5977	23.3425	22.5991	23.8562	24.5130	28.0787	30.7623	35.0239	(46)

Water storage loss:	
Store volume	250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.8903 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	1.0208 (55)

Total storage loss

31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)

If cylinder contains dedicated solar storage

31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	291.6975	257.9501	273.8185	240.0238	232.2250	208.7520	205.5676	213.9482	216.5553	242.0984	258.2177	288.3996	(62)
WWHRS	-33.5007	-29.6283	-31.0250	-25.6899	-23.9421	-20.4874	-19.2037	-20.4212	-21.1971	-24.9890	-28.3095	-32.8803	(63a)
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)
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	(63c)
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	(63d)
Output from w/h													
	258.1968	228.3218	242.7934	214.3338	208.2829	188.2646	186.3639	193.5270	195.3583	217.1094	229.9082	255.5193	(64)
										Total per year (kWh/year) = Sum(64)m =		2617.9796	(64)
12Total per year (kWh/year)												2618	(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)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	122.6583	108.9532	116.7136	104.6488	102.8837	94.2509	94.0202	96.8067	96.8455	106.1667	110.6983	121.5618	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	146.3030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	161.9979	179.3548	161.9979	167.3978	161.9979	167.3978	161.9979	161.9979	167.3978	161.9979	167.3978	161.9979	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	315.0288	318.2978	310.0600	292.5227	270.3850	249.5787	235.6787	232.4097	240.6475	258.1849	280.3226	301.1289	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	37.6303	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	-117.0424	(71)
Water heating gains (Table 5)													
	164.8634	162.1328	156.8731	145.3455	138.2846	130.9041	126.3712	130.1165	134.5077	142.6971	153.7476	163.3895	(72)
Total internal gains													
	711.7810	729.6763	698.8219	675.1570	640.5583	614.7715	590.9387	591.4151	609.4440	632.7708	671.3589	696.4072	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.3500	11.2829	0.6300	0.7000	0.7700	25.3444	(75)
Southwest	19.0500	36.7938	0.6300	0.7000	0.7700	214.2110	(79)

Solar gains	239.5554	416.4698	592.1929	771.2357	898.0582	906.6118	867.8083	770.8924	653.8352	466.3169	288.4652	204.0175	(83)
Total gains	951.3364	1146.1462	1291.0148	1446.3927	1538.6166	1521.3833	1458.7470	1362.3075	1263.2791	1099.0877	959.8241	900.4247	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.3662	72.5803	72.7913	73.7992	73.9909	74.8965	74.8965	75.0667	74.5451	73.9909	73.6042	73.2041	
alpha	5.8244	5.8387	5.8528	5.9199	5.9327	5.9931	5.9931	6.0044	5.9697	5.9327	5.9069	5.8803	
util living area													
	0.9988	0.9961	0.9881	0.9540	0.8530	0.6595	0.4864	0.5404	0.8029	0.9728	0.9966	0.9991	(86)
MIT	19.8228	20.0127	20.2719	20.6091	20.8623	20.9770	20.9967	20.9942	20.9289	20.5923	20.1476	19.7981	(87)
Th 2	19.9528	19.9556	19.9583	19.9710	19.9734	19.9845	19.9845	19.9866	19.9802	19.9734	19.9686	19.9635	(88)
util rest of house													
	0.9983	0.9945	0.9831	0.9345	0.7981	0.5657	0.3761	0.4251	0.7181	0.9573	0.9950	0.9988	(89)
MIT 2	18.5850	18.8296	19.1604	19.5848	19.8655	19.9733	19.9837	19.9849	19.9374	19.5742	19.0125	18.5614	(90)
Living area fraction										fLA = Living area / (4) =		0.1979	(91)
MIT	18.8300	19.0638	19.3804	19.7875	20.0628	20.1719	20.1842	20.1847	20.1336	19.7757	19.2372	18.8062	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8300	19.0638	19.3804	19.7875	20.0628	20.1719	20.1842	20.1847	20.1336	19.7757	19.2372	18.8062	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9926	0.9793	0.9302	0.8035	0.5838	0.3981	0.4481	0.7322	0.9533	0.9933	0.9982	(94)
Useful gains	948.9382	1137.6388	1264.2657	1345.4046	1236.2403	888.1613	580.6635	610.4449	924.9901	1047.7763	953.3466	898.7595	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2442.2232	2373.6465	2152.3050	1794.4506	1374.7615	904.8966	582.0870	613.2513	984.4994	1508.3926	2005.7185	2426.9200	(97)
Space heating kWh													
	1111.0041	830.5971	660.7012	323.3131	103.0597	0.0000	0.0000	0.0000	0.0000	342.6985	757.7078	1136.9514	(98a)
Space heating requirement - total per year (kWh/year)												5266.0329	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1111.0041	830.5971	660.7012	323.3131	103.0597	0.0000	0.0000	0.0000	0.0000	342.6985	757.7078	1136.9514	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5266.0329	
Space heating per m2											(98c) / (4) =	36.3175	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Space heating requirement
1111.0041 830.5971 660.7012 323.3131 103.0597 0.0000 0.0000 0.0000 0.0000 342.6985 757.7078 1136.9514 (98)
Space heating efficiency (main heating system 1)
92.3000 92.3000 92.3000 92.3000 92.3000 0.0000 0.0000 0.0000 0.0000 92.3000 92.3000 92.3000 (210)
Space heating fuel (main heating system)
1203.6880 899.8885 715.8193 350.2851 111.6573 0.0000 0.0000 0.0000 0.0000 371.2877 820.9185 1231.8000 (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 0.0000 (215)

Water heating
Water heating requirement
258.1968 228.3218 242.7934 214.3338 208.2829 188.2646 186.3639 193.5270 195.3583 217.1094 229.9082 255.5193 (64)
Efficiency of water heater 79.8000 (216)
(217)m 86.9507 86.6918 86.1879 84.9793 82.5701 79.8000 79.8000 79.8000 79.8000 85.0787 86.5282 86.9995 (217)
Fuel for water heating, kWh/month
296.9461 263.3717 281.7026 252.2189 252.2496 235.9206 233.5387 242.5151 244.8099 255.1867 265.7031 293.7021 (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 7.3041 7.3041 7.0685 7.3041 7.0685 7.3041 (231)
Lighting 33.6600 27.0033 24.3135 17.8131 13.7593 11.2415 12.5517 16.3152 21.1918 27.8048 31.4055 34.5955 (232)
Electricity generated by PVs (Appendix M) (negative quantity)
(233a)m -62.5868 -86.2371 -121.1469 -132.9605 -140.5965 -130.1264 -128.3735 -122.4419 -111.7144 -96.9119 -68.0329 -54.3350 (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 0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)
(235c)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 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)
(233b)m -41.7079 -86.9262 -171.3513 -255.3876 -335.8855 -336.9523 -333.1177 -282.9837 -208.5773 -123.8068 -55.5053 -33.0557 (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 (234b)
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 0.0000 0.0000 0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)
(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)
Annual totals kWh/year
Space heating fuel - main system 1 5705.3444 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 79.8000
Water heating fuel used 3117.8651 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
Total electricity for the above, kWh/year 86.0000 (231)
Electricity for lighting (calculated in Appendix L) 271.6552 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -3520.7212 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 5660.1435 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5705.3444	0.2100	1198.1223	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3117.8651	0.2100	654.7517	(264)
Space and water heating			1852.8740	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	271.6552	0.1443	39.2082	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1255.4639	0.1351	-169.6240	
PV Unit electricity exported	-2265.2573	0.1261	-285.6832	
Total			-455.3072	(269)
Total CO2, kg/year			1448.7043	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5705.3444	1.1300	6447.0392	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3117.8651	1.1300	3523.1876	(278)
Space and water heating			9970.2268	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	271.6552	1.5338	416.6738	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1255.4639	1.4994	-1882.4022	
PV Unit electricity exported	-2265.2573	0.4629	-1048.6746	
Total			-2931.0769	(283)
Total Primary energy kWh/year			7585.9245	(286)
Target Primary Energy Rate (TPER)			52.3200	(287)

Full SAP Calculation Printout

Property Reference	4B7P	**Issued on Date**	03/09/2025
Assessment Reference	BeGreen	**Prop Type Ref**	
Property	4B7P, Land at Coombe Farm, Sayers Common, BN6 9HY		

SAP Rating	91 B	**DER**	1.92	**TER**	9.19
Environmental	98 A	**% DER < TER**			79.11
CO_2 Emissions (t/year)	0.26	**DFEE**	33.74	**TFEE**	38.37
Compliance Check	See BREL	**% DFEE < TFEE**			12.05
% DPER < TPER	58.90	**DPER**	19.74	**TPER**	48.03

Assessor Details	Mr. Mirza Baig	**Assessor ID**	CK52-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.8600 (1b)	x	2.4000 (2b)	=	122.0640	(1b) - (3b)
First floor	54.8800 (1c)	x	2.7000 (2c)	=	148.1760	(1c) - (3c)
Second floor	54.9500 (1d)	x	2.1000 (2d)	=	115.3950	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	160.6900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	385.6350	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.0000 (23c)

Effective ac	0.3312	0.3275	0.3237	0.3050	0.3013	0.2825	0.2825	0.2788	0.2900	0.3013	0.3087	0.3163	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.0700	1.0000	2.0700			(26)
Window			25.8600	1.0536	27.2471			(27)
GF			50.8600	0.1000	5.0860	110.0000	5594.6000	(28a)
External Wall 1	170.5600	27.9300	142.6300	0.1600	22.8208	140.0000	19968.2000	(29a)
External Roof 1	54.9500		54.9500	0.1000	5.4950	9.0000	494.5500	(30)
Flat roof	20.6300		20.6300	0.1000	2.0630	9.0000	185.6700	(30)
Total net area of external elements Aum(A, m2)			297.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		64.7819			(33)
Main dwelling								
Internal Wall 1			238.8800			75.0000	17916.0000	(32c)
Internal Floor 1			54.8800			18.0000	987.8400	(32d)
Internal Floor 2			54.9500			18.0000	989.1000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 46135.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 287.1116 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.9800	0.0620	0.9908
E3 Sill	10.7800	0.0390	0.4204
E4 Jamb	39.5200	0.0520	2.0550
E5 Ground floor (normal)	28.9500	0.0560	1.6212
E6 Intermediate floor within a dwelling	42.1200	0.0050	0.2106
E16 Corner (normal)	16.8000	0.0360	0.6048
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0450	-0.1080
E18 Party wall between dwellings	14.4000	0.0495	0.7128
P1 Party wall - Ground floor	7.0000	0.0800	0.5600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	11.5800	0.0500	0.5790
E12 Gable (insulation at ceiling level)	9.4800	0.0570	0.5404
P4 Party wall - Roof (insulation at ceiling level)	13.0400	0.0385	0.5020
E20 Exposed floor (normal)	3.4600	0.0800	0.2768
E21 Exposed floor (inverted)	11.9600	0.0440	0.5262
E14 Flat roof	10.1400	0.0700	0.7098
E24 Eaves (insulation at ceiling level - inverted)	5.8000	0.0460	0.2668

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.4687 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 75.2506 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.1547	41.6775	41.2003	38.8142	38.3369	35.9508	35.9508	35.4736	36.9053	38.3369	39.2914	40.2458	(38)
Heat transfer coeff	117.4053	116.9281	116.4509	114.0647	113.5875	111.2014	111.2014	110.7242	112.1559	113.5875	114.5420	115.4964	(39)

Average = Sum(39)m / 12 = 113.9454

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7306	0.7277	0.7247	0.7098	0.7069	0.6920	0.6920	0.6891	0.6980	0.7069	0.7128	0.7188	(40)
HLP (average)												0.7091	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9499 (42)
Hot water usage for mixer showers

73.6795	72.5723	70.9588	67.8716	65.5934	63.0528	61.6086	63.2099	64.9652	67.6931	70.8466	73.3972	(42a)

Hot water usage for baths

31.8078	31.3354	30.6702	29.4437	28.5252	27.5068	26.9567	27.6173	28.3366	29.4263	30.6781	31.7003	(42b)

Hot water usage for other uses

44.8396	43.2091	41.5786	39.9480	38.3175	36.6870	36.6870	38.3175	39.9480	41.5786	43.2091	44.8396	(42c)

Average daily hot water use (litres/day) 138.1842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.3270	147.1168	143.2076	137.2633	132.4361	127.2466	125.2524	129.1448	133.2498	138.6980	144.7338	149.9372	(44)
Energy conte	238.0812	209.4924	220.1047	187.9066	178.2845	156.4645	151.4819	159.9082	164.3104	188.2118	206.1998	234.7654	(45)

Energy content (annual) Total = Sum(45)m = 2295.2113
Distribution loss (46)m = 0.15 x (45)m

35.7122	31.4239	33.0157	28.1860	26.7427	23.4697	22.7223	23.9862	24.6466	28.2318	30.9300	35.2148	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

286.4536	253.1836	268.4771	234.7186	226.6569	203.2765	199.8543	208.2806	211.1224	236.5842	253.0118	283.1378	(62)
WWHRS 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)
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)
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	(63c)
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	(63d)

Output from w/h

286.4536	253.1836	268.4771	234.7186	226.6569	203.2765	199.8543	208.2806	211.1224	236.5842	253.0118	283.1378	(64)

Total per year (kWh/year) = Sum(64)m = 2864.7573 (64)
12Total per year (kWh/year) 2865 (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)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

117.8599	104.6092	111.8827	99.9286	97.9775	89.4740	89.0656	91.8674	92.0828	101.2784	106.0110	116.7574	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.4663	193.1591	174.4663	180.2819	174.4663	180.2819	174.4663	174.4663	180.2819	174.4663	180.2819	174.4663	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.9280	335.3724	326.6927	308.2146	284.8893	262.9669	248.3213	244.8770	253.5567	272.0348	295.3600	317.2825	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	(71)
Water heating gains (Table 5)	158.4139	155.6684	150.3800	138.7897	131.6902	124.2695	119.7119	123.4777	127.8928	136.1268	147.2375	156.9320	(72)
Total internal gains	732.0563	751.4480	718.7871	694.5342	658.2940	634.7663	609.7476	610.0690	628.9794	649.8760	690.1275	715.9289	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.9100	11.2829	0.4000	0.7000	0.7700	19.5070	(75)
Southwest	16.9500	36.7938	0.4000	0.7000	0.7700	121.0141	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	140.5211	245.8389	353.5781	466.9480	549.3514	556.9608	532.1497	468.9024	392.5602	276.3448	169.4919	119.4933	(83)
Total gains	872.5774	997.2869	1072.3652	1161.4822	1207.6454	1191.7271	1141.8974	1078.9715	1021.5396	926.2208	859.6194	835.4221	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	109.1564	109.6019	110.0511	112.3532	112.8253	115.2462	115.2462	115.7430	114.2655	112.8253	111.8851	110.9605	
alpha	8.2771	8.3068	8.3367	8.4902	8.5217	8.6831	8.6831	8.7162	8.6177	8.5217	8.4590	8.3974	
util living area	0.9993	0.9976	0.9916	0.9545	0.8261	0.5944	0.4283	0.4717	0.7395	0.9699	0.9975	0.9995	(86)
Living	20.4391	20.5357	20.6618	20.8323	20.9351	20.9625	20.9640	20.9641	20.9550	20.8269	20.6090	20.4306	
Non living	19.7916	19.8901	20.0174	20.1923	20.2807	20.3114	20.3120	20.3147	20.3023	20.1919	19.9751	19.7924	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.7131	20.5357	20.6618	20.8323	20.9351	20.9625	20.9640	20.9641	20.9550	20.8269	20.6090	20.5102	(87)
Th 2	20.3139	20.3165	20.3191	20.3321	20.3348	20.3479	20.3479	20.3505	20.3426	20.3348	20.3295	20.3243	(88)
util rest of house	0.9991	0.9967	0.9884	0.9386	0.7821	0.5352	0.3649	0.4053	0.6768	0.9560	0.9964	0.9993	(89)
MIT 2	20.0467	19.8901	20.0174	20.1923	20.2807	20.3114	20.3120	20.3147	20.3023	20.1919	19.9751	19.8668	(90)
Living area fraction									fLA = Living area / (4) =			0.1805	(91)
MIT	20.1669	20.0066	20.1337	20.3078	20.3988	20.4289	20.4297	20.4319	20.4201	20.3065	20.0895	19.9829	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1669	20.0066	20.1337	20.3078	20.3988	20.4289	20.4297	20.4319	20.4201	20.3065	20.0895	19.9829	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9962	0.9874	0.9380	0.7866	0.5426	0.3729	0.4136	0.6845	0.9553	0.9959	0.9992	(94)
Useful gains	871.7055	993.5064	1058.8065	1089.4261	949.9415	646.6824	425.8133	446.3109	699.2420	884.7849	856.0963	834.7757	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1862.8637	1766.3890	1587.6599	1301.2314	988.0756	648.1802	425.8643	446.4304	708.8319	1102.5355	1487.8400	1822.8676	(97)
Space heating kWh	737.4217	519.3771	393.4669	152.4998	28.3718	0.0000	0.0000	0.0000	0.0000	162.0064	454.8555	735.1404	(98a)
Space heating requirement - total per year (kWh/year)												3183.1395	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	737.4217	519.3771	393.4669	152.4998	28.3718	0.0000	0.0000	0.0000	0.0000	162.0064	454.8555	735.1404	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3183.1395	
Space heating per m2										(98c) / (4) =		19.8092	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	364.8278	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	737.4217	519.3771	393.4669	152.4998	28.3718	0.0000	0.0000	0.0000	0.0000	162.0064	454.8555	735.1404	(98)
Space heating efficiency (main heating system 1)	364.8278	364.8278	364.8278	364.8278	364.8278	0.0000	0.0000	0.0000	0.0000	364.8278	364.8278	364.8278	(210)
Space heating fuel (main heating system)	202.1287	142.3623	107.8500	41.8005	7.7768	0.0000	0.0000	0.0000	0.0000	44.4063	124.6768	201.5034	(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	0.0000	(215)
Water heating													
Water heating requirement	286.4536	253.1836	268.4771	234.7186	226.6569	203.2765	199.8543	208.2806	211.1224	236.5842	253.0118	283.1378	(64)
Efficiency of water heater												177.2051	(216)
(217)m	177.2051	177.2051	177.2051	177.2051	177.2051	177.2051	177.2051	177.2051	177.2051	177.2051	177.2051	177.2051	(217)
Fuel for water heating, kWh/month	161.6509	142.8760	151.5064	132.4559	127.9065	114.7125	112.7813	117.5364	119.1401	133.5087	142.7790	159.7797	(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	42.7952	38.6537	42.7952	41.4147	42.7952	41.4147	42.7952	42.7952	41.4147	42.7952	41.4147	42.7952	(231)
Lighting	40.5796	32.5544	29.3117	21.4750	16.5879	13.5524	15.1320	19.6692	25.5483	33.5208	37.8617	41.7074	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-55.6489	-82.0814	-122.6104	-140.4271	-153.3752	-144.1643	-142.3977	-132.5681	-114.7956	-93.8918	-61.9862	-47.6573	(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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

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	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(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)

Annual totals kWh/year		
Space heating fuel - main system 1	872.5046	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	177.2051	
Water heating fuel used	1616.6334	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0710)		
mechanical ventilation fans (SFP = 1.0710)	503.8784	(230a)
Total electricity for the above, kWh/year	503.8784	(231)
Electricity for lighting (calculated in Appendix L)	327.5004	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1291.6039	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2028.9128	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	872.5046	0.1570	136.9405	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1616.6334	0.1410	227.9589	(264)
Space and water heating			364.8994	(265)
Pumps, fans and electric keep-hot	503.8784	0.1387	69.8941	(267)
Energy for lighting	327.5004	0.1443	47.2684	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1291.6039	0.1341	-173.1457	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-173.1457	(269)
Total CO2, kg/year			308.9163	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.9200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	872.5046	1.5810	1379.4657	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1616.6334	1.5214	2459.5514	(278)
Space and water heating			3839.0171	(279)
Pumps, fans and electric keep-hot	503.8784	1.5128	762.2672	(281)
Energy for lighting	327.5004	1.5338	502.3310	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1291.6039	1.4954	-1931.4898	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1931.4898	(283)
Total Primary energy kWh/year			3172.1256	(286)
Dwelling Primary energy Rate (DPER)			19.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)			Volume (m3)	
Main dwelling							
Ground floor	50.8600	(1b)	x 2.4000	(2b)	=	122.0640	(1b) - (3b)
First floor	54.8800	(1c)	x 2.7000	(2c)	=	148.1760	(1c) - (3c)
Second floor	54.9500	(1d)	x 2.1000	(2d)	=	115.3950	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	160.6900						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		=	385.6350	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1037	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3537	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3537	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4510	0.4422	0.4333	0.3891	0.3803	0.3360	0.3360	0.3272	0.3537	0.3803	0.3979	0.4156	(22b)
Effective ac	0.6017	0.5978	0.5939	0.5757	0.5723	0.5565	0.5565	0.5535	0.5626	0.5723	0.5792	0.5864	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.0700	1.0000	2.0700			(26)
TER Opening Type			25.8600	1.1450	29.6107			(27)
GF			50.8600	0.1300	6.6118			(28a)
External Wall 1	170.5600	27.9300	142.6300	0.1800	25.6734			(29a)
External Roof 1	54.9500		54.9500	0.1100	6.0445			(30)
Flat roof	20.6300		20.6300	0.1100	2.2693			(30)
Total net area of external elements Aum(A, m2)			297.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.2797			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	287.1116 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.9800	0.0500	0.7990
E3 Sill	10.7800	0.0500	0.5390
E4 Jamb	39.5200	0.0500	1.9760
E5 Ground floor (normal)	28.9500	0.1600	4.6320
E6 Intermediate floor within a dwelling	42.1200	0.0000	0.0000
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E18 Party wall between dwellings	14.4000	0.0600	0.8640
P1 Party wall - Ground floor	7.0000	0.0800	0.5600
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	18.9400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	11.5800	0.0600	0.6948
E12 Gable (insulation at ceiling level)	9.4800	0.0600	0.5688
P4 Party wall - Roof (insulation at ceiling level)	13.0400	0.1200	1.5648
E20 Exposed floor (normal)	3.4600	0.3200	1.1072
E21 Exposed floor (inverted)	11.9600	0.3200	3.8272
E14 Flat roof	10.1400	0.0800	0.8112
E24 Eaves (insulation at ceiling level - inverted)	5.8000	0.2400	1.3920

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		20.6320 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	92.9117 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.5721	76.0695	75.5769	73.2631	72.8302	70.8150	70.8150	70.4418	71.5912	72.8302	73.7060	74.6215	(38)
Heat transfer coeff	169.4838	168.9812	168.4886	166.1748	165.7419	163.7267	163.7267	163.3535	164.5029	165.7419	166.6177	167.5332	(39)
Average = Sum(39)m / 12 =												166.1727	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0547	1.0516	1.0485	1.0341	1.0314	1.0189	1.0189	1.0166	1.0237	1.0314	1.0369	1.0426	(40)
HLP (average)												1.0341	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9499	(42)
Hot water usage for mixer showers	73.6795	72.5723	70.9588	67.8716	65.5934	63.0528	61.6086	63.2099	64.9652	67.6931	70.8466	73.3972	(42a)
Hot water usage for baths	31.8078	31.3354	30.6702	29.4437	28.5252	27.5068	26.9567	27.6173	28.3366	29.4263	30.6781	31.7003	(42b)
Hot water usage for other uses	44.8396	43.2091	41.5786	39.9480	38.3175	36.6870	36.6870	38.3175	39.9480	41.5786	43.2091	44.8396	(42c)
Average daily hot water use (litres/day)												138.1842	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.3270	147.1168	143.2076	137.2633	132.4361	127.2466	125.2524	129.1448	133.2498	138.6980	144.7338	149.9372	(44)
Energy conte	238.0812	209.4924	220.1047	187.9066	178.2845	156.4645	151.4819	159.9082	164.3104	188.2118	206.1998	234.7654	(45)
Energy content (annual)										Total = Sum(45)m =		2295.2113	
Distribution loss (46)m = 0.15 x (45)m	35.7122	31.4239	33.0157	28.1860	26.7427	23.4697	22.7223	23.9862	24.6466	28.2318	30.9300	35.2148	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	289.8278	256.2312	271.8513	237.9840	230.0311	206.5418	203.2285	211.6548	214.3877	239.9584	256.2771	286.5120	(62)
WWHRS	-33.6832	-29.7897	-31.1941	-25.8299	-24.0725	-20.5990	-19.3083	-20.5325	-21.3126	-25.1252	-28.4638	-33.0594	(63a)
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)
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	(63c)
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	(63d)

Output from w/h

	256.1446	226.4415	240.6572	212.1541	205.9585	185.9428	183.9202	191.1223	193.0751	214.8333	227.8134	253.4525 (64)
										Total per year (kWh/year) = Sum(64)m =		2591.5155 (64)
12Total per year (kWh/year)												2592 (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)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

	120.5593	107.0473	114.5821	102.5408	100.6769	92.0863	91.7650	94.5667	94.6951	103.9777	108.6233	119.4568 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	147.4936	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	174.4663	193.1591	174.4663	180.2819	174.4663	180.2819	174.4663	174.4663	180.2819	174.4663	180.2819	174.4663	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	331.9280	335.3724	326.6927	308.2146	284.8893	262.9669	248.3213	244.8770	253.5567	272.0348	295.3600	317.2825	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	37.7494	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	-117.9949	(71)

Water heating gains (Table 5)

	162.0420	159.2966	154.0082	142.4178	135.3184	127.8977	123.3401	127.1058	131.5209	139.7550	150.8657	160.5602	(72)

Total internal gains

	738.6844	758.0762	725.4152	701.1624	664.9221	638.3945	613.3758	613.6972	632.6076	656.5041	696.7557	722.5570	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.9100	11.2829	0.6300	0.7000	0.7700	30.7236	(75)
Southwest	16.9500	36.7938	0.6300	0.7000	0.7700	190.5972	(79)

Solar gains	221.3208	387.1963	556.8856	735.4431	865.2285	877.2132	838.1358	738.5213	618.2823	435.2431	266.9498	188.2019	(83)
Total gains	960.0052	1145.2725	1282.3008	1436.6055	1530.1506	1515.6077	1451.5116	1352.2185	1250.8899	1091.7472	963.7054	910.7589	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.6152	75.8401	76.0618	77.1209	77.3223	78.2740	78.2740	78.4528	77.9047	77.3223	76.9159	76.4955	
alpha	6.0410	6.0560	6.0708	6.1414	6.1548	6.2183	6.2183	6.2302	6.1936	6.1548	6.1277	6.0997	
util living area													
	0.9990	0.9969	0.9904	0.9602	0.8634	0.6683	0.4931	0.5493	0.8159	0.9771	0.9973	0.9993	(86)
MIT	19.8651	20.0420	20.2878	20.6158	20.8659	20.9786	20.9971	20.9947	20.9302	20.6000	20.1759	19.8427	(87)
Th 2	20.0380	20.0406	20.0431	20.0550	20.0572	20.0676	20.0676	20.0695	20.0636	20.0572	20.0527	20.0480	(88)
util rest of house													
	0.9987	0.9957	0.9865	0.9439	0.8140	0.5813	0.3904	0.4417	0.7388	0.9646	0.9960	0.9990	(89)
MIT 2	18.7083	18.9364	19.2510	19.6664	19.9482	20.0565	20.0668	20.0679	20.0191	19.6554	19.1174	18.6872	(90)
Living area fraction										fLA = Living area / (4) =		0.1805	(91)
MIT	18.9171	19.1360	19.4381	19.8377	20.1138	20.2229	20.2347	20.2352	20.1835	19.8259	19.3085	18.8957	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9171	19.1360	19.4381	19.8377	20.1138	20.2229	20.2347	20.2352	20.1835	19.8259	19.3085	18.8957	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9941	0.9832	0.9392	0.8173	0.5964	0.4090	0.4612	0.7498	0.9605	0.9946	0.9985	(94)
Useful gains	958.0877	1138.5344	1260.7265	1349.3162	1250.6442	903.8825	593.7259	623.6894	937.8688	1048.6131	958.4673	909.4261	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2477.3628	2405.6096	2179.9226	1817.5718	1394.5167	920.6229	595.1007	626.4857	1000.7594	1529.1104	2034.1460	2462.0187	(97)
Space heating kWh													
	1130.3407	851.4745	683.8820	337.1440	107.0411	0.0000	0.0000	0.0000	0.0000	357.4900	774.4887	1155.1289	(98a)
Space heating requirement - total per year (kWh/year)												5396.9899	
Solar heating 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 heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1130.3407	851.4745	683.8820	337.1440	107.0411	0.0000	0.0000	0.0000	0.0000	357.4900	774.4887	1155.1289	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5396.9899	
Space heating per m2											(98c) / (4) =	33.5863	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1130.3407	851.4745	683.8820	337.1440	107.0411	0.0000	0.0000	0.0000	0.0000	357.4900	774.4887	1155.1289	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													

	1224.6378	922.5076	740.9339	365.2698	115.9709	0.0000	0.0000	0.0000	0.0000	387.3131	839.0993	1251.4940 (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	0.0000 (215)
Water heating												
Water heating requirement												
	256.1446	226.4415	240.6572	212.1541	205.9585	185.9428	183.9202	191.1223	193.0751	214.8333	227.8134	253.4525 (64)
Efficiency of water heater												79.8000 (216)
(217)m	86.9875	86.7448	86.2674	85.0934	82.6652	79.8000	79.8000	79.8000	79.8000	85.1933	86.5806	87.0338 (217)
Fuel for water heating, kWh/month												
	294.4612	261.0433	278.9665	249.3191	249.1477	233.0110	230.4764	239.5016	241.9488	252.1714	263.1229	291.2116 (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	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	36.2507	29.0816	26.1848	19.1841	14.8183	12.1067	13.5178	17.5709	22.8229	29.9449	33.8227	37.2582 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-63.2279	-87.5650	-123.6189	-136.3478	-144.7172	-134.1150	-132.3064	-125.9377	-114.4934	-98.7287	-68.8891	-54.8378 (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	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)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 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-40.6568	-84.9177	-167.7295	-250.4737	-329.8918	-331.1277	-327.3707	-277.8941	-204.5393	-121.1224	-54.1635	-32.2093 (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 (234b)
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	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(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)

Annual totals kWh/year	
Space heating fuel - main system 1	5847.2263 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	3084.3818 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	292.5635 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3506.8815 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5803.2901 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5847.2263	0.2100	1227.9175	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3084.3818	0.2100	647.7202	(264)
Space and water heating			1875.6377	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	292.5635	0.1443	42.2260	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1284.7851	0.1350	-173.4516	
PV Unit electricity exported	-2222.0965	0.1261	-280.1091	
Total			-453.5608	(269)
Total CO2, kg/year			1476.2322	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.1900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

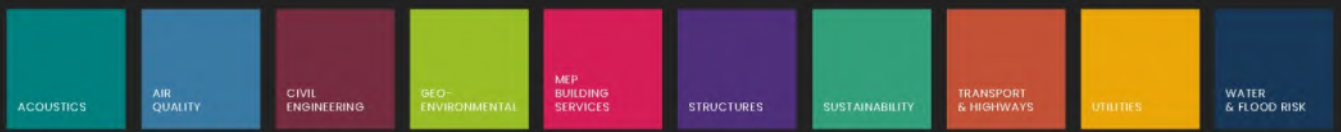
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5847.2263	1.1300	6607.3657	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3084.3818	1.1300	3485.3514	(278)
Space and water heating			10092.7171	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	292.5635	1.5338	448.7437	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1284.7851	1.4990	-1925.8631	
PV Unit electricity exported	-2222.0965	0.4627	-1028.2074	
Total			-2954.0705	(283)
Total Primary energy kWh/year			7717.4912	(286)
Target Primary Energy Rate (TPER)			48.0300	(287)

Welbeck Strategic Land II LLP

LAND AT COOMBE FARM, SAYERS COMMON

Energy and Sustainability Statement

The information contained within this report and any appendices or supporting information provided are to be treated as confidential.



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